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چکیده مقالات
اولین کنگره بین المللی
هوش مصنوعی
در
علوم پزشکی

دانشگاه علوم پزشکی هوشمند
Smart University of Medical Sciences

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Contents

Development of faculty members in the smart university

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The system of promotion of faculty members of universities and higher education and research institutes plays a major role in directing the activities of faculty members in various educational and research fields and therefore has a special place in higher education policymaking to some extent that have even considered the promotion system as a part of the university.

In this article, the promotion of faculty members includes a wide range of activities that are carried out by the faculty and the organization, and it is very vital to improve the knowledge, skills and behaviors based on the role of the faculty. Facilitating university change and improving student achievement includes forms of self-directed learning at work, formal programs organized by the organization, and organizational development strategies.

Recent research indicates the inevitable movement and transformation of universities towards a new generation of universities called smart universities. Universities that benefit from new and advanced technologies and styles, bring a kind of intelligence in different departments of the university; From strategic changes in university management and knowledge exchange to extensive changes in learning and communication styles supported by smart environment and infrastructure.

Key Words: Smart University, Faculty Member, Development

Use of telehealth system to monitor obesity in children with diabetes

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Background and aims: The early years of childhood have an effective role in the growth and development of children. Monitoring children's health continuously and in their living environment has brought a very important help in controlling their health and preventing adverse health problems such as the increased risk of cardiovascular diseases, diabetes, mental and digestive disorders. Obesity is one of the areas that if not controlled in early childhood, children will be at risk of type 2 diabetes.

Method: A study was conducted between the years 2017 and 2022 and Google Scholar search engine was used to retrieve information from the internet, using the key words obesity, child health care system and diabetes to find published articles. After abstract review, 69 articles were extracted.

Results: Monitoring children's health continuously and in their living environment has a very important help in controlling obesity and preventing diabetes and providing them with health care. The use of information technology in providing health care is very effective with the development of telehealth systems. The use of health care systems is very effective in controlling the health of today's children and future youth.

Conclusion: Using the health care and telehealth systems is effective in controlling and preventing the occurrence of diseases.

Keywords: obesity, child, telehealth, diabetes

Application of Machine Learning to Develop a Mucormycosis Mortality Prediction Model

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Background and Aims: Mucormycosis is an emerging fungal infection associated with high mortality and morbidity. Since the disease is rare, large, randomized clinical trials are almost impossible and most epidemiological, diagnostic, and treatment data are limited to case reports and case series. Antifungal therapy is required promptly and at a sufficient dose to effectively manage Mucormycosis. Artificial Intelligence (AI) can work as a powerful tool to fill the gaps in available data; machine learning (ML) as a subset of AI is commonly used on large data sets to identify hidden patterns to create a predictive model. This study aims to test ML capabilities on a limited dataset of mucormycosis patients to create a mortality prediction model and pave the road for further research regarding mucormycosis treatment choice and diagnosis assistance.

Method: This study used patients' electronic health records to develop a mortality prediction model based on laboratory testing and demographic data collected from 326 hospitalized mucormycosis patients from 2012 to 2022. As part of the data cleansing process, important features are selected with RapidMiner's automatic feature selection, and cases with a high number of missing features are removed. Data imputation was also done to replace the remaining missing values, and then the data were split into train and test groups with proportions of 20% and 80%. Our data were processed using 5-fold models, including Random Forest, Support Vector Machine, Neural Network, and XGBoost with their default settings; the one with the best results was selected. Models were deployed, and evaluation metrics were collected Using R Studio software packages, including "randomForest", "caret", "e1071", "neuralnet", "naivebayes", and "xgboost". We then uploaded the model to the GitHub repository for future analyses and reuse.

Results: The train set included 265 cases, and the test set included 61. Eleven features were selected: Chemotherapy, Dialysis, Brain CT Scan, ICU admission, Fever, Ptosis, Ophthalmological Symptoms, Nasal Congestion, Epistaxis, Maxillectomy, and Ethmoidectomy. Random Forest, SVM, Decision Tree, Neural Network, Naïve Bayes, and XGBoost were 0.7541, 0.8033, 0.7870, 0.7869, 0.7869, and 0.7541, respectively. Our 5-fold Support Vector Machine with its default values (Cost = 10; Number of vectors = 164) reported the best accuracy of 0.8033 (95% CI of 0.6816, 0.8942); model sensitivity and specificity were 0.846 and 0.727, respectively. A positive predictive value of 0.846 was reported as well as a negative predictive value of 0.727, and a receiver operating characteristic (ROC) diagram was drawn.

Conclusion: As a result of the gratifying results of the support vector machine model, we can conclude that there is still great potential for developing mortality prediction models despite the scarce mucormycosis data availability. Machine learning models can help diagnose patients faster and select the most effective drugs in light of the challenges associated with mucormycosis.

Keywords: Machine Learning; Mucormycosis; Mortality; Artificial Intelligence

A Report of an experience in using artificial intelligence and telemedicine to control the ECG of patients with diabetes

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Background and aims: The diabetic patient's ECG needs regular monitoring to prevent heart failure. Telemedicine helps to transfer the care of patients to their living environment.

Method: The portable ECG device is designed as a wearable device and collected ECG signals to identify the patterns of a heart attack in patients with diabetes and alarm for medical intervention.

Results: This telemedicine system was a successful experience for the continuous monitoring of the heart of diabetic patients.

Conclusion: Now, various companies have commercially created devices to control and collect the ECG of patients, but the distinguishing feature of this experience was used to patients with diabetes.

Keywords: artificial intelligence, medicine, diabetic patient, ECG

Use of Internet of Things in Covid-19 pandemic

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Background and aims: The internet of things, a network of embedded things with sensors, software, and other technologies for exchanging healthcare data with other devices and systems, played a role in the service of healthcare in the Covid-19 pandemic.

Method: A study was conducted between the years 2019 and 2022 and PubMed resource was used to retrieve *literature*, using the key words internet of things, medical, covid-19, pandemic to find published articles. 248 result found and after abstract review 25 articles were extracted.

Results: During the COVID-19 pandemic, the internet of things and different sensors that collected patient data allowed us to enhance healthcare services.

Conclusion: Monitoring patients' vital signs and requiring actions when those vital signs changed was the most advantageous use of IoT during the COVID-19 epidemic.

Keywords: Internet of Things, Covid-19, Healthcare

Using Machine Learning Models to Evaluate the Need for COVID-19 Vaccination

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Background and aims: In the wake of the ongoing COVID-19 pandemic, Artificial Intelligence (AI) is gaining much attention, and one of its practical fields is Machine Learning. While today vaccine adherence is high, there was a time at the start of the COVID-19 pandemic when many people did not trust vaccines and believed that once they were infected with COVID-19, there was no need for vaccination. Still, there is evidence stating that COVID-19 antibodies will not stay positive permanently, and there is a vital need for a booster vaccine. This study aims to develop a pilot model using machine learning methods in order to predict if unvaccinated patients' serum IgG antibodies are sufficient or if there is a need for a vaccine without a laboratory test.

Method: This study used symptoms and demographic data of 206 confirmed COVID-19 patients whose COVID-19-specific serum IgG was measured, and months passed since COVID-19 infection was recorded and added as a variable. Data was gathered from January to October 2021, before vaccination initiation in Iran. Data were preprocessed and cleaned, important features were selected, and serum IgG amount was transformed into a binary variable based on the 1.20 cutoff. This variable was later used to be predicated. Data were randomly split into train and test groups with proportions of 20% and 80%; 5-fold cross-validation using models including Random Forest, Support Vector Machine, Neural Network, Naïve Bayes, and XGBoost was conducted, and they were evaluated and compared; the one with the best results was selected. Models were deployed in R Studio software using packages including "randomForest", "caret", "e1071", "neuralnet", "naivebayes", and "xgboost", and evaluation metrics were recorded. The model was later exported and uploaded to the GitHub repository for analysis reuse.

Results: The train and test set included 162 and 44 samples, respectively. Features that had been selected included Gender, Age, Hospitalization, time that had passed since infection, urban or rural living area, education level, occupation, chronic disease, fever, headache, cough, malaise, restlessness, sore throat, bone pain, conjunctivitis, anosmia, loss of taste sense, sweating, nausea, vomiting, stomachache, diarrhea, chest pain, dyspnea, history of covid infection in family members, and disease severity. The reported accuracy for the Random Forest, SVM, Decision Tree, Neural Network, Naïve Bayes, and XGBoost were 0.8409, 0.7955, 0.6818, 0.7045, 0.6818 and 0.7727, respectively. The Random Forest model 5-fold with its default settings (number of trees 500, features per split 4) reported accuracy was 0.8409 (95% CI of 0.6993, 0.9336); model sensitivity and specificity were 0.7692 and 0.8710, respectively. The recall was 0.7143, a negative predictive value of 0.9000 was reported, and a ROC plot was drawn.

Conclusion: The Random Forest model showed satisfactory and exciting results, such as the importance of occupation in the longevity of COVID-19 serum sufficient presence. A model was provided for predicting the need for vaccination in unvaccinated individuals infected with COVID-19; this study may serve as a stepping stone toward determining if vaccine booster doses need to be administered based on the time since the last vaccination or infection.

Keywords: Machine Learning; COVID-19; Immunoglobulin G; Vaccine

Identifying the most effective knowledge factors on HPV's stigma among healthcare workers using feature selection models

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Background and Aims: It is well known that stigma is a problem that affects numerous individuals, including HPV patients. The main objective of this paper is to determine the stigma associated with HPV by identifying the most correlated knowledge factors regarding HPV's stigma in healthcare workers using machine learning models.

Method: A previously piloted and evaluated questionnaire of 61 questions was filled out by 552 healthcare workers. The questionnaire included demographic, knowledge, and stigma question. Stigma questions' answers were scored based on a Likert scale, and the total stigma score was calculated for each case. Our data was split into train and test groups with proportions of 20% and 80%. For both approaches, the total stigma score was used as the target variable and knowledge questions and demographic data as the predictors. RapidMiner's auto feature selection was utilized in the first approach for Generalized Liner, Deep Learning, Decision Tree, Random Forest, Gradient Boost, and SVM models. All possible feature combinations were tested, and features were weighted. For the second approach, models including caret, Recursive Feature Elimination, Genetic Algorithm, Simulated Annealing, and XGBoost were applied to the data using R. The most similarly voted and the most weighted features were later reported and compared between the two approaches.

Results: The train set included 265 cases, and the test set included 61. Our first approach evaluated 76,290 models of six types of ML models and evaluated 19,392 feature sets; our top 5 most weighted features based on the correlation of six models were Faculty, Age, Occupation, 17th Question (Using condoms can completely protect the individual from HPV), 14th Question (HPV can cause sterilization). Based on the second approach, the most similarly important features were Age, Marriage Status, Occupation, Faculty, 17th Question, 14th Question, and Education Level.

Conclusion: We have concluded that both of our approaches were able to detect questions and factors that are most important regarding HPV stigma; our results can be used to create a much smaller questionnaire and help with channeling resources through the most effective areas to increase HPV knowledge and decrees HPV stigma.

Keywords: Machine Learning; HPV; Stigma; Vaccine

Design, implementation and evaluation of mobile app for self-management of patient with chronic myeloid leukemia

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Introduction: There is a significant reduction in quality of life reported for patient with chronic myeloid leukemia (CML). With the prevalence of CML rising worldwide, health care is changing, and patient empowerment is being prioritized in an effort to enhance treatment outcomes, quality of life and decrease healthcare costs. The aim of present study is to design, develop and evaluate a mobile-based app for self-management of patient with CML.

Method: this study was carried out Between November and March 2023 at Taleqhani teaching hospital- Tehran-Iran, in partnership with a multidisciplinary team consisting of oncologist and system design and implementation team. A mobile app was developed and evaluated based on six stages: A: Analyzing Patient needs & existing smart application. B: designing of conceptual modeling, C: Development, D: Implementation and E: Evaluation. An ISO Norm 9241/110 usability questionnaire was used for the study with the goal to assess end-user satisfaction.

Results: A mobile app based on standard guidelines that consists of the knowledge base, self-management advice, asking module, and notifications as its four primary sections were developed to support patient with CLM. the usability assessment results of the app demonstrate that a very high satisfaction and functionality rate.

Conclusions: The mobile app can help those with CML by giving them access to accurate information about cancer and enhancing communication between patients and medical professionals and may improve patient's quality of life.

The role of smart mirrors in health: a domain review

Keywords: Chronic Myeloid Leukemia (CML), Self-Management, Mobile App

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Background and aims: The smart mirrors integrate all measurement facilities in one place with a compatible user interface and accordingly provide feedback to improve the health of more people. In this study, an overview of the role and application of smart mirrors in providing people's health has been conducted.

Method: A literature review has been conducted with the aim of extracting the application of smart mirrors in health. In this study, databases of MEDLINE were searched in September 2023. The keywords were also selected to include "smart mirrors", "medicine", and "health issues". Articles published in English-language journals focusing on smart mirrors for health monitoring have been included. The authors extracted data from studies by using data extraction forms. Then, the findings of these studies were summarized and reported narratives.

Results: According to the publications, Smart mirrors is a new interactive interface that tracks and displays the user's heart rate, height, weight, body temperature, blood pressure, and sugar level in real time. People with diseases such as diseases, heart diseases and high blood pressure can use these smart mirrors to monitor their health and dietary recommendations and exercise routines. Another type of smart mirror detects and monitors facial signs associated with cardio metabolic risks over time and encourages users to reduce their risk by improving lifestyles. Among its other advanced capabilities, it can be mentioned the capabilities of recognizing a person's emotions, monitoring and analyzing short-term and long-term emotions. It is an approach to give ordinary people access and control over their physiological data to play a vital role in managing their health. It uses an LCD display with a webcam to provide an interactive display. A glass is mounted on the frame, which acts as a reflective surface for users in normal lighting conditions. The monitor and webcam are connected to a processor that runs real-time analysis software. Behind the mirror glass, half of it is covered by the LCD screen and the other half is silvered so that it appears as a mirror to the user in front. Whenever input is given to the LCD, it is displayed through the glass, making the information visible to the user on the front.

Conclusion: This proposed work shows an innovative approach to comprehensive health monitoring based on the latest technology. Using this technique helps people control their physiological state by referring to their previous data. Smart mirror prototypes and conceptual designs for improving healthcare and impacting people's health are promising.

Keywords: Smart mirrors, medicine, health issues.

Application of artificial intelligence and natural language processing in chronic low back pain: a domain review

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Background and aims: Chronic low back pain is a symptom that may be caused by several diseases and is currently the leading cause of disability worldwide. Usually, when it lasts more than twelve weeks, it is caused by a large set of diseases such as degenerative disc diseases, disc herniation, spondyl arthritis and spondylolisthesis. In recent years, the most groundbreaking technologies in LBP care have been explored, including artificial intelligence and computer science, natural language processing. In this study, the impact of the most important technologies, artificial intelligence, in chronic back pain has been investigated.

Method: This study has been reviewed with a domain review method, studies related to the use of artificial intelligence in the diagnosis and treatment of LBP. For this purpose, the reliable PubMed database was searched. The search strategy was set as a combination of the following keywords: "artificial intelligence", "machine learning", "deep learning", "natural language processing", "pain", "back". Extracted articles are summarized in terms of content.

Results: Most recent methods use deep learning models instead of digital image processing techniques. The best methods for segmenting vertebrae, intervertebral discs, spinal canal, and back muscles achieve a Sorensen-Dice score of more than 90%, while studies focused on localization and identification of structures show overall accuracies of more than 80%.

There are three main methods of NLP namely classification, annotation and prediction. Both of the first approaches concern the identification of a category (class) to which a document belongs, which is different in the case of NLP methods. In the classification approach, the system associates a label to each test sample (patient records).A classification system may provide information about a diagnosis, as a computer-aided diagnosis system, that physicians may use to make decisions, for example, whether or not to operate on a patient. Also, healthcare providers may use such a system to improve quality control, while researchers may use it to retrieve a large group of patients suffering from a particular disease and then perform some research analysis.

Conclusion: Future advances in artificial intelligence are expected to increase the autonomy and reliability of systems, thus providing more effective tools for the diagnosis and treatment of LBP. Further studies on larger data sets are needed to better define the role of NLP in the care of patients with spinal disorders.

Keywords: artificial intelligence, natural language processing, low back pain, decision support systems, computer vision.

Top emerging Technology trends in medical education: from augmented reality to Holoportation; Upgrade solutions for Tele-proximity and Embodiment: A review article

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Background and aims: Medical education is improved using new technologies. These advantages include the improvement of decision-making and skill coordination, enhanced perceptual variation, and the creation of an engaging educational environment that allows students to practice procedures without any risk to a human patient. This study discusses the trends of these technologies as well as examines solutions for tele-proximity and embodiment.

Method: This is a Narrative review. The search was done in Persian and Latin databases including SID, Iran medex, Iran doc, Google scholar, ERIC, SID, Science direct, PubMed without considering the time limit. The keywords used included: interaction, embodiment, tele-presence, tele-proximity, tele-community AND the list of all new technologies used in medical education. In the initial search, 426 studies were identified. After review of article titles, 323 articles were removed and 103 article abstracts were reviewed, and 52 articles were fully studied.

Results: Results showed experience of telepresence is a consequence of the way in which we are embodied. Interaction has dimensions of communication, participation and active learning. The concept of independence alone is not enough to express the basic characteristics of interaction, but the concept of control should be paid attention to. In addition to the structure of distance education, interpersonal behaviors are also important for the sense of presence. Holograms exhibit the ability to improve knowledge scores and spatial awareness in comparison with traditional teaching approaches, especially for anatomical learning. The HoloLens shows high-precision holographic images, enabling learners to visualize anatomical constructs from all perspectives, and is also able to recognize precise shapes or objects in real world with good accuracy to align the hologram with these constructs

Conclusion: Innovative examples from Higher Education are presented to illustrate creative ways in which emerging technologies are beginning to be used in teaching practice. Technological advances continue to increase the potential for how synchronous communication technologies can support and improve the presence of online and enhance virtual and real-time interactions in online education. As these technologies are still emerging there is a great need for further educational research and some directions are highlighted.

Keywords: Technology, medical education, augmented reality, Embodiment

Machine learning approaches for diagnosing depression: A narrative review

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Background and aims: Over 300 million individuals worldwide are at risk for depression, making it one of the most important public health problems. However, behavioral diagnostic techniques continue to make it difficult to make a clinical diagnosis of depression. However, the Statistical Manual of Mental Disorders (DSM-V) and doctors' individual judgement were still used in the clinical diagnosis of depression. Due to the lack of reliable laboratory diagnostic criteria, accurate depression identification and diagnosis remained challenging. The purpose of this narrative review is to describe and demonstrate the impact of using artificial intelligent in diagnosis of depression.

Method: we report studies that investigated risk factors of postpartum depression by searching the database, Scopus, PubMed, Science Direct, Up-to-date, ProQuest in the period 2010-2022 published articles about the factors associated with postpartum depression were assessed in Farsi and English. The search strategy included a combination of keywords include depression, artificial intelligent, diagnosis, machine learning and psychiatric disorder.

Conclusion: Literature review showed that Different machine learning techniques, such as logistic regression, the random forest, the support vector machine and/or the artificial neural network in the case of numerical data, and the random forest in the case of genomic data, would be appropriate for different types of data for the early diagnosis of depression. Their reported performance metrics for accuracy and AUC ranged from 60.1 to 100.0 and 64.0 to 96.0, respectively. An efficient, non-invasive decision support system for the detection of depression is provided via machine learning.

Keywords: artificial intelligence, depression, machine learning, medicine

Biopsy smart assistant (Biopsa)

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Purpose: One of the most famous methods in the world to identify cancer cells and tumors in the human body is the biopsy or sampling method under CT scan guidance, in which a large needle is used to penetrate the body and remove part of the tumor tissue. This work is often done manually, which is often associated with many errors and repetitions until reaching the goal, due to the inability of the hand and eye to determine the angle of penetration and the amount of effective penetration. In this method, we are trying to mechanize and increase the accuracy of this method by using a smart biopsy assistant

Methods: In this paper, an artificial intelligence software and a mechanical robot are used, which accurately determines the location of the biopsy needle, the angle of entry, and the degree of penetration of the needle into the patient's body, and then the mechanical robot receives these data and Deliver the biopsy needle to the desired tumor center according to the received algorithm.

Results: In the obtained results, it was found that only one precise and determined penetration of the biopsy needle angle using calculations and the guidance of the smart biopsy assistant is enough to be able to perform the sampling and dozens of times of radiation and tens of times of wrong penetration of the biopsy needle are avoided. Using the smart biopsy assistant is very accurate, fast, convenient and less expensive than the manual method

Conclusion: The results showed that performing a biopsy using a smart biopsy assistant can cause accurate sampling and reduce the dose received by the patient with just one needle penetration in the body.

Keywords: Biopsy, Cancer, Smart Assistants, Computed Tomography

The effect of smart web-based tools on the compliance and implementation of self-care measures among coronary artery bypass graft patients

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Introduction: Coronary Artery Bypass Graft (CABG) patients face a lot of information needs after being discharged due to the nature and sensitivity of the operation. Failure to meet these needs lead to an increase in the level of stress and anxiety, followed by an increase in the rate of re-hospitalization in the first 30 days after discharge, which will result in an increase in treatment costs. Expanding access to novel technologies and the Internet has made these clients use search engines to get answers for their questions and meet their information needs. Therefore, the aim of this study is to investigate application of smart web-based solutions to meet the educational needs of CABG patients.

Method: In the present review article, the papers published between 2000 and 2022 were reviewed. In order to access to the related scientific documentation, studies related to providing preoperative or post-discharge self-care educations for CABG patients in which various services such as M-health and web-based systems were used, were investigated in the PubMed, Science Direct, Scopus, ProQuest and Google Scholar databases. The materials of all the publish articles were carefully analyzed and arranged in an appropriate sequence after extracting, categorizing, and integrating.

Result: The results of this study showed that the use of web and mobile based solutions to provide self-care education has a great impact on reducing stress and anxiety levels. Scalable access to trainings (regardless of place and time), cost-effectiveness, and also increasing the motivation to implement self-care measures are some advantages. However, due to the providing mostly general educations and the lack of providing personalized contents according to patient's clinical condition, it can cause problems and this causes the patient to have little compliance with the implementation of the education measures. Many patients expressed the need for personalized educational content based on their clinical situation for compliance and correct implementation of self-care educational measures. Also, due to the complexity of the specialized materials and the lack of familiarity of them, CABG patients had experienced many problems in understanding and learning the trainings, such as facing with unclear and complex contents and the lack of continuity between the educations.

Discussion: Many websites and mobile-based services and tools generate content in the field of health. But for various reasons, they do not meet the needs of the patient. Some of the reasons are difficulty in conveying medical concepts due to its nature, the lack of using evidence-based materials and reliable references, the lack of personalization based on the patient real needs, and the dispersion and lack of coherence of the materials. With the increasing development of web and mobile based technologies, and their combination with artificial intelligence which helps to provide smart health, it seems that the use of intelligent tools and services is capable of meeting the educational needs of CABG patients with the help of processing educational data and examining the needs of patients. Also, it may lead to increased adherence to self-care measures among these patients.

Keywords: Smart Health, coronary artery bypass graft patients, Self-care, Artificial Intelligent

Artificial Intelligence for Self-Care: A Systematic Review

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Background and aims: Artificial intelligence have been using in almost all aspects of human life and plays and important role in everyone's life. Artificial intelligence is widely used in many fields of health, one of which is self-care. The present study aims to systematically review the studies related to the use of artificial intelligence for the self-care among patients.

Method: The current research was conducted in accordance with the PRISMA guidelines and by searching the keywords "Artificial intelligence" and "self-care" and their synonyms in Web of Science, PubMed and Scopus databases without time limit until February 22, 2023. All short articles, letters to the editor, conference abstracts, observational studies, review articles, as well as articles without accessible full page, were excluded from the study. The original articles published in English, which were somehow related the use of artificial intelligence for self-care, were included in the study and their characteristics were investigated. Data analysis was done through content analysis method.

Results: 298 articles were retrieved. After removing duplicate items (109) and unrelated items based on evaluation of title and abstract (163) and full text (15), 11 articles were recognized as eligible. These studies have been conducted in China, America, Australia, Panama, Ghana, France, London, England, and India. Technologies based on artificial intelligence in the field of self-care for diseases such as diabetes (54.54%), bipolar disorder (9.09%), chronic neck and back pain (9.09%), Parkinson's (9.09%), obesity (9.09%) and chronic diseases (9.09%) were used. The largest volume of articles was devoted to the use of artificial intelligence such as machine learning (27.27%), expert system (18.18%), deep learning (9.09%), and genetic algorithm (9.09%).

Conclusion: The results showed that technologies based on artificial intelligence are useful in many fields of health and self-care of patients. In fact, the use of artificial intelligence can help patients make better decisions, be very effective in reducing their problems and improving self-care, and accelerate the movement towards smart health and better patient empowerment.

Keywords: Artificial Intelligence, Self-Care, Smart-Health

Medical Decision Support using Machine Learning for Early-Onset Neonatal Sepsis Prediction

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Background and aims: The early neonatal period, which extends from birth to the seventh day of life, is the most dangerous period for a neonate, with an increased risk of morbidity and mortality from early-onset sepsis mainly due to bacteria acquired before and during delivery. Forasmuch as these are newborns, the procedure of diagnosis and treatment is extremely difficult. Given that sepsis management is highly time-sensitive, early prediction of sepsis before its onset in newborn patients is crucial in preventing mortality as it gives clinicians additional lead time to plan and execute treatment plans. Thus, this research aimed to investigate the predictive value of machine learning models of demographic and laboratory data to detect early-onset sepsis.

Method: Datasets were collected from the medical records of 459 neonates up to 7 days of life hospitalized in the Neonatal Intensive Care Unit of the Maternal, Fetal, and Neonatal Research Center, Vali-Asr Hospital, affiliated to Tehran University of Medical Sciences during the period from 2016 to 2019 due to their suspicion of early-onset sepsis, in which patient names were eliminated in order to have an anonymized dataset. The neonates were evaluated for 213 demographic and laboratory features. The performance of the machine learning models including Support Vector Machines, Decision Trees, Random Forest, K Nearest Neighbor, Gradient Boosting, and XGBoost were investigated for predicting early-onset sepsis. Parameters were selected based on grid search and results were evaluated based on the area under the receiver operating curve and the best F1 score metric on the validation set. Statistical analysis was performed using Python 3.6.

Results: Based on the decision tree classifier, 57 features out of 213 were selected as the most essential features in the diagnosis and prediction of early-onset sepsis. Some of these features are continuous positive airway pressure therapy, neonatal age (day) of oral nutrition starting time, premature rupture of membranes, corticosteroid administration in pregnancy, low birth weight, hematocrit test, hemoglobin concentration, umbilical vein catheterization, neonatal jaundice, absolute monocytes and lymphocytes count, blood calcium and potassium levels, red blood cell distribution width, mean platelet volume, respiratory distress syndrome, and Apgar score at five minutes. As per findings, Support Vector Machines and Random Forest gave the best results as compared to the other models to predict early-onset sepsis with the area under the receiver operating curve of 98.4% and 97.6%, respectively. Both algorithms had F1 scores of 0.94.

Conclusion: The results demonstrated that Support Vector Machines and Random Forest can help identify early-onset sepsis hours prior to clinical recognition regarding demographic and laboratory data while screening a large portion of negative cases and may therefore be valuable as a medical decision support tool. Thus, these models could be implemented in the hospital in order to significantly reduce the in-hospital mortality rate, unnecessary hospital stay, and cost of treatment. Further prospective research is warranted to assess machine learning models using vital signs data to improve the accuracy of antibiotic use in the management of neonatal sepsis.

Keywords: decision tree classifier, early prediction, sepsis.

Machine Learning Approaches to Predict Late-Onset Neonatal Sepsis in the Neonatal Intensive Care Unit

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Background and aims: Neonatal sepsis is a major cause of neonatal morbidity and mortality and refers to an invasive infection, usually bacterial, involving the bloodstream. Late-onset neonatal sepsis occurs in infants between 7 and 28 days old. The primary challenge in neonatal sepsis is its evasive signs and symptoms which makes the diagnosis and prognosis burdensome. The only unrivaled quick fix is blood culture confirmation which takes virtually two days to generate results. On the other hand, in order to diminish neonatal mortality, early medical treatment must be initiated promptly. Thus, early and accurate prediction of sepsis ensures correct and prompt antibiotic treatment and minimizes diagnostic uncertainty. This research aimed to implement machine learning models that can efficiently predict neonatal sepsis based on the features.

Method: The target population was 455 cases of neonates aged between 7 and 28 days admitted to the Neonatal Intensive Care Unit of the Maternal, Fetal, and Neonatal Research Center, Vali-Asr Hospital, affiliated to Tehran University of Medical Sciences during the period from 2016 to 2019 due to their suspicion of late-onset sepsis. Each neonate record included 213 demographic and laboratory features. Machine learning models including Support Vector Machines, Decision Trees, Random Forest, K Nearest Neighbor, Gradient Boosting, and XGBoost were employed on the provided dataset to predict late-onset sepsis. Parameters were selected based on grid search and results were evaluated based on the area under the receiver operating curve and the best F1 score metric on the validation set. Statistical analysis was performed using Python 3.6.

Results: In order to predict late-onset sepsis, 42 features out of 213 available features were selected using the decision tree classifier. Some features such as neonatal age (day) of full oral nutrition starting time, anemia, diagnosis of sepsis by the physician, fresh frozen plasma, mean corpuscular volume, respiratory distress syndrome, patent ductus arteriosus, surgical intervention, blood type, blood phosphorus, sodium, magnesium, and potassium levels, intravenous immunoglobulin intervention, intervention after resuscitation, type of nutrition, and neonatal age (day) of phototherapy starting time can be mentioned in the headline. The results revealed that Random Forest and XGBoost performed highly at the prediction of late-onset sepsis with the area under the receiver operating curve of 94.9% and 93.6%, respectively. These algorithms also had the highest F1 scores of 0.87 and 0.84, respectively.

Conclusion: Outcomes obtained from this research showed the promising potential of Random Forest and XGBoost in predicting late-onset sepsis based on demographic and laboratory data when blood culture results are not still available or without a result. These results can benefit the clinicians in appropriate management of neonatal sepsis so as not only to reduce sepsis-related mortality in sick neonates but also to prevent the misuse of antibiotics in healthy newborns. However, this research can be extended by collecting patient vital signs data to feed more data to the machine learning models.

Keywords: machine learning, neonatal mortality, sepsis.

Developing a Conceptual Framework for a Smart University of Medical Sciences: A scoping review

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Introduction: With the advancement of modern technologies in the 21st century, significant progress has been made in medical education technologies, leading to the increased use of smart health technologies in hospitals and improved access to healthcare. As a result, the need for universities of medical sciences to adapt to technological advancements has grown, along with the demands of students, graduates, and society. However, current university processes and infrastructures lack the necessary agility to identify and address these needs effectively. To prepare future students, graduates, staff, and administrators for the evolving landscape, it is essential to embrace new technologies and innovations in medical education. Transforming medical science universities into intelligent institutions can provide a cutting-edge solution to these challenges. This study aimed to establish a conceptual framework for a Smart University of Medical Sciences.

Methods: A Scoping Review method was employed to identify the core components and dimensions of a Smart University of Medical Sciences, as well as to develop a conceptual framework. This method involved a rapid assessment of key concepts within a specific research topic and an examination of primary sources and types of evidence. The search was conducted using reliable databases, such as PubMed, Web of Science, EMBASE, Scopus, Science Direct, and Google Scholar, from 2000 to 2022, with the keywords “Smart University” and “Medical sciences.”

Findings: The study’s findings led to the design of a conceptual architecture, or Master Plan, for the University of Medical Sciences. This architecture consists of six primary layers: smart hardware infrastructure, smart software infrastructure, connected devices and smart technologies, smart platforms, smart solutions, and smart organizational transformation. The conceptual architecture is based on the principle of decentralizing university activities using cloud system architecture. Subsequently, the conceptual framework for a Smart University of Medical Sciences was outlined across seven key dimensions.

Conclusion: In conclusion, a Smart University of Medical Sciences adapts to the dynamic needs of stakeholders (students, faculty, staff, and society) by creatively utilizing advanced technologies and innovative methods. This facilitates learning, enhances performance, improves the quality of educational processes, increases management efficiency, and strengthens the health system. As part of a smart city, the Smart University of Medical Sciences is a conceptual framework comprising solutions under the headings of smart campus, smart education, smart hospital, smart healthcare, smart e-learning, smart pedagogy, and smart classroom.

Keywords: Smart University, Smart Campus, Medical Sciences

Mobile Health Technology for Monitoring and Management of Inflammatory Bowel Disease: a systematic review of technical aspects

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Background and aims: Inflammatory bowel disease (IBD) is gastrointestinal disorder that is chronic, and debilitating, and diminishes the quality of life. In recent years, with a better understanding of the pathophysiology of the disease, as well as advances in mobile health technology, we have had new strategies in the management of IBD. This study aimed to summarize the technical aspects of using mobile health in IBD patients.

Method: The study protocol adopted the PRISMA guidelines. A systematic review was performed using PubMed, Web of science and Scopus to identify articles using M-health Technologies in English literature and published from 2010 to 2022. Based on the predefined selection criteria, 2 levels of screening were performed.

Results: We retrieved 197 potential articles were from the 3 databases. After 2 levels of screening, only 12 articles that met our inclusion criteria were identified. The findings indicate that Applications have been designed with different purposes, including education, treatments, disease control, monitoring, communication between patients and healthcare providers, and improved health outcomes. In 9 (75%) studies Mobile apps developed in two formats (web-based and mobile-based), and only 3 (25%) studies have integrated with electronic health records. In 10 studies (84%), Applications have been evaluated from different aspects, including usability, accuracy, feasibility, satisfaction, and effectiveness.

Conclusion: Mobile health technologies can improve quality of life, quality of care and self-management in IBD patients. Future studies and app design for IBD should include integration and interoperability of mobile apps with EHRs.

Keywords: inflammatory bowel disease, IBD, Mobile health, smartphone

Bone fracture risk prediction based on clinical variables and DXA results by support vector machine

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Background and aims: Osteoporosis is defined as bone strength impairment due to mineral depletion, which puts the patient at risk of fracture. Quantitative assessment of bone mineral density (BMD) is performed by dual energy X-ray absorptiometry (DXA). Then the obtained results are judged according to the T-score index. The T score, together with information related to a person's health and lifestyle, is one of the important components for calculating fracture risk, which is used in fracture risk prediction calculators such as CAROC and FRAX.

In order to prevent fractures caused by osteoporosis, it is necessary to assess the risk of fracture. Some of the studies that have been done before in this field have proposed methods for diagnosing osteoporosis and determining bone density based on the processing of radiographic images, but radiographic images are only two-dimensional images that give us less information about the texture and porosity of the bone. they give. Therefore, using DXA method can be more beneficial in order to get the exact amount of bone density. The proposed methods often have high computing time and are not easy to use for diagnostic predictions for the general public. To facilitate the prediction of osteoporosis with more available data, the use of machine learning methods can be beneficial.

The purpose of this study is to use a machine learning model based on neural networks that can predict the risk of fracture based on the specifications of the patient's clinical and laboratory variables and DXA results. Another goal is that the proposed method can be used by any type of user with high accuracy and speed.

Method: The dataset used in this article was collected from 817 person in the age range of 50 to 98 years. The features in the dataset include the history of diseases, effective behaviors, the type of fracture and the level of bone density, etc. Based on the features, several supervised learning algorithms have been used to predict the possibility of fracture occurrence in future years. The final proposed method is based on neural network and support vector machine algorithm. The final model will be evaluated based on the cross-validation method, confusion matrix, etc.

Results: After pre-processing and data standardization, several models of supervised learning algorithms including perceptron neural network, support vector machine, k nearest neighbor, decision tree were used. The SVM neural network obtained the highest accuracy among the algorithms, which could be used for the purpose of fracture risk prediction with 94.48% accuracy.

Conclusion: Neural networks can be used as a suitable model for osteoporosis classification by finding the best possible boundary between two classes of data. SVM works very well on high-dimensional data and is well suited to binary classification problems. According to the obtained results, the use of support vector machine can be beneficial in predicting the probability of fracture in the coming years.

Keywords: Osteoporosis, machine learning, SVM, BMD, Fracture risk prediction

The Diagnostic values of Machin learning models in early detection of Endometrial Cancer: A Diagnostic Meta-Analysis

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Objective: Endometrial cancer is considered one of the six most common types of cancer and the fourteenth leading cause of women's cancer deaths worldwide. Due to the high number of deaths, Incidence, prevalence, and ultimately disease burden, early detection of this type of cancer is very important for health and clinical decisions. This study was conducted to compare different Machine-Learning (ML) models in predicting the occurrence, recurrence, and lymph node involvement of endometrial carcinoma and ultimately finding the best model for early detection of this type of cancer.

Methods: This meta-analysis was gathered based on the PRISMA guidelines and the PIRT structure. The preferred databases for searching included PubMed (Medline), Scopus, Web of Sciences, Embase, and Cochrane Library, from January 2000 to March 2023. Some of the basic keywords were "Endometrial Cancer", "Machine Learning", and the synonyms of these keywords were retrieved through Mesh and Emtree. After the search, articles were screened based on the title, abstract and full text. And finally, using the researcher's own checklist, data extraction was done. Finally, the quality assessment of the articles was accomplished based on the QUADAS-2 checklist, and data analysis was done with version 17 of STATA software.

Results: After the search, a total of 183 articles were retrieved from international databases. After screening based on title, abstract, and full text, 6 studies met the inclusion criteria and were considered for meta-analysis. Out of these 6 studies, 2 studies examined the diagnostic value of different ML models in the early detection of occurrences, 2 studies in the early detection of recurrence, and 2 other studies in the early detection of metastasis to lymph nodes in endometrial cancer. The pooled sensitivity, specificity, accuracy, AUC, PPV, and NPV of ML in general in the diagnosis of endometrial cancer was 0.80 with a confidence interval of (95% CI: 0.83 - 0.77), 0.81 (95% CI: 0.78 - 0.84), 0.81 (95% CI: 0.78 - 0.84), 0.85 (95% CI: 0.83 - 0.88), 0.51 (95% CI: 0.46 - 0.56) and 0.96 (95% CI: 0.95-0.96), respectively. ADC model with a sensitivity of 0.86 (95% CI: 0.57 - 1.00) was the most sensitive in diagnosing endometrial carcinoma. The highest AUC (88%) was related to GBDT, NN, and RF models.

Conclusion: The results of the present meta-analysis confirmed that different ML algorithms can be beneficial in the early diagnosis of endometrial cancer.

Predict of Non-alcoholic Fatty Liver Disease Using Anthropometric Analyzing and Obesity Degree by Machine Learning

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Background and aims: Non-alcoholic fatty liver disease (NAFLD) is one of the most important complications of obesity, especially abdominal obesity. Increased visceral fat is the most important risk factors for this. Diseases that are caused by the pathogenesis of insulin resistance are closely related to this disease. The aim of this study is to investigate the effect of obesity degree and anthropometric changes in predicting liver steatosis and fibrosis based on artificial intelligence.

Methods: A cross-sectional study was conducted among 650 individuals over the age of 18 without a history of continuous alcohol consumption and underlying liver disease in two southern and eastern provinces of Iran. Anthropometric and body composition measurements were performed manually and body composition analyzer In Body 270. Hepatic steatosis and fibrosis were determined using a Fibro scan. ML methods including k-Nearest Neighbor (kNN), Support Vector Machine (SVM), Radial Basis Function (RBF) SVM, Gaussian Process (GP), Random Forest (RF), Neural Network (NN), Daboost and Naïve Bayes were examined for model performance and to identify anthropometric and body composition predictors of fatty liver disease.

Results: RF generated the most accurate model for fatty liver (presence of any stage), steatosis stages and fibrosis stages with 82%, 52% and 57% accuracy, respectively. Abdomen circumference, obesity degree, Waist to hip ratio, Waist circumference, trunk fat and body mass index were among the most important variables contributing to fatty liver disease.

Conclusion: ML-based prediction of NAFLD using obesity degree and visceral obesity rate and effective anthropometric data. It can help physicians at any level of health in early diagnosis of the disease and prevention of the progression of the disease towards the occurrence of fibrotic liver and cirrhosis complications.

Keywords: Artificial Intelligence, Fibro scan, Steatosis, Liver Fibrosis, obesity degree

Bone Age and Sex Prediction by Left-hand X-ray Images Dataset using ResNet50 Deep Neural Network

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Abstract: Bone age and sex prediction is a crucial diagnostic tool in the assessment of bone development and the determination of endocrine and metabolic disorders. In this paper, we present a novel deep learning approach for bone age and sex prediction using the left-hand X-ray images dataset. We utilized a pre-trained ResNet50 deep neural network to extract the features from the left-hand X-ray images and perform bone age and sex prediction. The proposed approach achieved high accuracy and outperformed other state-of-the-art methods. ResNet, also known as Residual Network, is a popular deep neural network architecture that was introduced by Shaoqing Ren, Kaiming He, Jian Sun, and Xiangyu Zhang in 2015. ResNet has been one of the most successful deep learning models to date, winning the ILSVRC challenge in 2015. This model's success lies in its ability to train very deep neural networks with more than 150 layers, which was previously challenging due to the vanishing gradient problem.

The vanishing gradient problem occurs when gradients become too small during backpropagation, making it challenging to update the weights in the network's early layers effectively. ResNet addresses this issue by introducing skip connections that enable the flow of information from one layer to the next without being transformed, effectively allowing the network to learn the identity function.

Bone age and sex prediction using left-hand X-ray images dataset is a task that requires the ability to process and analyze large amounts of image data. In this paper, we propose to use the ResNet50 deep neural network architecture for this task. ResNet50 is a variant of ResNet that has 50 layers and is capable of achieving high accuracy in image classification tasks.

To train and evaluate the proposed model, we will use a publicly available dataset of left-hand X-ray images for bone age and sex prediction. The dataset contains a large number of images and annotations, making it suitable for training deep neural networks.

Our approach will involve training the ResNet50 model using the dataset and evaluating its performance on a separate test set. We will also explore techniques such as data augmentation, regularization, and fine-tuning to improve the model's performance.

The results of our experiments will demonstrate the effectiveness of using ResNet50 for bone age and sex prediction from left-hand X-ray images. This approach has the potential to improve the accuracy and efficiency of this important medical task, leading to better diagnosis and treatment for patients.

Investigating the relationship between laboratory elements and factors affecting stress levels by using data mining

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Background and aims: considering the epidemic of stress in the society and the importance of identifying relevant and effective factors in this field, this research aims to identify laboratory elements and their relationship with other factors influencing the stress level of people using the Apriori algorithm of the association rules method of data mining.

Method: In this study, the laboratory data of 3470 people referred to Shahrekord Cohort Research Center were used. After data preparation and pre-processing, by using Apriori algorithm, various models were applied and finally the rules that expressed the effective factors and laboratory elements on high level of stress among people were extract and analyzed.

Results: The findings show that people with SBP and blood urea higher than normal or people with MCH less than 26, neutrophil less than 39, lymphocyte less than 33 and have fasting blood sugar higher than normal, they experience high level of stress.

Conclusion: The results show that by investigating the laboratory elements, it's possible to examine analyze the stress level of people in the society and care and therapeutic measures were used at the necessary time.

Keywords: Stress, Data Mining, Association rules, Laboratory element.

The strategic role of artificial intelligence in developing mobile health

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Background and aims: In recent years, the integration of artificial intelligence (AI) into mobile health (m-Health) has shown great promise for improving healthcare delivery, enhancing patient outcomes, and reducing healthcare costs. This review aims to explore the current state of AI applications in m-Health and its potential impact on healthcare.

Method: A comprehensive search was conducted in electronic databases including PubMed, Scopus, and Web of Science for relevant studies published from 2016 to 2023. The search terms used were "artificial intelligence", "mobile health", "m-Health", and "machine learning"(and synonyms). English language articles were retrieved, screened, and reviewed by the authors. Studies that investigated the application of AI in m-Health and its impact on healthcare were included in this review.

Results: A total of 45 studies met the inclusion criteria and were included in this review. The studies were conducted in various settings and focused on different aspects of healthcare delivery, including diagnosis, treatment, and monitoring. The most common applications of AI in m-Health were in the areas of disease detection and diagnosis, personalized treatment planning, and remote patient monitoring.

Disease Detection and Diagnosis:AI-powered m-Health applications were found to be effective in the early detection and diagnosis of various diseases. For instance, AI-powered mobile apps have been developed for the early detection of skin cancer, diabetic retinopathy, and lung cancer. These applications use image recognition algorithms to analyze images of skin lesions, retinal scans, and CT scans, respectively, to identify early signs of disease.

Personalized Treatment Planning:AI-powered m-Health applications have also been developed for personalized treatment planning. These applications use machine learning algorithms to analyze patient data, such as medical history, genetic information, and lifestyle factors, to provide personalized treatment recommendations. For instance, AI-powered mobile apps have been developed for personalized treatment planning for diabetes, hypertension, and depression.

Remote Patient Monitoring AI-powered m-Health applications have also been developed for remote patient monitoring. These applications use sensors and other wearable devices to collect patient data, such as heart rate, blood pressure, and glucose levels, and analyze this data using machine learning algorithms to provide real-time feedback to healthcare providers.

Conclusion: The integration of AI into m-Health has the potential to transform healthcare delivery, enhance patient outcomes, and reduce healthcare costs. AI-powered m-Health applications have been shown to be effective in disease detection and diagnosis, personalized treatment planning, and remote patient monitoring. However, several challenges and limitations must be considered, including the availability and quality of data, ethical and privacy concerns, and the need for significant investment in technology and infrastructure. Despite these challenges, the potential benefits of AI-powered m-Health applications make them an exciting area of research and development in healthcare.

Keywords: artificial intelligence, medicine, mobile health, machine learning, healthcare

Application of deep learning in the prognosis of liver cancer patients: A systematic review

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Background and aims: Prediction of survival after the treatment of liver cancer has been vastly investigated, yet remains deficient. Deep learning has demonstrated its capability to recognize specific features that can prognosis of liver cancer patients. Artificial intelligence is rapidly emerging because of the ability to process large amounts of data and find hidden connections between variables. Artificial intelligence and deep learning are increasingly used in several topics of liver cancer research, including diagnosis, pathology, and prognosis. The purpose of this article is to assess the role of deep learning in the prediction of survival following liver cancer treatment.

Method: A systematic review of the published literature focused on the prognostic impact of deep learning in the management of liver cancer was undertaken. Databases PubMed and the Web of Science and research books were systematically searched using the words “artificial intelligence”, “deep learning” and “liver cancer” (and synonyms). English language articles were retrieved, screened, and reviewed by the authors. The quality of the papers was assessed using the risk of bias In the Non-randomized Studies of Interventions tool. Data were extracted and collected in a database.

Results: Among the 387 articles screened a total of 127 studies reported on the use of deep learning in liver cancer. Among these articles, only 9 (7.1%) studies referred to the employ of deep learning in the prediction of survival among patients with liver cancer and were included in this review. Other studies using deep learning in liver cancer were excluded; specifically, these studies reported on the employ of deep learning for the diagnosis of the tumor (n = 76, 59.8%), identification of specific genes or pathways (n = 17, 13.4%), prediction of tumor response after therapy (n = 16, 12.6%), and the prediction of pathological aspects (n = 9, 7.1%). All studies included in the analytic cohort were published in the last decade.

Conclusion: Deep learning used for survival prediction after liver cancer treatment provided enhanced accuracy compared with conventional linear systems of analysis. While a few limitations have been identified in these studies, there was an optimal level of accuracy of the deep learning used in the prognosis of liver cancer patients. Improved transferability and reproducibility will facilitate the widespread use of deep learning methodologies, so healthcare providers are suggested to take advantage of deep learning capabilities to predict liver cancer patients’ survival.

Keywords: artificial intelligence, artificial neuronal network, deep learning, liver cancer, liver transplantation, resection

PTM: Part-Of-Speech Tagger for Persian clinical notes Based on Hidden Markov Model

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Background and aims: Part of Speech tagging is an essential part of clinical text processing applications. Complications with part-of-speech (POS) tagging of clinical texts is accessing and annotating appropriate training corpora. These difficulties may result in POS taggers trained on corpora that differ from the tagger's target clinical notes which will result in low tagging accuracy. This paper presents the Persian Part of Speech (POS) tagger, based on the Hidden Markov Models for Persian clinical notes. The proposed tagger (PTM) supports some properties of text to speech systems, such as Break Phrase Detection, Homograph words Disambiguation, and Lexical Stress Search and the main aspects of Persian morphology is introduced and developed. In order to have evaluation about the accuracy of the proposed approach, it is applied on both formal and informal clinical corpus. The experimental results show an overall accuracy of 90.3%, which is the best result reported for Persian POS medical texts.

Method: PTM estimates a tag's likelihood for a given token by combining token collocation probabilities and the token's tag probabilities calculated using a Naive Bayes classifier. We compared PTM to three POS taggers used in the medical domain (mxpost, Brill and TnT). We trained each tagger on a non-clinical corpus and evaluated it on clinical corpora.

Results: To evaluated proposed method, two different experiments were performed. Firstly, we applied PTM on the formal clinical text. Hence, the emergency part of the corpus is selected. This part of corpus has 13924 words in which 12562 of them are known words. We also applied PTM on informal clinical text. This part of corpus has 10329 words in which 10062 of them are known words. PTM was more accurate in clinical text tagging than mxpost, Brill and TnT (respective averages 83.9, 81.0, 79.5 and 78.8).

Conclusion: Analyzing of tagger performance illustrates the lexical differences between corpora have profound effect on tagging accuracy than originally considered by related studies. Clinical POS tagging methods may be improved to advance their accuracy without requiring extra training or large training data sets. In this paper, we proposed a Persian clinical POS tagger based on HMM and an optimization process is suggested. Moreover, some main challenges of POS tagging systems introduced. High accuracy rate of PTM in compared with other related methods demonstrates that HMM Models are suitable for POS tagging in Persian clinical texts. Our future work will focus on improving the accuracy Persian clinical Natural language processing (NLP) by providing a multi- approach system.

Keywords: Clinical text tagging, POS tagger, Hidden Markov Model

Analysis of competitive endogenous RNA (ceRNA) network to find diagnostic biomarkers for gastric cancer using machine learning methods

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Background and aims: Gastric cancer (GC) is the third cause of cancer-related deaths, worldwide. With the sequestering of shared miRNAs, competitive endogenous (ce) RNAs can regulate one another and influence the development of cancer. The aim of this study was to build a diagnostic model for GC using ceRNA network and machine learning methods.

Methods: The RNA-seq and clinical data of GC patients were downloaded using TCGAbiolinks R-package, including 335 tumor and 30 non-tumor samples. Differentially-expressed long non-coding RNAs (lncRNAs) (DELs), miRNAs (DEmiRs), and mRNAs (DEMs) between tumor and non-tumor samples were extracted by R-package DESeq2 based on |Log2 fold change|>1 and adjusted $p<0.05$. The samples were divided into low-stage (stages I and II) and high-stage (stages III and IV) based on their AJCC stage feature and the chi square test was used to determine the association between RNA expression and tumor stage. These stage-related genes were then used to predict the miRNA–mRNA and miRNA–lncRNA interactions utilizing the multiMiR R-package and DIANA-LncBase v3.0, respectively. A lncRNA-miRNA-mRNA ceRNA network was then constructed and those lncRNAs which entered the network were used in machine learning steps. For machine learning, we split the data into training and test with a ratio of 0.7 to 0.3 and SMOTETomek method was utilized to balance the number of samples in the training cohort. Feature selection was performed using Recursive Feature Elimination (RFE) method and the selected features were utilized to build a logistic regression model.

Results: We identified 193 DELs, 15 DEmiRs, and 214 DEMs which were stage-related in GC patients. After extracting the miRNA–mRNA and miRNA–lncRNA pairs, the ceRNA network was constructed and all 19 lncRNAs of the network were considered as inputs for machine learning steps. For model construction, samples were categorized into three groups including tumor/low-stage, tumor/high-stage and non-tumor. After balancing the training cohort, using RFE, four lncRNAS were selected (ENSG00000197085, ENSG00000230002, ENSG00000274964 and ENSG00000286208) as final candidates. A logistic regression model was constructed which its area under the curve (AUC) in the test cohort was 0.86 showing its great ability to separate tumor from non-tumor and high-stage from low-stage GC samples.

Conclusion: Machine learning techniques can make a huge contribute on the process of early diagnosis and prediction of cancer. This study successfully constructed a ceRNA network and introduced a stage-related lncRNA signature utilizing machine learning approaches which reliably splits GC patients according to their tumor stage.

Keywords: Gene Expression Profiling, Non-coding RNAs, Machine learning, Stoma

Application of machine learning in building a diagnostic model for gastric cancer based on a survival-related competitive endogenous RNA (ceRNA) network

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Background and aims: Gastric cancer (GC) is known as a highly aggressive malignancy in which environmental and genetic factors can influence its development. Among the genetic factors, competitive endogenous (ce) RNAs are identified to affect the development of cancer. The aim of this study was to find diagnostic biomarkers for GC based on a ceRNA network by utilizing machine learning approaches.

Methods: The RNA-seq and clinical data of 335 GC tumor and 30 non-tumor samples were downloaded using TCGAbiolinks R-package. Differentially-expressed long non-coding RNAs (lncRNAs) (DELs), miRNAs (DEmiRs), and mRNAs (DEMs) were extracted by R-package DESeq2 based on |Log2 fold change|>1 and adjusted $p<0.05$. Utilizing univariate Cox regression, those DELs, DEmiRs, and DEMs which were survival-related were detected with a threshold of $p<0.05$. The multiMiR R-package and DIANA-LncBase v3.0 were used to predict the miRNA–mRNA and miRNA–lncRNA interactions. A lncRNA-miRNA-mRNA ceRNA network was then constructed. Using lncRNAs of the network, machine learning analysis were conducted. First, the data was split into training and test with a ratio of 0.7 to 0.3 and then tsamples in the training group were resampled using SMOTETomek method. Recursive Feature Elimination (RFE) method was used as the feature selection technique and the selected features were utilized to build a diagnostic model utilizing support vector machine (SVM) algorithm.

Results: 3947 DELs, 266 DEmiRs, and 4388 DEMs were detected in differential expression analysis between tumor and non-tumor GC samples which among them, 187 DELs, 24 DEmiRs, and 524 DEMs were associated with the overall survival of GC patients. By integrating the relations with common miRNAs, we constructed a ceRNA network consisting of 12 DELs, 11 DEmiRs, and 70 mRNAs. After balancing the training cohort and by using RFE, four lncRNAs were selected (ENSG00000213279, ENSG00000248103, ENSG00000249001 and ENSG00000262061) as final diagnostic signature. A SVM diagnostic model was then constructed with an area under the curve (AUC) of 0.98 in the test group.

Conclusion: In this study, using ceRNA network construction and machine learning analysis, we identified four diagnostic lncRNAs for GC patients which were survival-related as well. Since machine learning approaches are powerful methods to introduce biomarkers, our future efforts will be focused on the experimental and clinical validation of these biomarkers.

Keywords: Machine learning, Non-coding RNAs, Stomach neoplasms, Systems Biology

Applications of Artificial Intelligence in osteoporosis and post-fragility fracture care: A Short Review

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Background and aims: The increasing load of osteoporosis and fragility fractures highlights the need for better management of osteoporosis in the Healthcare system and is a proper context for digital health interventions including new artificial intelligence algorithms. Osteoporosis is one of the main causes of disability in old ages, reduced quality of life and loss of independence, therefore the use of artificial intelligence (AI) is an essential way to minimize the diagnostic errors associated with osteoporosis. The review study aims to address concerns and inform those interested in the using artificial intelligence in osteoporosis management.

Method: This review was conducted based on the review of articles available in pub med, google scholar and med line databases from 01/01/2010 to 01/01/2023 with keywords AI (artificial intelligence), osteoporosis, fragility fracture and machine learning. It led to the inclusion of 22 articles in the review. 5 articles were removed from the study due to similarity in 3 bases, and ultimately 17 articles were read.

Peer-reviewed articles cover 5 areas of osteoporosis management. BMD predictive Variables (n=1)

Diagnosis, screening and classification of osteoporosis (n=6) diagnosis and screening of fracture (n=5)

Forecast of fracture risk(n=3) Auto-division of various images found (n= 2)

Results: Recent advances in machine learning (ML) have enabled the field of artificial intelligence (AI) to make dramatic advances in complex data environments in which human capacity for high-dimensional relationships is limited. Different techniques to check bone health with AI went beyond X-ray imaging such as: bone acoustics to regulate bone health, dental radiography and BMD, use of MRI to assist with diagnose and distribution of energetic X-ray images dual energy(DXA), image analysis and multi-row multi-detector (MDCT). Prediction algorithms using different input data sets based on known risk factors help physicians to calculate 5 or 10-year fracture risk. The results of most of the studies showed better performance of CNN in fracture diagnosis than doctors and orthopedists. This performance is improved by data enhancement techniques of generative networks and digitally reconstructed radiographs, compared to those without booster. AI-designed Channel Convolutional Neural Network are able to automatically detect cracks and trajectories at different levels of compression with high precision.

Conclusion: Initial efforts to harness the power of machine learning algorithms like neural networks are still limited to the macroscale of bone, while there is a clear lack of their application at the smaller scale, where the damage begins to erode. This approach is especially for developing of a powerful detection system to understand the initiation of bone microdamage propagation and paves the way for the application of machine learning studies in bone micromechanics. Although these recent advances have had successful initial application to osteoporosis research, their development is continuing to improve the assessing the effectiveness and affordability of this technology requires strong controlled studies.

Keywords: artificial intelligence, osteoporosis, fragility fracture, bone density

Determining the type of BTE or ITE hearing aid Using Expert System

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An expert system is a piece of software which is used to solve problems within a specialized domain that ordinarily requires human expertise.it relies on two components: a knowledge base and an inference engine. A knowledge base is an organized collection of facts about the system's domain. Facts for a knowledge base must be acquired from human experts through interviews, observations, specialized books, and documents. An inference engine interprets and evaluates the facts in the knowledge base in order to provide an answer. So far, many expert systems have been proposed in the field of medicine and paramedics which tried to speed up the transfer of information from experts to others in order to make correct diagnosis possible in the shortest time.

This research has designed an expert system for identifying proper type of hearing aids (in-the-ear and behind-the-ear hearing aid) to hearing impaired people. Therefore, indicators and rules that are generally considered by experts identified and placed in the knowledge base of system. Then, the inference engine that can provide necessary and sufficient suggestions for identifying and selecting the proper type of hearing aid designed by VP-Expert shell.

Taking advantage of this system can be reduced expert's disagreements and challenge of hearing aid diagnosis to an acceptable level.

Keywords: Expert System, In-The-Ear hearing aid, Behind-The-Ear hearing aid

A review on AI in radiology in Iran

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Background and aims: Radiology is one of the fields of medicine that uses various imaging techniques such as CT scan, ultrasound, MRI, simple x-ray to diagnose and follow up with patients and respond to treatment. With the introduction of artificial intelligence, especially machine learning, the hopes to obtain knowledge and undiscovered rules between data have become more intense. Among the different fields of artificial intelligence, computer vision or image processing has a unique position and popularity. We conducted a study to review articles written in Iran using radiological methods and artificial intelligence & nbsp; to Show their results and to suggest some solutions to enhance the quality of such studies

Methodology: We searched google scholar, SID, and PubMed and found 400 articles studied, and we separated related articles until December 1, 2022.

Results: Among the 93 reviewed articles, 39 articles met the inclusion criteria, including: Iranian author, use of artificial intelligence methods, activity in the field of radiology We excluded 54 articles from the study according to the exclusion criteria, including the following: Studies conducted outside of Iran, review articles from foreign articles / not having enough connection with the topic of this article Among these articles, 9 cases used chest CT images, 17 used MRI and CT images, 3 used simple X-rays, and 10 used ultrasounds. Among these studies, 18 cases used external, and 21 used internal databases. Twenty-six cases investigated tumor and malignancy, five investigated and diagnosed covid, and eight dealt with topics such as fatty liver, Alzheimer's, age estimation, and MS, ...

Conclusion: The studies conducted in Iran in the field of radiology and used image processing show the desire of researchers to study tumors and malignancies. Unfortunately, a high percentage of researchers conducted on foreign databases. Our results show the necessity of creating and adequately storing data to provide internal resources for the optimal use of researchers to produce practical knowledge for the country. Machine learning for the prediction of inflammatory bowel diseases: a systematic review

Background and aims: Inflammatory bowel disease (IBD) are gastrointestinal (GI) disorders that are chronic, and debilitating, and diminish the quality of life. In recent years, with a better understanding of the pathophysiology of the disease, diagnosis and treatments, as well as technological advances such as artificial intelligence, we have had new strategies and approaches in the management of IBD. Artificial intelligence (AI) is a new discipline that aims to simulate, extend, and expand human intelligence and integrates theory, method, and application research and development. The purpose of this study is to review articles about Machine learning (ML) that were applied to the field of inflammatory bowel diseases (IBD).

Method: The study protocol adopted the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A systematic review was performed using PubMed and Scopus to identify articles using machine learning in English literature and published from January 2017 to November 2022. Based on the predefined selection criteria, 2 levels of screening were performed: title and abstract review, and full review of the articles. Data extraction was performed independently by all investigators and included algorithms, risk factors, sample size, purpose, evaluation index, deep learning, system developed, imaging modality, and limitation.

Results: The study protocol adopted the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A systematic review was performed using PubMed and Scopus to identify articles using machine learning in English literature and published from Janu-

ary 2017 to November 2022. Based on the predefined selection criteria, 2 levels of screening were performed: title and abstract review, and full review of the articles. Data extraction was performed independently by all investigators and included algorithms, risk factors, sample size, purpose, evaluation index, deep learning, system developed, imaging modality, and limitation.

Conclusion: IBD public datasets need to be constructed and data standardization is necessary for clinical application of machine learning in digestive field. It is noteworthy that the purpose of using ML in the management of IBD is not to replace it with the physician, but as a tool to support human-led decision-making and delivery of care.

Protocol for design and development of a mobile application based on self-acupressure and Chinese dietetics guide for women with menopausal hot flashes

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Background and aims: Hot flashes, a bothersome complication of menopausal transition, affects approximately 46% - 74% of female population. Despite several drugs which have been used to alleviate such symptom, not all patients can be prescribed these drugs due to their adverse effects. Thus, non-pharmacological alternatives seem to be crucial for symptom relief. Acupressure could be a reasonable, easy to self-administer option for treatment of menopausal hot flashes. Considering the global increase in use of mobile health applications, we aimed to develop a smartphone application to help patients deal with menopausal hot flashes by self-management techniques of acupressure and Chinese dietetics.

Method: We have designed to develop an easy-to-learn smartphone application program based on research outcomes and resources of acupressure and Chinese dietetics which would be accessible to smartphone owners in Persian language via available app stores enabling them to carry out our instructions in order to reduce hot flashes and deal with menopausal complications.

Conclusion: Mobile health applications with their increasing popularity have the benefit of self-management, cost-effectiveness and easier and faster access. Regarding the aging of population and the high prevalence of hot flashes in female proportion, it is important to provide menopausal women and their care-givers with effective methods leading to improvement of their quality of life.

Keywords: Hot flashes, Menopause, Acupressure, Mobile Applications

Psychometric Evaluation of Medical Artificial Intelligence Readiness Scale for Medical Students

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Background: Due to the progress of artificial intelligence in medicine and its worldwide application, it is expected that artificial intelligence will be one of the main elements of medical education in the coming years. This study aimed to translation and psychometric evaluation of the Persian version of medical artificial intelligence readiness scale for medical students.

Methods: The translation of the questionnaire was done according to backward-forward translation procedure. Reliability was examined by calculating Cronbach's alpha coefficient. Exploratory factor analysis and Confirmatory Factor Analysis was studied among 300 medical students. Content validity was assessed by calculating Content Validity Index and Content Validity Ratio.

Results: Cronbach's alpha coefficient for the whole scale was 0.94. Content Validity Index was 0/92 and Content Validity Ratio was 0/75. Exploratory factor analysis showed that the sample size was appropriate. Confirmatory factor analysis resulted the goodness of fit indices and the scale was confirmed with four factors including cognition, ability, vision and ethics.

Conclusion: The Persian version of the medical artificial intelligence readiness scale for medical students with four factors including cognition, ability, vision and ethics appears to be a valid and reliable instrument for the evaluation of medical artificial intelligence readiness.

Traditional medicine and artificial intelligence

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A computer software that does as a virtual human body could help predict how individuals will react to new therapeutic drugs. It will enable more chemicals to be examined with fewer human trials, making drug developing faster, cheaper, and safer.

Researchers at the Bio- Synergy Research Centers, recently have programmed CODA (Context-Oriented Directed Associations), software that working on recent advances in artificial intelligence and biotechnology. They makes programs to use CODA to explore the therapeutic potential of chemical compounds found in traditional medicines, such as Samul-Tang — a combination of extracts from four Asian plants used to treat anemia.

It is believed that CODA could accelerate personalized drug management — tailored medicines based on a patient's genetic and physiological characteristics — by reducing the number of superfluous trials. Also, "CODA's prediction power can save time and money by providing important biological information that will enable conducting experiments efficiently. Previous strategies in drug development have focused on producing chemicals designed to react only with the proteins involved in a disease, reducing the risk of side effects. But these drugs can still react with unintended targets. But "some serious diseases, such as cancers, can cause many complex interactions, so a multi-target approach that regulates them entirely can be effective". It is impossible to test every possible combination of drug on a broad range of patients.

CODA aims to find a solution. To build CODA, the researchers first developed a computer language to represent biological interactions. They

Then gathered information from public databases and the scientific literature to construct a network of potential interactions between chemicals, proteins and genes within, and between, organs. "Identifying unexpected drug interactions is an essential step in drug development," It has recently developed a method to test the effects and interactions of drug pairs, rather than single drugs, using CODA. "The CODA system can be used to predict and analyze the efficacy, toxicity and mechanism of action of multiple components," So as conclusion, when tested using drugs with verified effects, CODA successfully identified both therapeutic and adverse effects.

It hopes to make CODA into an online service that will "enable users to easily perform various drug analyses, and predict the effects of single and complex drugs". The research center will continue to investigate the molecular activity of natural compounds extracted from traditional medicines. "With CODA, we can discover new healthcare materials, including botanical drugs, and functional foods".

Analyzing Science and Innovation-Related Indicators and Their Relationship with COVID-19 Pandemic Control Using Statistical and Machine Learning Experiments

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Background and aims: The COVID-19 outbreak was one of many global illnesses and was declared a pandemic by the World Health Organization. When the pandemic was announced, scientific research and innovations were swiftly proposed, created, and carried out worldwide to manage the disease. Nevertheless, it is unclear whether these scientific research and innovations were effective in helping countries control the COVID-19 pandemic. The purpose of this article is to address this question.

Method: This study aims to determine if the level of science and innovation in a country, measured by H-index and GII_Score, can predict the effectiveness of controlling the COVID-19 pandemic. Data were collected from 102 countries in 2020 and 2021, including COVID-19 death and case numbers, test ratios, case fatality ratio (CFR), and test positivity ratio (TPR). H index and GII_Score were obtained in 2020 using SCImago and WIPO. The data was analyzed using Python 3.9.

Results: The study's results showed a significant and decreasing correlation between GII_Score and TPR (P-value < 0.001, r=-0.37), as well as GII_Score and CFR (P-value < 0.001, r=-0.40). Additionally, there was a significant and decreasing correlation between H-index and TPR (P-value < 0.016, r=-0.23), as well as H-index and CFR (P-value < 0.005, r=-0.27). Moreover, the K-means algorithm categorized countries into three clusters, and the study obtained the average H-index, GII_Score, TPR, and CFR values for each cluster.

Conclusion: This study examined the relationship between innovation and scientific indicators of countries and COVID-19 control. The study found that countries with higher GII_Score and H-index in 2020 had better COVID-19 control in 2021. The K-means algorithm clustered countries based on innovation and scientific indicators, and countries in the group with the highest indicators had lower CFR and TPR. The study suggests investing in innovation and scientific research can help control pandemics, and governments should have a coherent plan to guide innovation toward crisis resolution.

The interaction of artificial intelligence tools and development of Parkinson's drugs: a new glance to near future

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Background and aims: Parkinson (PD) is the second-most common neurodegenerative disease after Alzheimer's disease that is a degenerative condition of the brain associated with motor symptoms (slow movement, tremor, rigidity and imbalance) and other complications including cognitive impairment, mental health disorders, sleep disorders and pain and sensory disturbances. Currently, PD has no cure and no early diagnostics methods exist. Mitochondrial dysfunction is presented in the early stages of PD, and it is considered an important pathophysiology component. The supreme point is that reinforcing a positive compound effect in mitochondrial can occur using the machine learning model, confirming the platforms for mitochondria-based drug target interaction (DTI).

Method: A comprehensive systematic search by using the terms such as "Artificial Intelligence", "machine learning", "Parkinson's disease", "Drug target interaction" as keywords, was conducted in four Online Databases: Web of Science, Scopus, PubMed, and Embase up to February 2023. Also, for screening and data extraction, some applications such as "Rayyan" were used. Reviews and studies that did not use artificial intelligence for Parkinson's disease DTI were excluded. Studies that met our inclusion criteria were then critically appraised by two authors independently.

Results: We retrieved 950 relevant publications from online databases. After a thorough examination of the titles and abstracts and the removal of duplicate publications (n=73), 505 studies were eliminated. In 38 cases of disagreement between two authors, the opinion of the third author was the determiner. The full texts of ninety- four papers were reviewed. Eventually, thirteen studies met our inclusion criteria and included in our study. About 62 percent of studies used ML (machine learning) algorithm to improve drug target interaction and modeling of new drug targets for patients with PD. In some studies, the QSAR model developed with artificial intelligence was used to identify drug targets.

Conclusion: Based on the results of the studies, artificial intelligence approach can be useful in identifying drug targets and developing them. A logical target in the drug treatment of Parkinson's disease is leucine-rich repeat kinase 2 (LRRK2). It is also related to the treatment or reduction of symptoms. Structure-based and ligand-based approaches can be used. Using artificial intelligence, QSAR models have been developed with the aim of using them for pharmaceutical purposes. This model can be used in virtual screening to identify inhibitory proteins. There are several software available for QSAR development that are either commercial or free to use.

Keywords: Parkinson, Drug development, Artificial Intelligence, Drug target interaction, Deep Learning

A Scoping Review of Clinical Diagnosis, Classification and Treatment of Patients in Huntington's Disease: An Artificial Intelligence Approach

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Background and aims: Huntington's disease (HD) is a hereditary disorder arising from neurodegeneration individualized by chorea, dystonia, impaired gait and dementia. Degeneration occurs when there is mutation of HTT gene which encodes the protein is called Huntingtin. Also, there is considerable domain of genes associated with Huntington's disease in addition to the mentioned one. Nowadays, numerous methods are utilized to detect these genes, prominent examples are Artificial Intelligence methods. We aim to clarify AI-based impact on delineation of Huntington's disease.

Method: Four databases including PubMed, Scopus, WOS and Embase were searched according to terms related to diverse algorithms of Artificial Intelligence. All aspects of Machine Learning in detecting, classification and analyzing of genetic factors and also, verification of previous studies were considered in search. 165 results for PubMed, 159 for WOS, 347 for Scopus, 490 for Embase and then 1161 from all databases were found. After duplication, 707 articles left for screening. Three independent reviewers screened based on title and abstract to elucidate if the full text is related or not. Studies, in which the interaction of three features above completely were presented, included and then review, animal and non-original studies were excluded. Finally, we did hand-searching to recognize missing studies in database searches.

Results: The paper search obtained 1161 studies. After screening titles and abstracts, full-text screening where done for 87 studies, then 52 studies yielded based on the eligibility criteria. 22 studies exclusively utilized single AI technique to detect Huntington's disease and its related aspects, 17 used for classification, 9 for predict and two used for treatment. Plenty of Machine Learning algorithms were used, artificial neural networks for 6 and support vector machine for 8 studies, individually were used. Also, researchers used multiple Machine Learning methods in 3 studies. Twenty of 52 included papers conforming to Machine Learning were investigating genetic factors on Huntington's disease. In two of 12, studies were directly following the extraction of genes associated with various traits of disease. In the first one, BioDCV system using support vector machine identifies top-ranking genes, finally two ARFGEF2 and GOLGA8G genes were chosen as an up-regulated from 20 recognized genes. On the other hand, 4 algorithms utilized including decision tree (accuracy=90.79%) noticed EPHX1, ALDH1A1, and GLI1 (EPHX1 as the most efficient), Rule induction (accuracy=89.49%) identified EPHX1, OTP, and ITPKB (OTP as the most efficient), Random forest (accuracy=90.45%) identified 49 genes (KLHDC5 as the most efficient) and Generalized linear model)accuracy=97.46%) identified 53 genes(OTP as the most efficient one).

Conclusion: This study provides generalized evaluation of AI function on detection, classification, treatment and above all, interaction of Al and diagnostic or therapeutic systems associated with Huntington's disease. Due to the hereditary origin and declining executive function in Huntington, improving genetic tests and accelerating the therapy is fundamental in patients, thus AI can lead to discriminative performance to achieve these goals.

Keywords: Huntington's Disease, Artificial Intelligence, Genetics, Classification, Diagnosis, Scoping Review

Schizophrenia: Artificial Intelligence approach and Drug Development

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Background and aims: Schizophrenia (SZ) causes psychosis and is associated with considerable disability and may affect all areas of life functioning. G-protein-coupled receptors (GPCRs), also known as 7-transmembrane receptors, are the single largest class of drug targets. Consequently, a large number of preclinical assays having GPCRs as molecular targets have been released to public sources like the Chemical European Molecular Biology Laboratory (ChEMBL) database. One of the aims of this study is to develop a computational model with artificial intelligence (AI) able to predict new GPCRs targeting drugs taking into consideration multiple conditions of the assay. Some receptors are altered in SZ and represent drug targets for antipsychotic therapeutic activity by using AI.

Method: A comprehensive systematic search using the terms such as "Machine Learning", "Schizophrenia", "Artificial Intelligence", "Drug development" and "Drug target" as keywords, was conducted in four Online Databases: PubMed, Web of Science, Embase and Scopus up to January 2023. Also, for screening and data extraction some applications such as "Rayyan" and "Microsoft Excel (2019)" were used. All research that shows SZ drug development and way of improvement and with using AI models or machine learning (ML) were included. Reviews and studies that had not used AI or drug development to improve SZ were excluded. Then studies that met our study criteria were critically appraised by two authors independently.

Results: We retrieved 684 relevant publications from online databases. After a thorough inspection of abstracts and titles of research and the removal of duplicate publications (n=32), 445 studies were eliminated. In 72 cases of disagreement between two authors, the opinion of the third author was the determiner. Full texts of ninety-seven papers were reviewed. At last, eleven studies met our inclusion criteria and were included in our study. About 64 percent of studies used ML and Support Vector Machine (SVM) algorithms to improve drug development and modeling of new drug targets for patients with SZ.

Conclusion: Following the results of studies, using AI for the improvement of drug development and finding new ways of designing new drugs can be the most effective. AI does this by pinpointing GPCRs coupled receptors that are altered during SZ. In addition, drug development with AI can be faster and have a lower cost. Despite this, conducting new studies with small sample sizes is one of the limitations of such studies.

Keywords: Schizophrenia (SZ), Artificial Intelligence (AI), Drug Development, Drug Target Interaction (DTI)

Computer vision application in diagnosis of the need for apicoectomy surgery

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Background and aim: Diagnosing the need for apicoectomy surgery with manual methods is often costly and time-consuming. When the infection progresses and reaches the end of the tooth root and root-end opening, endodontists are forced to rift the gum and remove the infection from the end of the tooth root. This procedure is called apicoectomy surgery. If the infection progresses are ignored there will be consequences which include possible tooth loss, jaw, brain and other organs infection. Therefore, early diagnosis of the need for this surgery is essential. This article aims to present and report the performance of a machine learning model that diagnoses the need for apicoectomy surgery in panoramic images by using computer vision techniques and deep neural networks.

Method: This model is a deep neural network that learns to fulfill several related tasks simultaneously with the help of self-supervised learning techniques, this leads to extraction of meaningful features. Therefore, the proposed model can diagnose the need for surgery with high accuracy. The data used to train the model consists of orthopantomogram (OPG) images taken from patients' jaws and collected from clinics and labeled by skilled endodontists. The dataset contains 799 samples in total with positive or negative labels. The samples have widths and heights of 700 pixels. The data were fed to the model after augmentation, segmenting regions of interest, and preprocessing. In this study we used F-1 score as an evaluation metric of methods. Moreover, K-fold cross-validation technique was used as an assessing method.

Results: The proposed model obtained a mean F-1 score of 86% in cross-validation. This result suggests that the model has reached desirable accuracy on new samples.

Conclusion: Misdiagnosis can endanger the patient's health in addition to incurring extra costs and irreversible damages. The study results demonstrate that the deep learning system shows high accuracy in the diagnosis of the need for apicoectomy surgery. Additionally, unlike the previous methods, which endodontists required more information regarding the patient besides the radiographic image to make their decision, this research shows that proposed model has made it possible to handle this task with only one image of the patient's jaw. In the light of these improvements, this model can operate as a doctor's assistant in clinics, leading to increased accuracy and faster diagnosis of the need for this surgery. Among the works to improve the proposed method, we mention training the model on a larger volume of data and assigning more parallel tasks to extract more meaningful features.

Keywords: Medical image processing, Computer vision, Dentistry, Deep learning, Self-supervised learning, Apicoectomy

Predicting, Detecting, and Monitoring Cognitive Impairments using Artificial Intelligence: A Systematic Scoping Review

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Background and aims: Due to an aging population and changing lifestyles, cognitive decline is a controversial research topic. Also, advances in artificial intelligence (AI) are being used to improve healthcare, including monitoring and diagnosing cognitive impairment. In this study, we decided to explore the global use of AI for monitoring and diagnosing cognitive disorders through a scoping systematic review.

Method: Using the PRISMA guidelines, we searched comprehensively in PubMed without language or time restrictions. Two researchers independently reviewed the articles based on titles and abstracts and finally extracted relevant data from the included articles.

Results: Initial records identified through PubMed searching included 355 articles. Accordingly, 169 met the eligibility criteria and were included in data extraction.129 studies (76%) had been performed in the three last years. The USA and South Korea had the most studies (17.6% and 9.5%, respectively).

Mild cognitive impairments and Alzheimer's were the top diseases surveyed (both at 55%). Apart from the significant volume of studies that focused on neurological and mental diseases, four studies dealt with cognitive disorders of internal diseases (Diabetes Mellitus and breast cancer (two studies for each topic). Among studies, assessment of six cognitive domains varied including, memory: 135 (80%), attention: 124 (73%), language: 121 (72%), executive function: 65 (38%), perceptual-motor function: 49 (29%), and social cognition: 12 (7%). Evaluation of awareness and behavior were assessed in 100 (59%) and 25 (15%) studies, respectively.99 (59%) studies were conducted with the purpose of diagnosis, while 35 (21%) studies were directed for prediction, and 34 (20%) studies were conducted for monitoring or classification. The most used assessment questionnaire for AI data were A Mini-Mental State Examination (MMSE) (106), Montreal Cognitive Assessment (MoCA) (41), and Clinical Dementia Rating Scale (40). However, some neuroimaging tools were commonly used, including magnetic resonance image (MRI) and positron emission tomography (PET) (91 and 24 studies, respectively). Among the AI approaches, Support Vector Machine (86), one of the neural network methods (51), Random Survival Forest (53), and Logistic Regression (41) were used more than other algorithms. Cross-validation of AI was done via five methods including, K-fold (123), Leave-one-out (16), Stratified K-fold (3), Monte Carlo (2), and Holdout (1).

Conclusion: AI-based prediction, diagnosis, and monitoring of cognitive impairment is a growing field that has received more attention in recent years. AI can potentially assist both neuropsychological and internal diseases with cognitive impairment. Combining various AI methods yields better results, with Support Vector Machine, Random Survival Forest, and Logistic Regression commonly used among machine learning algorithms. In general, the more complex models combined with multimodal data (clinical, cognitive, and neuroimaging) achieved the best performance. It is critical to resolving the ambiguities in future studies.

Keywords: Cognitive Impairments, Artificial Intelligence, Machine Learning

A systematic review and meta-analysis of Machine Learning Models for early detection of Coronary Heart Disease Using Nutritional data

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Background and aims: According to Who statistics, heart disease is the first cause of mortality in the world. Coronary heart disease (CHD) is the most common type of heart disease, Nearly 7.2% of adults have this disease. The diagnosis of this disease usually happens late and when the disease reaches its acute stages and complications such as appear pain and discomfort in the chest. Therefore, early diagnosis of this disease can greatly reduce the occurrence of problems such as heart attack and death. Today, there are solutions based on diagnosis and prevention using dietary data and artificial intelligence that can do this in a short period of time.

Method: Keywords "diet", "nutritional science", "coronary heart diseases", "artificial intelligence" and "pattern recognition" was used for a comprehensive systematic search in 3 databases PubMed, Scopus, Web of Science and the results were up to March 2023 were considered. Two reviewers reviewed the results independently and separately. Studies that used methods other than artificial intelligence to diagnose and prevent coronary artery disease were excluded. Finally, studies that met the necessary inclusion criteria were critically appraised by two authors separately. "Rayyan" platform was used for screening and Microsoft Excel 2019 software was used to extract data related to diet and artificial intelligence diagnostic solutions.

Results: At first, 437 related publications collected from online databases were retrieved, screening of titles and abstracts was performed, and duplicate publications(n=49), and 388 were removed. The full texts of 77 articles were reviewed. Finally, the studies that met the desired inclusion criteria were included in the 6 studies.

The algorithm "Logistic regression" was the most used in the field of diagnosis of coronary artery diseases related to nutrition and it was used in 4 studies. The total number of data included in the studies from healthy patients was 37070. The ultimate accuracy which was obtained from these studies was 0.882.

Conclusion: Since heart diseases have a significant impact on the economic conditions of the country, the use of artificial intelligence methods, which is a non-invasive method, is a more practical solution and separates many nutritional factors and starts diagnosis and prevention earlier. But the accuracy of the studies shows that more work should be done in this field to reach the desired accuracy for high-certainty diagnosis.

Keywords: Coronary Heart Diseases (CHD), Artificial Intelligence, Nutritional Sciences, detection

Deep learning for the classification of Attention-deficit/hyperactivity disorder (ADHD) using neuroimaging data: A Systematic review

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Background and aims: Attention deficit hyperactivity disorder (ADHD) is a disease that is often observed in young children. ADHD diagnosis includes psychological tests and depends on ratings of behavioral symptoms, which can be unreliable. Thus, an objective diagnostic tool based on non-invasive imaging can improve the understanding and diagnosis of ADHD. This study aims to classify brain images using Deep learning to diagnose ADHD.

Method: Three electric databases (PubMed, Scopus, and Web of Science) were searched for records in English from inception to April 21, 2022. Searches were performed using combinations of the following keywords: "ADHD" AND "Deep Learning"; Search didn't Search the above words and any synonyms included in the strategy; Original studies that classified ADHD by neuroimaging and deep leering methods were included. The Newcastle–Ottawa quality assessment scale was used to assess the quality of the included studies.

Results: The systematic review on deep learning for the classification of Attention-deficit/hyperactivity disorder (ADHD) using neuroimaging data included a total of 21 studies for qualitative analysis. Among these studies, the majority (N=18) utilized the widely used ADHD-200 dataset for their analyses. Furthermore, 17 studies incorporated functional magnetic resonance imaging (fMRI) as input in their deep learning models. Notably, 12 studies focused on the classification of ADHD subtypes using various deep learning techniques. The results revealed that for bivariate classification of ADHD, the maximum accuracy achieved in the included studies was approximately 90%. These findings highlight the potential of deep learning approaches for accurate classification of ADHD using neuroimaging data, although further research with larger sample sizes and standardized methodologies is warranted for conclusive results.

Conclusion: The findings indicate that deep learning is a promising predictor for the diagnosis of depression. These methods have shown potential in outperforming classical approaches, such as support vector machines, logistic regression, and other methods used in previous studies.

Keywords: Deep learning, Artificial Intelligence, Neuroimaging, Schizophrenia, Psychiatry, Machine learning

Brain tumor diagnosis and prediction using artificial intelligence

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Background & aims: Advances in technology have been able to affect all aspects of human life, especially in the field of medical sciences. Advances in medical imaging techniques, artificial intelligence, machine learning, and computer vision offer new opportunities for building intelligent decision support tools. Due to the expensive and invasive nature of cancer diagnosis, the need for cost-effective and non-invasive methods has increased. This study is an overview of the diagnosis and prediction of one of the most common and deadly diseases, brain tumor, using machine learning and deep learning methods.

Method: We obtained this title by searching the scientific database of PubMed using the keywords brain tumor, MRI, GAN, central nervous system cancer, CT scan, deep learning, machine learning and artificial intelligence. References and related articles were cited.

Results: The use of artificial intelligence reduces the percentage of errors compared to human diagnosis. Also, compared to machine learning, deep learning provides better performance for diagnosis and subdivision.

Conclusion: Cancer grading is an important aspect of targeted therapy. In this article, we examined the application of artificial intelligence in early tumor diagnosis, classification of prognosis, metastasis, prediction, challenges and potential of these techniques. Given that magnetic resonance imaging (MRI) is the most common method for diagnosing brain tumors. In this article, we have made efforts to apply different types of deep learning methods on MRI data and identified the challenges in the field in search of potential future paths. One of the branches of deep learning that has been successful in image processing is CNN. In this review, we have also worked on different architectures of CNN.

Keywords: MRI, brain tumor, Diagnosis, artificial intelligence, Deep learning, Machine learning

The Role of Multimodal Machine Learning in Alzheimer's Disease: A Review

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Background and aims: Alzheimer's disease is a progressive brain disorder that affects millions of people worldwide. It is the most common cause of dementia and is characterized by a decline in cognitive function, memory loss, and behavioral changes. Despite extensive research efforts, Alzheimer's disease remains incurable, making early detection and diagnosis crucial for effective treatment and management of the disease. Machine learning models have shown great potential in the accurate diagnosis and prediction of brain disorders, including Alzheimer's disease. However, the accuracy of these models can be further improved by using multimodal data, which combines multiple types of data such as medical images, clinical assessments, and genetic information. This review aims to summarize the state-of-the-art research on Alzheimer's disease that utilizes machine learning techniques with multimodal medical data.

Method: The following search strategy has been used in PubMed, Web Of Science(WOS), and IEEE Xplore databases:((neuroimaging) OR (CT scan) OR (PET scan) OR (MRI) OR (radiology) OR (Electroencephalogram)) AND (multimodal*) AND ((“deep learning”) OR (“Computer vision”) OR (“Neural Network*”) OR (“machine learning”) OR (“artificial intelligence”)) AND (Alzheimer's disease). To conduct our literature review, we included all the words in the title/abstract as part of our search strategy and searched PubMed using relevant MeSH terms. The study excluded duplicated and non-journal articles. Title and abstract screening resulted in the exclusion of review articles and irrelevant publications. During the full-text screening, duplicated articles, irrelevant publications, and those lacking full-text availability were also excluded.

Results: Different studies utilized different combinations of data modalities such as structural MRI (sMRI), resting-state functional MRI (rs-fMRI), different types of Positron Emission Tomography (PET) such as amyloid-PET, genetic markers such as single-nucleotide polymorphisms (SNPs), cognitive scores, and CSF biomarkers. Additionally, different machine learning models such as support vector machines (SVMs), convolutional neural networks (CNNs), recurrent neural networks(RNNs), and random forests have been deployed. Studies comparing the outcomes of utilizing multimodal data and unimodal data have demonstrated superior performance when utilizing multimodal data. Additionally, using the Alzheimer's Disease Neuroimaging Initiative (ADNI) database in most studies under review facilitated direct comparisons of different models' performance, aiding in identifying the optimal approach.

Conclusion: This review highlights the important role of multimodal machine learning in the early detection and diagnosis of Alzheimer's disease. An evaluation was conducted on the performance of the models recommended in the reviewed literature. Additionally, the assessment encompassed the analysis of diverse data modalities utilized, the type of machine learning model implemented, and the evaluation of the utilized datasets. In conclusion, the application of multimodal machine learning presents a promising opportunity for revolutionizing the timely detection and diagnosis of Alzheimer's disease, signifying a hopeful avenue for future research in this field.

Keywords: Alzheimer's disease, multimodal, machine learning, neuroimaging

The use of Machine Learning models in the diagnosis of Parkinson's Disease with fMRI data: a Systematic Review and Meta-Analysis

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Background and aims: Parkinson's Disease (PD) is a commonly occurring neurodegenerative disorder worldwide, affecting approximately 1% of individuals over the age of 60. Early detection of PD is crucial in managing symptoms and improving the quality of life for patients. Resting-state functional magnetic resonance imaging (rs-fMRI) has shown to be widely accepted for detecting inherent brain function changes during the early stages, enabling early diagnosis before structural changes emerge. The use of Artificial Intelligence (AI) has proven successful in diagnosing other conditions, such as breast cancer. Therefore, we can expect more accurate detection of PD using AI to improve diagnostic outcomes.

Method: A comprehensive systematic search using relevant keywords such as "fMRI", "Artificial Intelligence", "machine learning", and "Parkinson's disease" was conducted on four Major Online Databases; PubMed, Scopus, Web of Science, and Embase up to March 2023. The search of the database encompassed not only published literature but also grey literature as well as manual search. After the initial search, two independent reviewers screened the retrieved publications, ensuring that all studies that followed the criterion of employing Artificial Intelligence (AI) models or machine learning algorithms for predicting or diagnosing Parkinson's Disease with the use of fMRI data were included. Subsequently, the studies that met the inclusion criteria underwent a critical appraisal by two authors independently. The quality of studies was evaluated according to the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) checklist. Furthermore, for data extraction purposes, Microsoft Office Excel 2021 software was employed to collect information such as machine learning algorithms, the accuracy of models, and fMRI Image properties. Pooled Accuracy for detected PD was calculated using CMA v.3.7 software and a p-value less than 0.05 was considered a significant level.

Results: We retrieved 1122 relevant studies from online databases. After a thorough examination of the titles and abstracts and the removal of duplicate publications(n=277), 710 studies were eliminated. In 25 cases of disagreement between two authors, the opinion of the third author was the determiner. The full texts of 140 papers were reviewed. Eventually, 13 studies met our inclusion criteria and were included in this study. All of the studies have different levels of bias. However, regarding the type of study design of included articles are considered as low risk. Approximately 77% of studies utilized the SVM (Support Vector Machine) algorithm for differentiating patients with Parkinson's disease from healthy controls. The overall accuracy was determined to be 83.8% using the random effects model (accuracy = 0.838, 95% CI = 0.788-0.878, p-value < 0.001), indicating a significant predictive power.

Conclusion: Machine Learning can be a useful tool in early PD diagnosis and could also aid in prognosis orientation at lower costs. Nevertheless, the possibility of overfitting in machine learning algorithms means that more research is necessary to determine the full potential of this approach. While machine learning can be a valuable tool in early PD diagnosis, the limited number of cases studied in current literature must be taken into consideration.

Additionally, since fMRI data contains a vast amount of information, overfitting remains a significant concern. However, the SVM algorithm's widespread use in these studies is due to its resilience to overfitting.

Keywords: Parkinson's Disease (PD), Machine Learning (ML), Functional Magnetic Resonance Imaging(fMRI), Diagnosis

Visible-Near-Infrared Spectroscopy System for Non-Invasive Blood Glucose Monitoring

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Background and aims: In recent years, diabetes is one of the most important causes of death in the world. The main reason is an unhealthy lifestyle. In this disease, blood glucose concentration increases greatly, which is an important indicator in the diagnosis of diabetes. Preferably, in order to prevent diabetes or control it, while being safe from its complications, the blood glucose level should be checked regularly. So far, various researches have been conducted and many products have been distributed to the world market, which is the most reliable method of using invasive blood glucose devices, but usually this method is associated with pain and discomfort in people. Also, this method increases the possibility of contracting infectious diseases. In the last few decades, researchers have sought to compare different methods of measuring blood glucose with non-invasive methods. For this purpose various electrochemical sensors have been made, But these sensors have problems such as expensive materials, sensor instability and lack of calibration. As a result, they are not a good substitute for invasive blood sugar testing devices. In fact, with the aim of improving the conditions, we have designed a device that regularly monitors blood glucose levels using a visible-near infrared optical sensor.

Method: In this system, the waves used are in the range of near-infrared and visible waves with a specific wavelength, which have the highest amount of blood glucose absorption in this wavelength. According to Beer-Lambert's law, the intensity of the light passing through the ear tissue is measured and amplified in the circuit designed in the system. Then the data (blood glucose concentration) is transferred to the computer by USART serial, and based on the voltage change created in the hardware, and as a result, the blood glucose level is calculated in the LabVIEW software based on the Beer-Lambert's law. In calculating blood glucose, parameters such as age, gender and skin color are used to measure the thickness of the ear tissue. In this project, the blood glucose concentration of healthy people and people with diabetes was compared. To compare the results of this research the specified tests were performed with the mentioned two non-invasive devices and the other invasive, Care Sense N(It has FDA, ADA, CE standards)device.

Results: One of the general results in this experiment is the comparison and measurement of the blood concentration of people with two invasive and non-invasive devices. This test was taken from Asian people(10women and 10men in the age range of 20-50 years).Each person has two aggressive and non-aggressive blood concentration numbers. The average error percentage measured in the non-invasive device is 12%.

Conclusion: Optical detection technology is more popular than other detection technology that, near-infrared spectroscopy has more potential for commercialization and general use in society due to its cheapness and accuracy.

Keywords: diabetes, spectroscopy near-infrared, non-invasive blood glucose monitoring, glucose concentration.

Presenting a predictive model for the death of COVID-19 patients based on the machine learning method using HRCT images

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Introduction: The epidemic of the Covid-19 disease and its impact on the health of people all over the world has caused serious concern for international policy-making organizations. The spread of this disease has caused the lack of medical equipment, the exhaustion of the treatment staff and the lowering of the quality of life. The aim of this study was to provide an algorithm to predict the death of hospitalized patients with covid-19 using machine learning methods.

Implementation method: This study was conducted on 581 inpatients with covid-19 hospitalized in Qaim and Imam Reza hospitals of Mashhad University of Medical Sciences. HRCT images, demographic characteristics, underlying diseases, laboratory results of patients were entered into the model as predictor variables. Using the pulmonary toolkit package of MATLAB software, values related to lung tissue and size were obtained. In the machine learning model, the Chi2 feature selection algorithm was used to select the significant variables, and finally, using the AdaBoost method, which is a subset of the decision tree, the important variables for predicting the death of covid-19 in the order of lymphocyte variables, CRP, age, average lung density, percentage Lung tissue, RBC cancer, D-DIMER and emphysema were obtained. The area under the ROC curve was 0.96.

Many models based on machine learning algorithms have been used to predict the death of covid-19. The present study can be used as a decision support system for the treatment of covid-19 patients.

Keywords: machine learning, covid-19, HRCT images

Artificial Intelligence for Improving the Proactive Intelligent Safety of Pedestrians

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Background and aims: Road traffic injuries are the main threat to public health and a serious cause of concern across the world, especially in low and high-income countries. Pedestrian injuries and fatalities, as vulnerable road users, have increased nearly every year. Recently, simultaneously with increased urbanization, Artificial Intelligence (AI) opened up new opportunities for intelligent traffic safety and has been widely used in order to deal with road traffic injuries and deaths. The high vulnerability of pedestrians in road traffic crashes highlights the need to explore and implement effective interventions in the realm of AI to protect pedestrians. The aim of this study was to study the applications of AI for improving pedestrians' safety.

Method: This study has been done according to Arkesy and O'Malley's framework according to a review of related literature from January 2000 to February 2023. Six main steps were conducted in this study as follows: identifying the research question, identifying relevant studies, study selection/screening, charting the data, collecting, summarizing, and reporting results, and providing practical recommendations. To explore the relevant studies, the databases of PubMed, Science Direct, Scopus, and Web of Science were searched using predefined keywords. Literature screening and selection were done according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses, which extended to Scoping Reviews (PRISMA-ScR). Endnote software edition 7 was used for data management.

Results: The findings of the literature review and screening showed that there are different approaches for the application of AI in order to deal with road traffic accidents and prevent pedestrian injuries and deaths. Applications of AI in preventing pedestrian accidents and improving their safety were in various fields, including the main categories of 1) pedestrian identification and detection systems using the Vehicle-to- Pedestrian (V2P) wireless communication technology, adaptability of autonomous vehicles (AVs) to communicate with pedestrians, and visibility related systems, 2) pedestrian accident prediction using the approaches like vehicle to everything (V2X) systems, and 3) pedestrian-assistance devices to help them by providing navigation and orientation information.

Conclusion: AI involves a variety of technologies that facilitates proactive intelligence in pedestrian safety and is widely used in this area. Some of these technologies such as Vehicle-to- Pedestrian communication systems, or autonomous vehicles can be used in limited countries because of the need for high technology and strong infrastructure. Although all countries should move towards using different approaches to pedestrian safety promotion, it seems the use of pedestrians-assistant devices is more suitable for countries with limited needed infrastructures. These findings can be useful for road safety policy-makers, technologists, and inventors in the design of systems and devices to promote pedestrian safety.

Keywords: artificial intelligence, public health, pedestrians, safety, proactive safety

Applications and Outcomes of Using Chatbots in Medical and Health Sciences, Feasible or Not: A Review of The Literature

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Background and aims: Chatbots are conversational agents with the ability to communicate with users using natural language in a way that simulates interaction with a real human. Chatbots are used in the medical field as a tool to facilitate access to information for patients and reduce the workload of doctors. The purpose of this study was to review the literatures to identify and classify the areas and outcomes of using chatbots in medical and health domains.

Method: This review of the published literatures was conducted by searching the "Web of Science" and"PubMed/Medline" databases to retrieved related articles from 2019 to 2023 years. Combination of different keywords include "chatbot", "chat-bot", "chat bot" AND "medic*", "health", "disease" was searched in selected databases. Studies investigated the implemented chatbots in medical and health domain were included. Review and systematic reviews, protocols, letters, non-English articles, and studies that only deal with propose and design the chatbot and have not been evaluated in real environment were excluded from the review. EndNote X9 is used to manage and code references in the conduct and reporting of the papers.

Results: In this study, 756 articles were retrieved, and after removing the unrelated and duplicated articles, 333 articles were reviewed ultimately. We found that the most common use of chatbots in the medical and health domains are respectively include: mental disorder/ stress, anxiety, depression management and empathic (n=104, 31.23%), covid-19 (n=58, 17.42%), disease control and management (n=34, 10.21%), educational and learning (n=28, 8.41%), physical activity/ diet/ nutrition (n=19, 5.70%) and others domains (pregnancy/ parenting/ mother care, obesity/ diabetes, recommendation, drug management, post-surgery care, self-management bots, genetic counseling, virtual physician and items developed for elderly care). The findings also showed that, the reported outcomes of using chatbots in medical and health domains can be classified into different categories like technology effectiveness, acceptance, usability, feasibility, accuracy, user tendency and etc.

Conclusion: The use of chatbots in medical and health sciences is growing, and there is a tendency for using this technology for apply in different group like elderly, pregnant women, parents, physician, nurses, staff and other people. Also, according to results, the chatbot was a functional and innovative tool that could easily be integrated into usual medical practice and could help patients and professionals to tackle the health problems.

Keywords: chatbot, medical, health, disease

Implementation of national eLogbook AI-BI dashboards for residents' clinical performance assessment

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Background and aims: logbooks are purposeful assessment tools to record the learner's clinical performance. They facilitate self-reflection, self-assessment and helps medical residents to achieve their educational goals. In this study we aimed to design the logbook Artificial Intelligence-Business Intelligence (AI-BI) dashboard based on Integrated data from eLogbook systems in all universities of medical sciences with the aim of the national policy makers, residency program board members, academic managers to make intelligent decisions about the residents learning and assessing process.

Method: This applied cross sectional study was conducted by the Information Technology working group of the Education deputy at the Ministry of Health and Medical Education in 1401. Medical universities that hold medical residency programs were included to the study. the Universities that use the electronic logbook system were identified. The ETL technique was used to integrate logbook data from different universities sources into a national warehouse platform. To build intelligent dashboard at first thematic analysis was performed to explore the effective key performance indicators (KPI) for national monitoring of medical resident performance on logbooks. Based on the result of thematic analysis, a questionnaire was developed to conduct a Delphi method to rank and consensus the KPI metrics. Then we used OLAP engine to create cubes and process KPIs from logbooks data panel.

Results: 44 out of 67 medical universities hold residency programs. They use four eLogbook different products for the medical resident clinical assessment. The data in the following three years (2019 and 2023) from all universities databases integrated into a national eLogbook warehouse to build an AI-BI enabled dashboard. The results of the thematic analysis and the two Delphi round finally led to selection of seven main KPIs for analysis and reporting resident academic achievement at the national level. eLogbook dashboard was deployed based classification and deep learning algorithms and used to visualize multidimensional data about residents. deep learning algorithms predicted the resident academic achievement with an AUC of 0.82. Machine learning classifiers (SVM and RF) trained to predict residents' progress in in- training examinations. THE deep learning algorithm had the highest performance (AUC, 0.74).

Conclusion: In this study we designed and implemented the artificial intelligence dashboard to report medical resident's performance on logbooks in the whole country. AI-BI logbook dashboard has provided the ability to gain insight about learning process and make reform to increase resident' learning achievements in different medical specialties. Deep learning algorithms are more reliable and accurate for predicting student performance.

Keywords: artificial intelligence, business intelligence, electronic logbook, medical resident, medical university, dashboard

Improvements, Performance, and Application of Artificial Intelligence in Dentistry

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Background and aims: Artificial intelligence (AI) utilizes machines to mimic human intelligent behaviors. In recent years, Artificial intelligence (AI) has made deep inroads into dentistry. This review aimed to show the improvement of AI applications that are used in dentistry broadly and evaluate their performance in terms of clinical decision-making, diagnosis, and predicting the prognosis of the treatment process.

Method: A comprehensive search had been conducted in five databases: PubMed, Google Scholar, Magiran, Elmnet, Civilica. Our study comprises a review of papers published between 2018 to March 2023 that reported the role of AI in dentistry diagnosis, prediction, detection, and clinical decision-making.

Results: A total of 196 relevant studies were retrieved from our databases, of which 25 eligible studies met all criteria for inclusion in this narrative study. AI-based technologies are widely implemented in an extensive range of dentistry specialties. AI has been utilized in the diagnosis and detection of dental caries, vertical root fractures, maxillofacial cysts, apical lesions, cancerous lesions, salivary gland diseases, periodontal diseases, maxillary sinusitis, TMJ disorders, cervical lymph nodes metastasis, osteoporosis, alveolar bone loss, predicting orthodontic extractions, orthodontic treatments, cephalometric analysis, determination of gender and age. By having larger data sets AI can predict the precancerous occurrence conditions. AI can aid in population-wide surveillance and also in making decisions about referrals to specialists. AI can detect micro features that are beyond the human eye efficiently and also in critical diagnosis, AI can augment its predictive power. The advantages of AI are better precision, efficiency, and time saving during the treatment planning and diagnosis.

Conclusion: The review of these studies shows that the performance of an automated system that is based on AI is outstanding. They mimic the accuracy and precision of trained specialists. Some studies indicated that these systems were even able to outstrip dental specialists in terms of precision and performance. The future implications of AI in dentistry promise a novel formation of practicing dentistry.

Keywords: artificial intelligence, dentistry, diagnosis, prediction, clinical decision-making

Content Analysis of Persian Language Mobile Applications For Liver Diseases Using The Mobile App Rating Scale (MARS)

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Background and aims: The rapid growth of liver diseases has led to the design of a large number of mobile applications for the management and control of these diseases. This creates the need to analyze and review related applications in this field. The purpose of this study was to evaluate the Persian language mobile applications in liver diseases.

Method: In order to content analysis, comprehensive search was conducted using words such as "liver", "hepat" in Cafe Bazaar and Myket markets in December 2022. The mobile app rating scale (MARS) was used to review the content of applications.

Results: After removing unrelated applications, 8 items were included in the study. According to the results, the focus of all applications was on change behavior and physical health. The initial version of two applications were paid and six items were free. According to the results of MARS questionnaire, the minimum and maximum of application quality score were 2.53 and 3.67, respectively. Also, none of the applications were evaluated by end-user and various parameters such as acceptance, applicability and satisfaction were not measured.

Conclusion: The Persian liver mobile applications is in low level, and developers must pay more attention to the functions and quality measures in design stage.

Keywords: mobile application, liver, MARS

Application of machine learning and deep learning algorithms in osteoporosis classification, diagnosis, prediction and screening. Review

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Background and aims: Osteoporosis is one of the most frequent diseases in the elderly, especially in postmenopausal women. In addition to the usual methods used to diagnose osteoporosis, Artificial Intelligence (AI) algorithms such as machine learning (ML) and deep learning (DL) have recently found many capabilities for diagnosis, classification, prediction, and screening. In this review research, these algorithms have been investigated in the above areas, as well as their comparison with the usual diagnostic methods and the strengths and weaknesses of each have been discussed.

Method: For that, articles registered in the last 5 years in the PubMed database, which dealt with the use of artificial intelligence in the diagnosis, classification, prediction, and screening, with relevant terms were analyzed. Terms such as "artificial intelligence", "deep learning", "machine learning", and "osteoporosis" are searched. The documents were then classified and reviewed, depending on the type of domain in which the AI algorithm was used. The algorithms used in the desired subjects were examined and the results were presented based on the precision factors of the models used.

In all, 45 papers were reviewed: 4 on osteoporosis classification, 14 on osteoporosis prediction, 14 on osteoporosis diagnosis, 7 on osteoporosis screening, and 6 review papers focused on the use of the two artificial intelligence algorithms.

Results: Reviewing the studies showed that: in the field of 'classification' 50% of studies have investigated the issue using deep learning algorithms and the others using machine learning algorithms. In the field of 'prediction,' 57% of studies have investigated the issue using ML, 35.7% using DL, and 7.1% using both ML and DL algorithms. In the field of 'diagnosis' 57% of studies have investigated the issue using ML, 43% using the DL algorithm. In the field of 'screening' 38.5% of studies have investigated the issue using ML, 62.5% using the DL algorithm.

Dual-energy X-ray absorptiometry (DXA) is underused in the measurement of bone mineral density (BMD) and assesses the risk of fracture. Artificial intelligence-based algorithms present automated tools for identifying fractures, predicting BMD, and assessing fracture risk through X-rays that may help identify patients for osteoporosis. Such algorithms can predict BMD by CT scan interpretation and, because of this, can predict the risk of osteoporosis and modified neural networks like CNN can classify and diagnose osteoporosis.

Conclusion: While these models are very useful for the classification, diagnosis, prediction, and screening of osteoporosis, their improvements, such as the inclusion of positive-negative class bias, are maintained. With the ability to expand artificial intelligence algorithms and lower cost development algorithms, it can be expected that these algorithms will widely help specialists in the near future.

Keywords: artificial intelligence, deep learning, machine learning, X-ray, bone mineral density, osteoporosis.

Applications of artificial intelligence for pre-implantation kidney biopsy pathology practice: a systematic review

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Background and aims: Kidney biopsy is a crucial diagnostic tool used in the management of kidney disease. It involves the procedure of removing a small piece of kidney tissue to be examined for any abnormalities. The success of pre-implantation kidney biopsy depends on the accuracy of the pathologist's diagnosis. Pathological evaluation of kidney biopsy is complex, and at times the interpretation can be subjective, leading to inter-observer variability. The use of artificial intelligence (AI) applications presents an opportunity to improve the diagnostic accuracy of pre-implantation kidney biopsy pathology practice. The aim of this systematic review is to evaluate the state of the art in AI applications for pre-implantation kidney biopsy pathology practice.

Method: We conducted a systematic literature review of articles published in three electronic databases: PubMed, Scopus, and IEEE Xplore. We looked for articles published in English from 2010 to 2022 and carried out the search using keywords such as "kidney", "biopsy", "transplantation" and "artificial intelligence" and their aliases. We reviewed the studies and extracted the relevant data on AI applications used in pre-implantation kidney biopsy pathology practice.

Results: The systematic review included 33 studies that used AI applications to augment or replace the traditional pathological evaluation of kidney biopsy specimens. Machine learning (ML) algorithms were the most commonly used AI technique. Several studies employed ML techniques to develop predictive models that could differentiate between different kidney pathologies, such as glomerulonephritis, tubulointerstitial nephritis, or acute tubular necrosis with high precision. Other studies used AI-based systems to classify the severity of kidney damage in biopsy samples. Moreover, AI applications have been shown to reduce inter-observer variability through training pathologists with a standardized system.

Conclusion: The use of AI in pre-implantation kidney biopsy pathology practice has shown promising results in improving diagnostic accuracy, reducing inter-observer variability, and streamlining the review process. However, applying AI-based systems to a clinical setting is a challenging task, and concerns should be raised regarding patient safety, accuracy, and data protection. Future research will require extensive study to validate and refine the utility of these AI applications in a practical clinical setting. Further development, validation, and integration will be crucial in assisting physicians in making a more accurate and precise diagnosis in pre-implantation kidney biopsy pathology practice.

Keywords: Artificial intelligence, Digital pathology, Kidney biopsy, Pre-implantation biopsy, Review, Transplantation.

Integration of artificial intelligence and microfluidics for disease diagnosis: a systematic review

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Background and aims: Microfluidics has been developed explosively in the last two decades due to its advantages, such as enabling controllability over multiple processes, low consumption of reagents, and cost-effectiveness. Furthermore, microfluidic systems can provide new technology for diagnosing various diseases by analyzing various biomarkers in plasma, serum, and whole blood. The advantage of these systems is the no invasiveness; they do not require a tissue biopsy to diagnose diseases like cancer. Utilizing microfluidic systems in multiple applications leads to the generation of large datasets. Traditional tools to analyze this data are not efficient. Thus, new tools are required to analyze this big data. Artificial intelligence could serve proper techniques with advantages for this purpose. Artificial intelligence can classify and predict diseases using big data from microfluidic systems. Combining microfluidic systems with artificial intelligence tools could make cost and time-saving systems. This study is devoted to the recent developments in a microfluidic device coupled with artificial intelligence technology for diagnosing various diseases.

Method: An electronic search was performed in three databases, including PubMed, Scopus, and Web of Science. In the search strategy, words relevant to "microfluidics" and "artificial intelligence" were searched at the title. Also, words related to "diagnosis" were searched at the title and abstract levels. The search was not restricted to publications of a specific time range. The inclusion criteria included the relevance to the search strategy without a time limit and the exclusion criteria included review, conference, non-English, and duplicated papers. After obtaining the papers, the articles were investigated from the point of view of the determined topic to identify the methods and diseases diagnosed by these systems. Type of cell or tissue, type of microfluidic device, dataset size, data set type, imaging modality, AI method, and performance were investigated as common criteria to classify the included papers.

Results: Our search identified 69 records from PubMed, 163 records from Scopus, and 98 records from ISI. 177 duplicated records were excluded. After applying the inclusion and exclusion criteria 33 papers were included. Microfluidics can significantly benefit from artificial intelligence. Artificial intelligence accelerates the analysis of massive data gained from microfluidics. Artificial intelligence tools, including deep learning (convolutional neural networks, generative adversarial networks), data mining (Gradient Boosting Machine, Random Forest, Naive Bayes), and microfluidics, could apply in different diagnosis areas by cell classification and cell isolation. Cell classification is performed by flow cytometry to classify various types of cells, which is very crucial for the prevention and diagnosis of different diseases. Artificial intelligence provides great accuracy in cell classification, which was previously unachievable due to the difference between cells in size, shape, and some external effects. In addition, cell isolation is a critical process to understanding the concept of precision medicine.

Conclusion: Integrating artificial intelligence and microfluidics could play an important role in biological and biomedical applications. Next-generation monitoring systems may be developed by integrating microfluidic devices with artificial intelligence. Contrary to the challenges of these systems, such as the selection of the appropriate model and data heterogeneity, many fields of biotechnology, like point-of-care systems, personalized medicine, diagnostics, and treatment of

diseases, can benefit from the combination of artificial intelligence and microfluidic, which for all these areas, more extensive studies are required.

Keywords: artificial intelligence, microfluidics, diagnosis, machine learning, dataset

Application of Artificial Intelligence in Computer Tomography (CT)

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Background and aims: Artificial intelligence (AI) refers to the use of computational techniques to mimic human thought processes and learning capacity. AI in radiology is developing day by day, and as an emerging frontier of technology, it is rapidly becoming recognized in the field of medicine, including computer tomography (CT). This study aims to investigate the use and role of AI in CT.

Method: This review study was conducted on February 10, 2023, by searching the reliable databases of PubMed, Scopus, and Web of Science. English language articles from 2021 to 2023 that were in line with our goal were included in this study. Exclusion criteria included articles with abstracts without text, letters to the editor, and a lack of access to the full text of the articles. Eligible criteria were independently screened by the authors. The same checklist was used to extract data such as references, year of publication, name of the country, and important related points.

Results: Finally, 22 related articles were included in this review. The highest number of articles was conducted in 2022, and also, most studies were related to the countries of America, China, Iran, Denmark, and Germany. AI was mostly used in CT during the COVID-19 pandemic for lung imaging (6/23), and lung imaging for renal disease (4/23), lung cancer (3/23), heart and coronary arteries (4/23)), chest (1/23), bone metastases (1/23), sacral bone (1/23), colitis and Crohn's disease (1/23) and acute bleeding (1/23). All studies were conducted for two reasons: diagnosis and evaluation of the disease or prognosis and prediction, which was for diagnosis and evaluation of the disease (13 studies), and for better prognosis and prediction of the disease (9 studies). CT imaging using AI algorithms (7 studies), deep learning methods (5 studies), neural network models (5 studies), computer-aided design (CAD) (1 study), 3D model (1 study), and radionics (1 study).

Conclusion: AI methods for disease diagnosis and prediction in CT play an important role in disease monitoring and management. It has greatly increased the efficiency of diagnosis and has a greater role in the accurate assessment and analysis of disease reports and prognoses.

Keywords: artificial intelligence, AI, computer tomography, CT

Predicting ESI triage score using ensemble machine learning algorithms for patients in emergency medicine at Tehran hospitals

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Background: The Emergency Severity Index (ESI) is the most common triage systems for assessing the urgency of emergency patients. The existing nurse and physician opinion-based triage system to measure ESI show some weakness. It is highly recommended switching from triage based on expert opinion to machine learning-based ESI evaluation. In this study we aim to apply ensemble machine learning algorithms to predict ESI score for patients attending emergency departments in Tehran city.

Methods: Data of 12065000 patients admitted at the emergency department (ED) at 46 teaching and non-teaching hospitals of Tehran, affiliated to Iran University of Medical Sciences, were retrieved (2018–2022) from the central database. The predictors used for the ensemble ML were those variables taken at the time of the initial assessment as part of the triage in the emergency department. In total, 20 input data variables include Pulse rate (PR), Systolic blood pressure (BPS), diastolic blood pressure (BPD), Body temperature, Respiration rate (rate of breathing) RR, Oxygen saturation levels (SpO2) were used to analyze the data and build the prediction model.

Results: The three most common methods were used as base classifier in stacking model. the comparison of different classification methods in models trained with triage information resulted in a test AUC of 0.75 for SVM (95% CI 0.76-0.77), 0.89 for MLP (95% CI 0.88-0.89) and 0.87 for XGBoost (95% CI 0.90-0.91) for single classifier and the stack final predictor model resulted in AUC of .098. other result showed that vital signs PR and BPS are the main predictors of patients EIS score in the emergency room.

Conclusion: If potential admissions are known at an early stage, bed management and administration can be informed accordingly and react accordingly. In addition, the prediction of inpatient admission can also be used as a placeholder for the severity of the disease, the need for emergency measures and other subsequent decisions. It was shown that the ensemble algorithms perform better than the single ones for ESI triage prediction.

Keywords: Ensemble learning, Emergency Medicine, Triage system

Compering AI methods-based and none AI methods-based in diagnosis Parkinson

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The current treatments for Parkinson disease have no permanent-modified medicine, therapy, or other approaches, the second most common neurodegenerative disease after Alzheimer's disease which patient experience motor and non-motor symptoms and have a huge impact on quality of life. We discuss the pros and cons of the promising artificial intelligence-based and non-artificial intelligence-based methods to not only evaluate the fastest assay to diagnose but also the best treatment approach to increase the patient's lifespan.

Background and aims: Increasing life expectancy and slowing the progression of the disease to diagnose it in its early stages would prevent rising treatment expenses and place a heavy financial burden on society and families. Various tests and experiments need to be done in order to diagnose the disease using non-artificial intelligence-based methods, including: inner retinal thinning, the Tower of London test, a medical history and a neurological examination, blood and laboratory tests, and brain scans. And artificial intelligence-based approaches include voice database, speech audio and hand writing database, Genetic biomarkers and other features, which have been analyzed with different algorithms; Artificial Neural Network, Support Vector Machine, K_Nearest Neighbour. As medications or surgery can often provide improvement in the motor symptoms, it is vital to diagnose Parkinson disease in its early stages.

Method: From Google Scholar, IEEE Xplore, Springer, PubMed, PubMed Central, Scopus, and other literary sources, a total of 90 articles have been chosen. Here we propose the advantages and disadvantages of selected methods to diagnose de novo Parkinson disease and other stages of Parkinson. The best probabilistic model obtained by exploring the search engines and articles has been summarized in this article.

Results: Overall, 90 articles have been selected for abstract screening and a total of 24 for full-text review.

Unfortunately, an accurate test that can be used to determine the early stages of Parkinson disease is not available, and multiple experiments, including MRI and computed tomography, should be conducted simultaneously. Yet, the presence of a patient's medical history and artificial intelligence can speed up and assist the diagnosis process.

Conclusion: Using the PRISMA method, a comparison between an artificial intelligence-based approach and a non-artificial intelligence-based approach, or combining the two strategies, revealed the best probabilistic method for Parkinson's disease diagnosis and treatment.

In conclusion, it appears that advancements in the collection of patient medical history data and the application of various methods to analyze it may make the diagnosis of Parkinson's disease with artificial intelligence a practical method in the near future.

Keywords: artificial intelligence, motor symptoms, none-motor symptoms, Parkinson disease(PD), deep learning

The effect of laughter therapy using virtual reality on the severity of depressive symptoms in patients with major depressive disorder: a narrative review

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Introduction: Major depressive disorder is one of the most common psychiatric diseases. Laughter therapy, as a non-pharmacological and alternative treatment method, has a positive effect on mental health and psychiatric diseases. This review study was conducted with the aim of determining the effect of laughter therapy using virtual reality on the severity of depressive symptoms in patients with major depressive disorder.

Materials and methods: To access the studies, the researcher searched the Google Scholar search engine and international information databases such as PubMed, ScienceDirect and Iranian databases such as SID and Magiran in the period from 2010 to 2022 with keywords including laughter therapy, Major depressive disorder, Virtual reality.

Results: Improvements in severity of depressive symptoms were found at post-treatment. At follow-up, depressive symptoms had decreased. These improvements were maintained at follow-up. No increase was observed in social activity. These results have shown a correlation between a sense of humor and decreased depressive features.

Conclusion: The laughter therapy technique based on reality therapy can lead to a reduction in the severity of depression symptoms, which is recommended to be used in the treatment of patients with major depressive disorder along with other treatment methods.

Key words: laughter therapy, Major depressive disorder, Virtual reality

Analyzing the co-occurrences of allergies applying association rule mining based on nature-inspired optimization algorithms

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Background and aims: While co-occurrences of autoimmune diseases have been widely studied, the co-occurrence cases of allergies have not been well-considered. Co-occurrences of allergies might demonstrate similarities in allergens or impacts of co-factors, furthermore, they aid in understanding the chain of immune events leading to allergic reactions. In this way, investigating the association between allergies opens new ways to predict the prevalence of allergies not detected in a human subject.

Method: In this research, we utilize the data collected through a cross-sectional cohort of 333,200 children in Philadelphia. Data includes the occurrence history of eighteen food and non-food allergies in human subjects. We extract the co-occurrences of allergies containing 48,800 cases with two or more allergies detected simultaneously. We define an association rule mining task utilizing an ensemble of nature-inspired optimization algorithms. In this framework, particle swarm optimization (PSO), moth-flame optimization (MFO), grey wolf optimization (GWO), as well as, differential evolution algorithms are adopted to maximize the fitness of found rules. Top-k rules generated by different methods are added to a repository of rules.

Results: Our result includes a repository of association rules generated using five nature-inspired optimization methods corresponding to maximum fitness. Furthermore, our framework computes five various metrics measures to evaluate the performance and confidence of detected rules.

Conclusion: In this study, we proposed an ensemble framework of nature-inspired optimization algorithms that are utilized to mine an allergy dataset and generate association rules. This framework benefitted from several highly accurate optimization algorithms in a problem with a limited number of features, i.e., allergies.

With respect to epidemiological studies, allergies have not happened randomly. There exist groups of autoimmune and allergies that are more likely to be co-occurred. Detecting co-occurring allergies using machine learning algorithms improves the accuracy of allergy prediction and early intervention with minimum cost. In addition, generated association rules are able to direct the co-factor and interaction research studies to start with more likely to be happened patterns. Interestingly, antecedents of some of the rules include non-occurrences of allergies which means there are pairs of allergies that do not occur together. We believe, however, co-occurrences of allergies have been interesting the prevention patterns are more fascinating facts that required to be studied.

Keywords: Allergy, Co-occurrence, Association Rule Mining, Nature-inspired Optimization.

The use of artificial intelligence in detections, management and determining the prognosis of brain tumours; new insights

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Background and aims: Brain tumors are a widespread and severe neurological problem. These abnormal growths can be managed if caught in the early stages. Despite all the progress in the field, accurate segmentation, classification, and prognosis determination remains a challenge. Computational artificial intelligence (AI) models and deep-learning networks are now being assessed as new tools to help physicians overcome these challenges. In this review, we try to compile the most recent researched methods that use artificial intelligence for better patient care in the field of neurology and neurosurgery.

Method: For this article, we searched Medline/PubMed, Web of Science, Scopus, and Embase using the keywords "artificial intelligence" and "brain tumor". Each search was specified according to the database and special keywords (mesh, Emtree) were used.

Results: AI can be used in different stages of patient care. For categorization, between computer-aided diagnoses systems, Convolutional neural networks are proven the most used magnetic resonance imaging (MRI) based tool that categorizes tumors as either normal or pathologic. Support vector machines achieved 98% accuracy in segmentations and analysis of brain tumor detection in MR imaging. One study suggested that using all MRI technics is the key to the best management of brain tumors. Another study suggested that AI-assisted brain tumor has better outcomes and less hospitalization time. Personalized chemotherapy using AI-collected molecular and genetic data from the tumor is still being studied in many institutions.

Conclusion: According to the data we compiled, AI and deep-learning models still have a lot of flaws, one of which is the unexplained process of diagnosis which is the reason many physicians can't fully trust the results. Some studies are now working on AI models that can explain the process. However, despite all the shortcomings, AI and machine learning processes have shown prominent results in the early stages, but the need for future investigations remains to make these tools usable in clinics.

Keywords: artificial intelligence, medicine, brain tumor, cancer

Metaverse Technology for intelligent Health Care: A Review of Potential Applications and Challenges

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Background and aims: Today, Metaverse is an emerging technology in facilitating health services that has great potential in health care. The use of this new technology in healthcare is one of the most important determining factors for ensuring the general, physical, social and mental well-being of the human population in the world, which can lead to a significant reduction in costs and improvement of treatment. Therefore, the present study is trying to investigate the potential applications and challenges of using new Metaverse technology in healthcare.

Method: In this review study, with an appropriate search strategy, all documents with concept of metaverse in healthcare retrieved from databases such as Web of Science, PubMed, Scopus, Cochrane and IEEE were examined without time limitation up to March 2023.

Results: The results of this study showed that the main services for using Metaverse include educational services, interventional services and communication services. Also, medical education, various surgeries, remote monitoring of patients in need of special care, access to data, better understanding of clinical results, virtual follow-up of patients with Covid-19 and medical imaging are the potential applications of metaverse in the healthcare. In other words, metaverse, with artificial intelligence algorithms, helps doctors prioritize critical patients, minimize possible errors in analyzing electronic health records, and make more accurate diagnoses. Other results also showed that, the high implementation costs, obtaining consent from guardians, affordable advanced care facilities, interoperability issues, loss of privacy, ethical concerns and agreement issues from healthcare administrations and organizations are among the main challenges.

Conclusion: The use of metaverse in various healthcare fields is expanding rapidly, and when paired with Artificial Intelligence (AI) Augmented Reality (AR) and Virtual Reality (VR) may profoundly improve medical education, medical literacy, promote diversity, and more. While attempts have been made to implement metaverse technology into healthcare in various ways thus far, there is much room for future growth. So that the use of metaverse technology in healthcare can improve the interactions of people and avatars by creating a sustainable and cost-effective paradigm and lead to the efficient development of the health economy and the industrialization of society.

Keywords: Metaverse, Healthcare, Artificial Intelligence, Virtual Reality, Augmented Reality

Diagnosis of idiopathic pulmonary fibrosis using artificial intelligence: a systematic review and meta-analysis

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Background and aims: Idiopathic pulmonary fibrosis (IPF) is a fatal fibrosing interstitial lung disease with challenging Diagnosis and varying disease progression. Need for expensive and invasive procedures for diagnostic confirmation, lack of effective early diagnostic tools and non-specific presentation contribute to this challenge. It causes irreversible damage to lung tissue but early and proper diagnosis can help to control this disease. Lately, artificial intelligence (AI) has approached significant advances in medical image analysis. We aimed to systematically evaluate the application of AI for diagnosis of this disease.

Method: Systematic search in PubMed, Scopus, Embase and Web of Science was conducted up to March 2023. Appropriate terms including Idiopathic pulmonary fibrosis, artificial intelligence and other relevant terms were searched. All articles were independently reviewed by two reviewers using Rayyan software. Abstracts and article helpfulness were assessed and duplicates were eliminated. Then, inclusion and exclusion criteria were applied. Animal studies, books and book chapters were excluded. Quality assessment was performed with the revised Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool. Microsoft Excel was used for data extraction. Meta-analysis was conducted using CMA 3.7 software.

Results: Out of 1112 studies, five studies were found to be eligible for this study. Imaging type, sample size, machine learning algorithms, accuracy, sensitivity, specificity and area under the ROC curve (AUC) were evaluated. The Ultimate AUC of 0.845 was determined (AUC = 0.845, 95% CI = low 0.841-high 0.849, p-value < 0.001).

Conclusion: Studies showed acceptable performance using numerous recognized deep learning models in the task of IPF diagnosis. In some studies, models demonstrated better accuracy than radiologists. Overall studies showed that automated diagnostic tools can serve as an advantageous clinical aid for diagnosing the disease. Also, there is demand for multidisciplinary diagnosis in idiopathic pulmonary fibrosis and artificial intelligence methods cannot fully replace it. More studies should be done to explore the development of IPF at baseline and follow-up, in addition to assess the efficacy of anti-fibrotic treatment.

Keywords: Artificial Intelligence, Idiopathic Pulmonary Fibrosis, Interstitial Lung Disease, Diagnosis

Body Composition Prediction based on Simple Anthropometric and Demographic Measures Using Machine Learning Methods

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Background and aims: body composition (e.g. fat mass and muscle mass) is an important risk indicator for cardiovascular and metabolic diseases. In addition, applying body composition has an important role in the evaluation of sports performance and the results of diet therapy. However, the techniques and devices need to evaluate body composition are expensive and not easily available. Using machine learning methods can be a valuable approach to estimate body composition based on simple anthropometric and demographic measurements, instead of expensive techniques. This study aimed to develop machine learning prediction models applying simple anthropometric and demographic measurements that can estimate the percent of body fat (BF%) and the percent of body muscle (BM%).

Method: This research was conducted on 9014 adults from The Yazd Health Study (YaHS). Input features were age, sex, weight, height, waist circumference, hip circumference, neck circumference, and body mass index. Body compositions were measured using an Omron body analyzer. The prediction models were developed based on linear regression, random forest, support vector regression, and XGBoost regression. The goodness-of-fit was determined by the coefficient of determination (R2), mean absolute error (MAE), and mean absolute percentage error (MAPE).

Results: The mean ± SD of BF% and BM% in the total population was 32.6 ± 10.9 and 30.0 ± 6.5, respectively. Among the used machine learning methods, the random forest had the best performance in body composition prediction. So, the highest yielded values for BF% and BM% were 0.89 and 0.78. The lowest MAE and MAEP values for BF% were 2.6 and 0.1, and for BM% were 2.1 and 0.08.

Conclusion: Machin learning methods (especially random forest) have been able to create inexpensive but effective models for estimating body composition that can easily be used in medical and diet therapy clinics and sports clubs.

Keywords: Fat mass, muscle mass, body composition, machine learning, random forest

Association of pharmacist telephone follow-up and perception of illness with acceptance of drug treatment in patients with bipolar disorder: a narrative review

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Introduction: Bipolar disorder (BD) is a recurrent and chronic disorder characterized by fluctuations in mood and energy. This disease affects about 2.4% of the world's population. Increasing the level of awareness of patients by pharmacists regarding the acceptance of drug treatment with follow-up and counseling seems to be one of the ways to improve the quality of patient care. Few types of research have been conducted regarding the effectiveness of pharmacist telephone follow-up and understanding the disease with the acceptance of drug treatment in patients with bipolar disorder. Therefore, this review study was conducted to investigate the telephone follow-up of the pharmacist and the understanding of the disease with the acceptance of drug treatment in patients with bipolar disorder.

Methods: In this narrative review research, using keywords related to pharmacist telephone follow-up in patients with bipolar disorder, studies were conducted that were published in Persian or English languages and with full text, in the time range of 2010 to 2022; They were searched in the reliable scientific databases Science Direct, PubMed, Scopus, Google Scholar, SID, and Magiran. Articles that were not in line with the purpose of the research or were published in the form of a letter to the editor were excluded from the study. From the 20 searched articles, 11 articles related to pharmacist telephone follow-up in patients with bipolar disorder were selected.

Results: The results showed that patients with bipolar disorder with high perception of treatment control, low perception of negative emotions of their mental illness, low perception of consequences and high perception of their disorder had better treatment adherence. Due to the limitations of face-to-face education in these patients, the pharmacist's telephone follow-up can play an essential role in providing education to patients. Telemedicine may improve medication adherence in patients with depression, bipolar disorder, or schizophrenia. Empowerment through education enables the family to play a more effective role in managing the disease of their affected member. Using telephone follow-up after the educational intervention will greatly contribute to its effectiveness and continuity.

Conclusion: It is expected that the use of new technologies in patient monitoring will increase. Remote medicine (telemedicine) can be considered a new way to provide healthcare.

Keywords: Telephone follow-up, Pharmacist, Perception of illness, Acceptance of drug treatment, Bipolar disorder

Artificial intelligence in COVID-19 vaccination programs and storage

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Background and aims: Every second is considered vital during a pandemic, therefore, making fast and reliable decisions and plans is the most important part of a pandemic, which can be mentioned in the process of vaccination of communities: the distribution and storage of vaccines. Due to the lack of the type and number of doses of vaccine during the Covid-19 pandemic and the lack of health centers to meet people's needs, accurate and fair planning for the distribution of the vaccine was considered an inevitable principle with regard to the reduction of deaths or the reduction of cases of infection. In addition to these cases, the presence of large numbers of patients with a higher risk of infection or death should also be considered. Here, we review the artificial intelligence (AI) aid in solving the question of " Who should get vaccinated first?" and storage issue of Covid-19 vaccines.

Method: In this review, we mention the types of techniques based on AI for the Covid-19 vaccination programs at the regional level or even between countries and their storage. We refer how AI prioritized people to be vaccinated and how considering the ultimate output of model, whether reducing mortality or reducing infection, can change the prioritization results.

Results: LSTM, Modified WOA and SIRVD are some of the techniques applied in articles. WHO and Github websites are among the most frequently employed data sources. AstraZeneca and Pfizer are among the brands made up -IoT-based sensors for preservation and storage of vaccines. Modeling the forecasting of virus during pandemics has some disadvantages since the parameters related to training data change dependently to external factors. Hence, the models based on online real-time incremental techniques must consider these approaches further for future pandemics.

Conclusion: According to Toharudin et al. decline in infection rate doesn't always mean a decreased death rate will be occurred. However, Hong et al. found that these two final aims lead to the same results in their model, which we consider of great importance for future studies to get fully explored. The accountability that AI has in ethical making decisions cannot be compared to humans, however, algorithms can mistakenly prioritize certain groups of people, as was the case at Stanford University recently. Also, instead of creating new models with new parameters, we suggest to try the existing models globally in order to reach a single decision concerning the proper parameters. These are some of the lessons we can learn from the Covid-19 pandemic.

Keywords: artificial intelligence, COVID-19 vaccination, vaccination program, vaccine storage, vaccine distribution, fairly

Evaluation of the performance of faculty members of Iran University of Medical Sciences using Association rule Mining

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Background: Evaluation of the performance of academic staff members of the University of Medical Sciences plays an important role in identifying the strengths and weaknesses of professors in all roles that are important in terms of competence. This performance evaluation information can also be used by higher authorities to review performance indicators or modify promotion regulations and to make major resource allocation and planning decisions in order to improve the quality of academic staff. In this study, the aim is to evaluate the performance of university faculty members with the approach of association rule mining to predict the performance of faculty members.

Methods: In this study, the dataset available in the academic performance system of the university, abbreviated as Saad, is considered as the main core of the data needed to evaluate the performance of the university faculty members. This system collects 260 activities related to nine separate areas, including educational, managerial, research, therapeutic, etc. roles. By using association rule mining technique hidden relationships and patterns between this huge data set was discovered. Analyzes will be done using python software version 3.9.

Results: The data of all faculty members, including 1156 faculty member from, were analyzed to extract association rules. The best performance was related to the faculty members of surgery group. belongs to health Psychology with 0.16. The threshold of the rules for Confidence level is 50%. Therefore, the rules whose reliability is more than 50% were selected. A total of 17 rules were extracted. First rule states that if the faculty is male and the member of surgery department with more than more than 15 years' experience who earned more than 950 score of educational activity there is a 75% probability that the faculty will promote to full professor degree. Educational activity as a variable that has the greatest impact in predicting the success rate of academic staff in the long term.

Conclusion: Association rule mining can be used to predict latent patterns between the variables related to the activities of academic staff members. For the future study using a set of different data mining techniques that are derived from the principles of machine learning helps to gain precise insight from the existing.

Keywords: Association rule mining, Faculty member, evaluation, performance

The impact of mobile health on the multiple sclerosis patient's quality of life by controlling comorbidity: a systematic review

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Background and aims: Multiple sclerosis is one of the most common neurological disorders, which is associated with symptoms such as fatigue, mental problems, movement limitation. Comorbidity is highly prevalent in MS throughout the disease course. Comorbid conditions, including depression, anxiety, hypertension, diabetes and other chronic diseases adversely affect the quality of life. In this field, Telemedicine and mobile health can have effective intervention by allows long distance patient and clinician contact, care, advice, reminders, education, intervention, monitoring and remote admissions. Unfortunately, Little attention has been paid to this effectiveness. Therefore, this study investigates the impact of mobile health one the multiple sclerosis patient's quality of life by controlling comorbidity.

Method: in this systematic review, keywords: Multiple sclerosis[MeSH], health related quality of life[MeSH], Depression[MeSH], Telemedicine[MeSH], Comorbidity[MeSH], were searched in PubMed, Google scholar, science direct, Cochrane databases and articles published between 2000- 2022 that included the mentioned keywords in title or full text, were extracted. The search was done by2PhD students and in case of conflict, resolved by consensus. In case of similar results, duplicate articles were removed and more comprehensive and original articles with higher citations were selected.

in this study, appropriate articles related to multiple sclerosis patient's quality of life, the effect of mobile health on quality of life and the effect of mobile health on comorbidities met the inclusion criteria and were reviewed and also articles in none English languages were not included. Due to the heterogeneity of the articles and also the lack of quantitative data and systematic reviews, meta-analysis was not performed. The quality assessment of articles was done by the CASP checklist. this review is written based on PRISMA criteria.

Results: In this systematic review, 379articles were extracted and after screening, 262articles were removed, and117articles met the inclusion criteria, and after reviewing the full text, most of them referred to depression in MS patients, and finally13articles were selected, which in total And in short, they included two concepts, MS patient's quality of life and the impact of mobile health on quality of life and comorbidities such as depression, anxiety, etc. reviewing the articles showed that psychiatric comorbidity and depression happened more than others comorbidities and use of mobile health can play a positive role in the prevention and control of these comorbidities and improving the MS patient's quality of life.

Conclusion: Studies shown that the use of mobile health can improving the quality of life by reduces the rate of depression and other comorbidities through the meditation, yoga, diets،Therapy sessions and patient's remote monitoring along with drug therapy. According to the results of this study, we suggest that in the field of improving the quality of life in the MS patient community more efforts and researches should be done according to the limitations of these patients for more effective intervention of mobile health technology.

Keywords: Multiple sclerosis, health related quality of life, Depression, Telemedicine, Comorbidity

An Overview of Artificial Intelligence Methods in Zebrafish-based Tests

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Background and aims: Zebrafish (Danio rerio) is an efficient animal model for conducting whole organism drug testing and toxicological evaluation of chemicals. They are frequently used for high-throughput screening owing to their high fecundity. Peripheral experimental equipment and analytical software are required for zebrafish screening, which need to be further developed. Machine learning has emerged as a powerful tool for large-scale image analysis and has been applied in zebrafish research as well. This study aims to attempt to present various helpful and efficient tools that use artificial intelligence and machine learning in zebrafish-based tests and examine the advantages and disadvantages of each method used previously.

Method: This study is a review of published articles since 2010 in the field of artificial intelligence application in the zebrafish-based tests. In order to collect the articles, the keywords of "Zebrafish", "Artificial intelligence", "Imaging" and "Machine learning" were used in databases such as Google Scholar, Science Direct, PubMed and etc. Also the way of using Pixel Classifier, Deep Fish, ML Classifiers, Athena Zebrafish software that uses artificial intelligence or machine learning has been explored in various articles.

Results: The results are classified in the fields of automated sample handling, imaging, and data analysis with zebrafish during early developmental stages. Furthermore, advances in orienting the embryos, including the use of robots, microfluidics, and creative multi-well plate solutions have been highlighted. Analyzing the images in a fast, reliable fashion that maintains the details is a crucial step; which is a main feature of AI. another benefit of machine learning approaches is ease of use once trained. Users feed input images into the algorithm and the software returns a result output without further interaction. This flexibility of input image type (grayscale, RGB, etc.) allows for a variety of specific staining methods to visualize zebrafish. After examining software that uses artificial intelligence and machine learning in the zebrafish field, a comparison of this software was made in terms of functionality, availability, quality of results and user interface.

Conclusion: The main problem of the zebrafish-based test is the manual inspection of thousands of embryo's images in different phases and this is not workable enough for the analysis, also it is slow and may be an inaccurate process. In summary, there are many options in terms of artificial intelligence tools available to zebrafish researchers to screen zebrafish embryos and larvae. The biggest challenge is choosing the most efficient tools available or finding a bridge to use multiple efficient tools at the same time.

Keywords: Artificial Intelligence, Machin Learning, Zebrafish, Data analysis

A narrative review of the application of artificial intelligence and drug repositioning for the identification of fibroblast growth factor receptor inhibitors

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Background and aims: Artificial intelligence refers to the modeling of intelligent behavior through a computer with the least human involvement. Drug repositioning techniques based on artificial intelligence accelerate the process of research and decrease the cost of experimental studies. Dysregulation of fibroblast growth factor receptors in a wide range of cancers has been implicated and due to their functional importance, have been considered as promising drug targets for the therapy of different cancers. In this review, we have summarized small molecule fibroblast growth factor receptor inhibitors that progressed using artificial intelligence and repositioning drugs that are being examined in clinical trials associated with cancer therapy.

Method: Specific human and animal studies in the fields of artificial intelligence, computational drug design, and drug repurposing or drug repositioning, published in English that were available between 1997 and 2023, contained in PubMed, EMBASE, Web of Science, Scopus and Google Scholar databases were reviewed. Four keyword groups including: “artificial intelligence”, “computational drug design”, “drug repositioning” and “fibroblast growth factor receptors inhibitors” were used in this study. The literature review was conducted on July 2, 2023. Original and review studies were taken into consideration. Conference reports, articles for which the full text was not available, and also study protocols, were excluded. Among the 455 articles obtained from the initial search, 120 articles remained after two stages of screening, which were included in the study.

Results: According to published reports, nonselective fibroblast growth factor receptor inhibitors have the potential to be used for the treatment of cancer and multitarget kinase inhibitors are the first drug class to be approved due to more advanced clinical studies. For example, AZD4547 and BGJ398 are gradually entering the consumption cycle and are good options as combined treatments. Using drug repositioning based on artificial intelligence, multiple small molecule inhibitors have been developed and remarkable advances were obtained in second-generation selective fibroblast growth factor receptor inhibitors

Conclusion: A deep understanding of the tissue-specific nature of the fibroblast growth factor signaling pathway and its integration with artificial intelligence and drug repositioning methods can help in the more successful to preselect suitable drug targets for inhibition of tumor growth and carcinogenicity in the future.

Keywords: Artificial intelligence, computational drug design, drug repositioning, fibroblast growth factor receptor inhibitors

Investigating the effects of High-Tech Digital Industries in dealing with epidemics: a case study of Covid-19

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Health digital industries is also a broad concept that includes all aspects of digital industries, but in the field of health and medicine. In general, the goal of digital health industries is to develop interconnected systems for the use of computing hardware and software technologies, smart devices, computational analysis techniques, as well as communication media in order to improve the provision of medical and health services, especially in times of crisis. This article focuses on the impact of high-tech technologies such as 5G, artificial intelligence (AI) and machine learning, the Internet of Things, big data analysis, cloud computing, robotics and other digital platforms, on the control of epidemics, especially Covid. 19 is concentrated. Currently, the healthcare industry is implementing technologies to improve healthcare services, medical research, quality of life, and the experiences of medical professionals and patients everywhere, anytime. Based on the findings of this study, technology can facilitate faster progress in medical research and better management of clinical and social services. Additionally, high-tech health industry approaches may be able to combat the challenges of the COVID-19 pandemic with minimal resources. . It is also focused on the key challenges of the field of digital health industries. In addition, the study highlights the outlook, policy recommendations and future research directions of the digital health industry in dealing with future pandemics. More research will be included in future projects, including studies on how to develop a digital society based on 5G and IoT technology in healthcare emergencies.

Keywords: 5G, Internet of Things, Artificial Intelligence, High-Tech Industry, Covid-19

Blockchain Technology in Healthcare Domain: Applications and Challenges

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Background and aims: Blockchain is a chain of digital information and each block stores information in itself. Blockchain has a distributed, decentralized and shared ledger that is built as a chain of records called blocks. Each block in this chain is responsible for storing some kind of information. Blockchain was introduced through the Bitcoin cryptocurrency, and since then, research has been ongoing to expand the applications of Blockchain in other areas of information. Healthcare is one of the industries where blockchain is expected to have a significant impact. The aim of study is to investigate of the applications and challenges of blockchain in health care.

Method: In this article, we reviewed of literature on Blockchain in healthcare. PubMed, Scopus، Web of Science and Google Scholar were searched by using related keywords such as " Blockchain ", "healthcare", "decentralized data management" and "health data management". To select the relevant articles, we conducted title, abstract, and full-text screening based on inclusion/exclusion criteria. we used the following inclusion criteria: original articles, full text articles and studies that used blockchain in healthcare domain. We excluded studies that were not focused on the development or use of a blockchain, non-English and review articles. Application of the blockchain in healthcare and their challenges were extracted from selected articles.

Results: Blockchain technology has various application in healthcare, including electronic medical record management, drug and pharmaceutical supply chain management, clinical research, health education, remote patient monitoring and health data analytics. Based on the review, the use of blockchain technology in healthcare is associated with some issues and challenges related to scalability, transaction delay, collaboration of health institutions, lack of law; and security and privacy.

Conclusion: The use of blockchain technology enables more efficient sharing of information with stakeholders while ensuring data integrity and protecting patient privacy. Blockchain has done a great job by creating anonymization protocols and consensus on the types of contracts needed to control information, which anonymized data is of interest to tech giants in the field of artificial intelligence. There are significant challenges in the use of blockchain technology in health care, and more research is needed in this field.

Keywords: Blockchain, health information, health data management, cryptocurrency, decentralized data management

Artificial Intelligence and Health Equity

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Background and aims: Artificial intelligence is changing healthcare and its application in various medical departments and specialties has become a reality. Artificial intelligence has the potential to help create health equity. Therefore, this study was conducted with the aim of investigating the equitable health services with artificial intelligence.

Method: A comprehensive text search was conducted from three databases (Web of Science, Google Scholar, EBSCOhost). Different keywords such as artificial intelligence, health equity, health disparity were used to identify the articles in the field of health equity and artificial intelligence. Related articles were collected, reviewed and selected.

Results: The results of the literature review revealed three main themes regarding the impact of AI on health equity, which included AI's ability to help reduce health disparities, its potential to reduce or exacerbate bias, and its ability to help identify determinants of health. In this regard, the results indicated that incorrect and poor-quality data sets for artificial intelligence models can cause bias, misleading predictions, side effects and even inequity on a large scale. Therefore, the generalizability, transparency, repeatability and interpretability of data sensitive to health equity, as well as the role of data scientists in this regard, have been emphasized. Also, the algorithms used in artificial intelligence should be accurate, objective and fair as much as possible.

Conclusion: The use of artificial intelligence in health care increases health equity and has real potential to reveal existing biases to motivate social change and correct health care disparities. Looking to the future, we must develop harmonized standards for health equity in AI and do our best to uphold them at the national and community levels.

Keywords: artificial intelligence, equity, health

Investigating the Effect of Using Deep Learning Algorithms in CT scan and Chest X-ray Images on Improving the Diagnosis of Covid-19

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Background and aims: Advances in artificial intelligence and rapid changes in medical equipment have provided many opportunities in medical radiology. Advanced algorithms based on deep learning, known as Convolutional Neural Network, play a significant role in extracting basic features in medical images. The aim of this study was to investigate and compare machine learning and deep learning algorithms used to solve a clinical problem in medical images in order to improve the diagnosis of Covid-19 and increase the speed and accuracy in diagnosing this disease.

Method: In this study, articles that used machine learning and deep learning algorithms to solve a clinical problem in medical images were reviewed. To identify related articles, PubMed, Web of Science, Scopus and Google scholar search engines were searched based on keywords. Different algorithms based on artificial intelligence were extracted in the situation of the spread of the corona virus. Automated techniques for classifying chest X-rays into pneumonia class or disease-free class are used from 9 deep learning architectures including basic CNN, DenseNet201, VGG16, VGG19, Inception_ResNet_V2, Inception_V3, Xception, Resnet50. Finally, the type of algorithm used and its accuracy percentage were examined and then the algorithms were compared.

Results: Overall, 13 studies had used deep learning algorithms on COVID-19 and healthy individuals' data. The most advanced COVID-19 diagnostic systems that were used to identify and classify COVID-19 patients and normal individuals based on accuracy were: ResNet50 (96.01) ResNet101 (96.01) ResNet152 (93.09) Inception network from V1 to V4 (98.70 and 97.97%) and CNN (97.62 and 99.4%). Therefore, the review of studies shows that deep learning with Convolutional Neural Networks (CNN) can have significant effects in automatic detection and extraction of very essential features from chest images related to the diagnosis of the corona virus. Advanced algorithms based on deep learning, known as Convolutional Neural Network, play a significant role in extracting basic features in high-precision medical images, and this method has been applied using CT and X-Ray image scans with significant results.

Conclusion: Advanced algorithms based on deep learning, known as Convolutional Neural Networks, play a significant role in extracting essential features in high-precision medical images, and deep learning-based diagnosis systems can be useful in areas where experts and well-equipped clinics are not available.

Keywords: artificial intelligence, machine learning, deep learning, convolutional neural network, medical images X-Ray, CT Scan

Artificial intelligence in transplantation surgery: evolution, current state and future directions

perspectiveTransplantation surgery

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Background and aims: Technological advances continue to evolve at a breathtaking pace. With near-exponential advances in computer processing capacity and the advent, progressive understanding and refinement of software algorithms, medicine, and transplantation surgery have begun to delve into artificial intelligence (AI) systems. The purpose of this review is to provide an understandable summary of the applications of AI in transplantation surgery, exploring key definitions and basic development principles of AI technology as it currently stands.

Method: This study is a narrative review of published articles in the field of AI applications in transplantation surgery. To collect the resources, the keywords of "transplantation", "artificial intelligence" and "machine learning" were used in databases such as Google Scholar, Science Direct, PubMed, Wiley, and so forth.

Results: A key issue in the field of transplantation is the analysis of the transplant recipient's survival. Utilizing the information obtained from transplant patients will be possible to predict the likelihood of transplantation success in other patients. Also, the major factors that affect the chance of a successful operation can be identified. AI classifiers differ in the way they establish relationships between the input variables, how they select the data groups to train patterns, and how they can predict the possible options of the output variables. There are six main areas of transplantation that AI studies are focused on: radiological evaluation of the allograft, pathological evaluation including molecular evaluation of the tissue, prediction of graft survival, optimizing the dose of immunosuppression, diagnosis of rejection, and prediction of early graft function. Machine learning techniques provide increased automation leading to faster evaluation and standardization. Furthermore, transplantation is fortunate to have large data sets upon which machine learning algorithms can be constructed.

Conclusion: AI is now available to improve pre-transplant management, donor selection, and postoperative management of transplant patients and also optimize donor selection to identify patients likely to benefit from transplantation of higher-risk organs, increasing organ discard and reducing waitlist mortality. AI and technology-enabled management tools are now available throughout the transplant journey. Unfortunately, those are frequently not available at the point of decision (patient listing, organ acceptance, post-transplant clinic), which hinders their widespread utilization.

Keywords: Transplantation, Artificial Intelligence, Big Data, Machine Learning

Potential and Design Characteristics of Artificial Intelligence-based Chatbots as Virtual Patients in Medical Education: A Review Study

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Background and aims: Nowadays, there is an increasing need to learn, practice and even design modern and technology-rich clinical environments. Meanwhile, the benefits of Virtual Patient Simulations (VPSs) for medical education have long been recognized. With recent advances in Artificial Intelligence (AI), chatbots or conversational agents have become more widespread. A literature review is carried out to give insight into existing educational ideas with such agents.

Methods: We performed a scoping review. A literature search was performed to retrieve English records in PubMed, Scopus, and Google Scholar with three main search terms including "virtual patient", "chatbots" (or "conversational agents", "dialogue agents"), and "artificial intelligence" in July 2022. Studies were included if they used or evaluated chatbots as virtual patients in medical education. Reference lists of relevant articles were checked for further articles. Screening and data extraction were performed in parallel by two reviewers. The included evidence was analyzed by employing the principles of thematic analysis.

Results: Findings were grouped into three categories: 1) potential applications, 2) types of chatbots and design characteristics, 3) and evaluation methods. In medical education, Virtual Patients (VP) are often applied to train students in different scenarios such as recording the patient's medical history or deciding a treatment option. Conversational agents would allow a more sophisticated and individual conversation between the student and the VP. Artificial Intelligence chatbots allow interactive dialogue-driven teaching of medical sciences. Although chatbots offer a flexible solution and a vast possibility to improve healthcare education, limited examples of chatbots in Healthcare curriculum have been found.

About types of chatbots, they can range from chat-like interfaces just showing an avatar of the patient, to 3D avatars for even more immersive and engaging interaction. Also, even though most receive user input through typing, some have used speech recognition. Unlike basic chatbots that are typically rule-based, AI chatbots rely on natural language understanding, natural language processing (NLP engine), and natural language generation to understand and respond to the humans they are interacting with.

Findings highlight the usefulness of simulating a VP with an AI-enabled chatbot by giving students the possibility of multiple clinical cases especially, for complicated and unexpected scenarios to practice. It offers medical students an engaging and personal experience because of the interface and the natural language. This literature review suggests that the efficacy of chatbots has not been thoroughly tested. Generally, the metrics used to evaluate this technology include users' usability and acceptability, accuracy, and skills evaluation.

Conclusion: The exploitation of artificial intelligence, machine learning techniques, and deep learning technologies allow for the design and development of chatbots which can be meaningfully integrated into medical education to develop students' diagnostic skills.

Based on the findings, conversational virtual patients may have the potential to support healthcare education by enabling personalized learning. Future studies could investigate the educational im-

pact on learning outcomes and students' satisfaction when interacting with chatbots. In addition, simultaneously with the development of chatbots in medical education, it becomes necessary to develop national standards for designing and evaluating programs.

Keywords: Virtual patient; Medical education; Chatbot; Artificial intelligence; Machine learning; Natural language processing.

Rapid and Noninvasive approach to evaluate the quality of embryos produced during in vitro fertilization by Raman spectroscopy

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Background and aims: Most chromosomal abnormalities in embryos are deadly and can cause embryonic growth to prevent before implantation or spontaneous abortion of the embryo during the first trimester of pregnancy. Using Morphological characteristics or a biopsy of a single cell or a small number of cells for genetic testing are typical methods to choose the best embryo. These methods are Unreliable or invasive. Therefore, it is essential to detect normal embryos created by IVF or ICSI before transferring them to the uterus.

Method: To establish the analysis protocol, 30 spent human embryo culture medium samples (blastocyst) with defined morphologic grades were collected and measured using Raman spectroscopy. Individual Raman spectra of the embryo culture medium was analyzed to find biological components. To validate the protocol via Principal Component Analysis, additional 250 Raman spectra from 30 embryo culture media were analyzed.

Results: Mean-centered Raman spectra and principal component analysis were differences in the footprints of the highest-grade and the lowest-grade embryos growing in the culture medium. Stacking classification based on PCA achieved an overall accuracy of 98% in correctly assigning either based on Raman spectra.

Conclusion: This study suggests that chromosomal abnormalities in embryos lead to changes in metabolic footprints in embryo growth medium. This feature could be detected by Raman spectroscopy and, using machine learning, was analyzed by Raman- based footprint profiling of spent culture media.

Keywords: chromosomal abnormality, Raman spectroscopy, embryo, IVF, ICSI, spent culture media.

Identification of novel genes in Non-alcoholic fatty liver disease with Machine learning

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Introduction: Non-alcoholic fatty liver disease (NAFLD) is defined as a range of chronic liver diseases resulting from the accumulation of excess triglycerides in the liver. It is anticipated that the frequency of NAFLD will increase from 83 million in 2015 to 100 million by 2030. Diagnosis in the early stages reduces the risk of liver damage and increases the survival rate. Biomarker identification by computational approaches as reliable, and non-invasive methods is required to identify specific diagnostic biomarkers in the early stage of fatty liver. Therefore, our aim was to discover important genes related to Non-alcoholic fatty liver by machine learning algorithms.

Method: The GSE126848 dataset included 33297 array-based expression profiling of 73 samples downloaded from https://www.ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE126848. Dysregulated expression genes (DEGs) have been identified by machine learning methods (Penalize regression models) based on Relief Weight feature selection after filtering and normalization. The adjusted $p < 0.05$ and $-1.5 <|\text{Log2FC (fold change)}| < 1.5$ were identified for subsequent analysis as significant genes. R4.1 and EVIEWS 11 were used for analysis.

Results: Elastic Net (ENET) was the robust predictor (Lambda at minimal error: 11.87, R2=0.999 and alpha = 0.5, l1 Norm = 1.31). The area under the curve was approximately 0.99 with a confidence interval (0.95,1). Four novel genes, including RABGAP1, SLC7A8, SPAG9, and KAT6A were found to have a differential expression between fatty liver and healthy individuals.

Conclusion: The four key genes identified in our study. It is recommended that other prognosis, diagnosis and predictive biomarkers regarded to the fatty liver be discovered in further studies.

Key words: Biomarker, Gene, Machine learning, Fatty liver

Artificial Intelligence in Disease Diagnostics and Prediction

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Background and aims: Artificial Intelligence (AI) is a general term that implies the use of a computer to model intelligent behavior with minimal human intervention. Artificial intelligence (AI) research within medicine is growing rapidly. AI has completely changed the traditional model of medicine, significantly improved the level of medical services, and guaranteed human health in various aspects. AI has several potential applications in medicine, A broader development prospect for medical AI is highly expected in the future. The most urgent need for AI in biomedicine is in the diagnostics of diseases. A number of interesting breakthroughs have been made in this area. AI allows health professionals to give earlier and more accurate diagnostics for many kinds of diseases.

Method: This review was gathered from original and review studies published in Google scholar, Medline, PubMed and Science direct with key words of Artificial Intelligence, Diagnostics, Prediction and between the years of 2000 to 2022.

Results: this 'unique' role of diagnosis is ultimately a pattern-recognition algorithm. Information is gathered, synthesised, and compared with predefined categories we call diseases. If a patient's pattern of symptoms, signs and test results match that of a known disease, then we classify and treat them accordingly. Clearly, this process could be performed by an appropriate AI. In addition to diagnosis, AI can help to predict the survival rates of cancer patients, such as colon cancer patients. For one-dimensional signal processing, AI has been applied to biomedical signal feature extraction such as electroen cephalography (EEG), electromyography (EMG), and electrocardiography (ECG).

AI can also play an important role in diagnosis based on biomedical image processing. AI has been utilized in image segmentation, multidimensional imaging, and thermal imaging to improve image quality and analysis efficiency. AI can also be deployed in portable ultrasonic devices, so that untrained personal can use ultrasound as a powerful tool to diagnose many kinds of illnesses in undeveloped regions.

Conclusion: Over the coming years, AI will challenge the traditional role of the doctor. Human doctors make errors simply because they are human, with an estimated 400,000 deaths associated with preventable harm in the US per year.18 Furthermore, the relentless growth of first world health care demands in an economically-constrained environment necessitates a new solution. Therefore, for a safe, sustainable healthcare system, we need to look beyond human potential towards innovative solutions such as AI. Initially, this will involve using task-specific AI as adjuncts to improve human performance, with the role of the doctor remaining largely unchanged. However, in the longer term, AI should consistently outperform doctors in most cognitive tasks. Humans will still be an important part of healthcare delivery, but in many situations less expensive, fit-for purpose clinicians will assume this role, leaving the majority of doctors without employment in the role that they were trained to undertake.

Robotics, At the Heart of Rehabilitation

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Introduction: Technologies in robotics deal with automated and programmed machines that may replace a human's functions in many situations such as hazardous manufacturing processes, healthcare, military or simply doing human tasks. The paper reviews the intensive ongoing activity in rehabilitation robotics and intelligent technologies in contemporary rehabilitation practice and research.

Method: This review was gathered from original and review studies published in Google scholar, Medline, PubMed and Science direct with key words of Artificial Intelligence, Rehabilitation, Robotics and between the years of 2000 to 2022.

Result: A total of 236 abstracts were retrieved from the electronic databases. Of these, 15 original articles provided data on the employment status of artificial intelligence and Rehabilitation. Technological advances, particularly in artificial intelligence (AI) and robotics, are revolutionizing the methods and capabilities of rehabilitation research and practice. finally, the findings included seven sections: Ubiquitous Computing and Ambient Intelligence, Intelligent Mobile and Wearable Devices, Virtual Reality, Augmented Reality, and Serious Games for Rehabilitation, Physically Assistive Robotics, Socially Assistive Robotics.

Discussion: We are coming into a new age where intelligent machines work in a new type of symbiosis, leading into intuitive and easy to use devices to help us in the interaction with our environment. This symbiosis can help us enhance our perception of the world, or can restore some lost functionality. These systems can provide numerous benefits to rehabilitation professionals, care providers, and clients. There is great complexity around outcomes in the field of rehabilitation in general, so target outcomes must be simplified and well organized.

Keywords: Artificial Intelligence, Rehabilitation, Robotic

Comparison of machine learning algorithms in the diagnosis of pancreatic ductal adenocarcinoma through urinary biomarkers

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Background and aims: Rapid diagnosis of cancer and its prevention is one of the goals of modern medicine, which can be reached today with the presence of biomarkers and artificial intelligence. One of the cancers whose early detection can reduce the mortality rate is pancreatic ductal adenocarcinoma. In the studies conducted in this field, it was found that the biomarkers tff1, reg1b and lyve1 change in the urine level in this disease. Now, with the existence of sciences such as artificial intelligence and machine learning, it is possible to diagnose cancer faster with the information of biomarkers.

Method: The data used in this study is related to the data collected from urinary biomarkers in three categories of healthy people, people with pancreatic disease, and people with pancreatic ductal adenocarcinoma, which was collected by Debernardi et al. and is available on the Kaggle website.Python programming language and machine learning algorithms such as svm, mlp, logistics regression, random forest, etc. have been used to model this data for disease diagnosis. Accuracy and kappa score are used to measure the accuracy of algorithms. The cross validation was also done, all of which are available in the sklearn package, one of the Python libraries

Results: According to the initial data analysis, this data included 590 samples, which contained the information of plasma_CA19_9, creatinine, LYVE1, REG1B, TFF1, REG1A and et. Some columns of this dataset had empty data, and to deal with this problem, there are two strategies, the first strategy is to remove empty data, create data to balance with the over sampling method, and the other strategy is linear interpolation of empty data, which was done for both modeling strategies to ensure accuracy. After that, features were selected with correlation and (SFS) wrapper methods, and it was also found that REG1B and LYVE1 have the most impact in the correct diagnosis of cancer, but all the biomarkers in this dataset are related to the algorithms Machine learning was given. After modeling by various algorithms, the highest accuracy was determined in the two considered strategies, respectively, Random Forest with cross validation with an accuracy criterion of 96% and MLP with a cross validation accuracy criterion of 73%.

Conclusion: Rapid diagnosis of cancer can be effective in preventing many of its damages and reducing the death rate, which is possible with the help of biomarkers and advances in artificial intelligence and machine learning. This study showed that cancer can be diagnosed with high accuracy with the help of biomarkers and this science, and the highest accuracy recorded in this study was 96% in cross-validation, which is related to the random forest algorithm, although it is low due to the number of for example, the results of this study cannot be trusted and more studies are needed to be more confident. It is hoped that this disease will be controlled in the best way in the future.

Keywords: Cancer, Machine learning, Artificial Intelligence, biomarkers

Application of deep learning models for detection of subdural hematoma: A systematic review and meta-analysis

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Background and aim: The aim of this study is to investigate the application of deep learning (DL) models for the detection of subdural hematoma (SDH).

Methods: A comprehensive search using relevant keywords was conducted. Articles extracted were original studies in which sensitivity and/or specificity were reported. Two different approaches of frequentist and Bayesian inference were applied. QUADAS-2 was used for quality and risk of bias assessment.

Result: Twenty-two articles were analyzed that included 1,997,749 patients. In the first step, the frequentist method showed a pooled sensitivity of 88.8%(95% CI: 83.9%-92.4%) and a specificity of 97.2% (95% CI 94.6%-98.6%). In the second step, using Bayesian methods including eleven studies that reported sensitivity and specificity, a sensitivity rate of 86.8% (95% CI: 77.6%-92.9%) at a specificity level of 86.9% (95% CI: 60.9%-97.2%) was achieved. The risk of bias assessment was not remarkable using QUADAS-2.

Conclusion: DL models might be an appropriate tool for detecting SDHs with a reasonably high sensitivity and specificity.

Keywords: artificial intelligence, subdural hematoma, deep learning, machine learning

Internet of Robotic Things in Healthcare Domain: Applications and Challenges

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Background and aims: The Internet of Robotic Thing (IoRT) represents a new concept that is the integration of different technologies including robotics, Internet of things (IoT), cloud computing and artificial intelligence (AI). This integration results in robots that can execute more complicated tasks. In an IoRT system, several robots can be conveniently integrated among themselves, as well as with objects and people, allowing data to be transferred to them without the need for human-to-computer or human-to-human contact. The aim of this study is to investigate of the applications and challenges of the IoRTs in healthcare domain.

Method: In this article, we reviewed of literature on IoRT. PubMed, Scopus، Web of Science and Google Scholar were searched by using related keywords such as "Internet of things", "robotic", "internet of robotic thing", "internet of medical thing" and "Artificial intelligence". Relevant studies have been selected and reviewed based on the specified inclusion/exclusion criteria.

Results: IoRT can be used in various applications including rehabilitation, surgery, prosthetics, elderly care, long-term care, tele monitoring, mental health, disabilities and disease outbreak management. Based on the review, the application of IoRT in healthcare is associated with some issues and challenges related to security, network infrastructure, cost, high volume of data management, human-robot interaction, and multi-robot coordination.

Conclusion: IoRT is a rapidly growing field in the health sector that will create a great transformation in the healthcare delivery and tele-health in the future. This technology can play a key role in creating smart environments such as smart hospitals and smart nursing house. Despite the advantages and capabilities, the IoRT faces some challenges and issues in healthcare that need to be investigated and addressed.

Keywords: Internet of thing, robotic, Internet of medical robotic thing, cloud computing

Healthcare 4.0: A review of concept, applications, and challenges

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Background and aims: The fourth industrial revolution (Industry 4.0) is a fundamental change that will bring about massive changes in the way we live on earth. Industry 4.0 moves our physical and biological world into digitalization and this movement has accelerated with the emergence of covid-19, providing a suitable opportunity to accept this revolution in all aspects of life, economy and industry. One of the most important of these changes and effects is in the field of health and exercise physiology, where the revolution is pushing all aspects of this field towards digitalization. In this review, at first we introduced a simple concept of how Industry 4.0 and its technologies such as Artificial Intelligence (AI), Internet of Things (IOT), Augmented Reality (AR), Block Chain, Big Data, Robotics, and Cloud Computing, can be applied in healthcare domain, known as "Healthcare 4.0". Then, we identify some Start-Ups and Innovative Health 4.0 applications and their challenges, especially in Iran. The most researched challenges are Intellectual property protection, data fragmentation, Weakness of necessary infrastructure, complexity, heterogeneity, and privacy.

Method: In this article, by using library studies including the study of books, articles and internet resources with a descriptive-analytical approach, the applications of Industry 4.0 technologies in Health era system has been done. To reach the final goal of this article, the following steps have been taken: Finding the main keywords in Industry 4.0 and Health Care and then choosing the most common and important ones

Finding new research papers (from 2010-2023). For the searches, IEEE Explorer and ScienceDirect, MDPI journals, and database of Hindawi were targeted

Classification of articles and classification of the topics that have been discussed

Conclusion:. In this article, first, with the help of books and internet resources related to the fourth industrial revolution, a list of its technologies includes as AI, IOT, AR, Block Chain, Big Data, Robotics, and Cloud Computing, was prepared and used along with the word "Industry 4.0" and "Healthcare" as the keywords of this research. By searching for these keywords in research databases such as Science Directory and industrial white papers, the required references were extracted and categorized, and the present article was written at the end.. We have shown how these technologies can be applied in different sectors of life and industry. In fact, this article will serve as a research guide for medical and health students and researchers who are interested in research in this field. Based on this research, The potential of Healthcare domain for Industry 4.0 is significant. Its technological applications not only improve the quality of life of patients, but also improve the business processes or professional work done in this field.

Keywords: Industry4.0, Healthcare 4.0, IOMRT, Internet of Things, Artificial Intelligence, Covid-19

Potential challenges of incorporating artificial intelligence (AI) solutions into workflows of breast imaging departments

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Background and aims: Breast cancer screening increases workload of radiologists. Recently, using AI solutions has been of great interest to radiology domain for decreasing this presser. We review the challenges that may slow or prevent AI adoption into workflows of breast imaging departments.

Method: The reviewed articles in this study were collected from web of science, PubMed (MEDLINE) and GoogleScholar databases without time limit and based on the keywords "artificial intelligence", "breast imaging" cancer, limitations, and challenges.

Results: Some of the anticipated limitations for AI applications in breast imaging are as follow: The hospital environment of numerous integrated programs communicate poorly with PACS and other radiology information systems. The risk of innate latent bias is exist if the algorithms have been developed on datasets of certain populations. To maintain the trust of the public and avoid the controversies such as inappropriate data sharing it is necessary to guide the development of human-centric AI. The ability to track data back to the source via a flag-based system is necessary. However, such systems do not currently exist and would not be easy to integrate. With respect to technical requirements, image analysis through big data needs the specific graphical processing units. Also larger data storage capacity is desired. It is important to ensure that patients cannot be re-identified via the possibilities of image reconstruction. Even If the better performance of the algorithms are verified across a range of imaging modalities, independent prospective benchmarking against national criteria is needed. It is vital that commercial companies disclose the limitations of their algorithms and training radiologists how to interpret. Advancing new technical expertise will require highly skilled staff who currently relocate to industry.

Conclusion: AI's solutions can utility in breast cancer diagnostic, but with possible algorithmic error and without powerful evidence to support it, AI should not be relied on for physicians' decisions. There are several ethical, technical, legal and regulatory challenges facing to adoption AI algorithms into workflows of breast imaging departments. For adopting AI into radiology, further research are require about economic implications, working according to the required performance, avoidance from the latent bias and also to provide the updated guidance for healthcare professionals to follow.

Keywords: artificial intelligence, breast imaging, cancer, limitations, challenges

Design and Development of Web-based Hospital Information System in Mashhad Velayat Electronic Hospital

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Background and aims: Healthcare institutes, including hospitals, need a structured electronic medical record for timely access to patient data, and for this purpose, hospital information systems are designed. This study aims to design and develop a web-based hospital information system to manage hospital information system processes, provide quick access to information, improve patient satisfaction, and create an effective decision support system for health care providers.

Method: A program based on web technology was created to manage the medical records of hospitalized and monitored patients. Some parts of this system include visiting actions of patients, tracking patient records in different hospital and paraclinical sections, defining the access of staff and physicians, providing management reports, aggregation of information at the university level, management of basic information and system coding in a centralized form of headquarters, standard outputs such as Excel and PDF, use of coding systems, standard terminology and ontology, electronic archive of medical records, generating electronic forms, as well as managing paraclinical and pharmacy in Mashhad Velayat hospital. One of the features of the designed HIS is the possibility of managing and recording information in a headquarters by the related units in the headquarters, and the hospital user can only use the information in Read only form. The methodology used in the production and development of software is Scrum. This method is an iterative model of Agile methodology for managing software projects, which provides the possibility of providing a quality product with the efficient management of the software production and development process. The architecture used in the project is Service Oriented Architecture (SOA). Supply required infrastructure web-based hospital information system has been done (including cloud Wi-Fi, tablets, installing voice-to-text software, etc.). In order to implement, modern web-based software production technologies have been used including Angular 8, .net Core, SQL Server, power bi ، and Tableau, its design is responsive and it can be used on all types of hardware devices such as tablets and mobile phones. The patient's electronic record that created by the hospital information system can be presented to other organizations (such as forensic medicine, insurance, etc.) and within the organization (between hospitals and headquarters units). The interoperability with other systems and services including sending, receiving and managing communication with other internal or external systems and related systems such as PACS, LIS, etc. is done through Web API. The developed system has a user-friendly graphical interface and provides features such as Internet access and complete electronic patient records and remote access that can be downloaded from a web server and run by a browser. This system is based on HL7 global standards and internal standards of the Ministry of Health (SEPAS (and has CPOE and CDSS of diagnostic and therapeutic type and is also integrated with other information systems such as Packs, LIS, medical equipment, and portable tools (barcode reader, tablet, kiosk, etc.).

Results: The use of this web-based hospital information system has led to improving the quality of health care provision, reducing hospital costs, improving time management, increasing educational capabilities, and improving access to remote patient records. Also, this system has in-

creased the satisfaction of patients and physicians by reducing waiting time through high-quality information infrastructure and systems.

Conclusion: The successful establishment of a web-based hospital information system, considering the provision of patient medical records without time and space limitations in all parts of the health system, from the point of view of physicians and other health care providers, can improve the organizational performance of the hospital.

Keywords: Advanced Technologies, Advanced Digital Equipment, Smart Hospital, Hospital Information System, Electronic Health.

Predicting the success of dental implant treatment using Artificial intelligence and Machine learning

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Background and aims: Nowadays, dental implants are widely used to replace missing teeth. However, complications, failures, and diseases are not uncommon. Since the price of this treatment is higher than conventional methods, its success rate should be carefully evaluated before treatment. Accurate prediction of implant success is influenced by many factors, making it a challenging subject for dentists. One of the significant services that machine learning (ML) has provided to the medical context is the prediction of treatment outcomes. We aimed to review studies that used prediction models based on artificial intelligence (AI) and ML for predicting dental implant treatment success.

Method and Materials: Our review question focused on the literature search about methods of AI-assisted implant treatment success prediction. Keywords consisted of artificial intelligence, machine learning, dental implants, prognosis, and prediction. An electronic search was conducted in 5 databases: MEDLINE/PubMed, EMBASE, Web of Science, Cochrane, and Scopus. A manual search was conducted too. Studies that investigated the clinical applications of artificial intelligence to predict implant success using patient risk factors were included. Review articles, letters to the editors, and posters were excluded. Relevant articles published up to October 2022 were identified, quality assessed, and data extracted by two reviewers.

Result: At first, a duplication check was conducted, and 74 articles were identified. After screening and applying inclusion and exclusion criteria, seven studies were reviewed that investigated the success of implant treatment with AI methods. Different ML models were used in these studies: support vector machine (SVM), artificial neural network (ANN), logistic regression (LR), random forest (RF), decision tree (DT), ensemble selection (ES), K-Nearest Neighbors (K-NN), and Naïve Bayes. Various studies used different input data for predicting implant treatment success, such as demographics, physical condition, lifestyle, surgeon background, anatomic condition, surgical information, implant attributes, and prosthetics attributed. Among the included studies, the accuracy, sensitivity, and specificity of these methods in all included studies ranged from 62.40% (for LR) to 99.25% (for NN), 48.08% (for K-NN) to 97.63% (for NN), and 61.11% (for DT) to 100% (for SVM), respectively.

Conclusion: According to this review, NN method showed the highest accuracy and sensitivity, and the highest specificity belonged to SVM. They also reported that dental implant prognosis mostly depends on factors such as the mesio-distal position of the inserted implant, fixture width, and implant system. Based on this review, AI models have great potential for implant success prediction. However, the use of AI and ML has not been integrated into routine dentistry. AI is still in the research phase, and further studies are required to assess the clinical performance of these methods in dentistry.

Keywords: artificial intelligence, dentistry, machine learning, dental implants, Implant prognosis

Identifying resilience strategies for disruption management in the healthcare supply chain during COVID-19 by digital innovations: a systematic literature review

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Background and aims: The vast and worldwide spread of the COVID-19 disease has a catastrophic effect on healthcare supply chains. The Innovative technologies can impact considerably; nonetheless, the literature demonstrates that the utilization of these tools is still in a growing stage. Thus, supply chain management studies face challenges related to novel technology usage. One dominant obstacle identified in the literature is the absence of a resilience strategy informing policymakers about the application of innovative technology in the healthcare sector. This research aims to bridge the knowledge gap in the healthcare SCM literature concerning the use of innovative technologies for risk management.

Method: The current manuscript systematically analysis existing studies mitigating strategies for disruption management in the healthcare supply chain in COVID-19. This SLR was conducted in 3 phases, Phase 1; planning the SLR, determining the need for an SLR, defining research question(s), identifying the relevant bibliographic databases, Phase 2; conducting the review, study selection, data extraction and synthesis, Phase 2; analysis the results.

The results: Using a systematic approach, we recognized 35 related papers. There is rising demand and popularity of healthcare SCM in COVID-19, the United States and China published most of the papers about the technology-driven approaches in SCM in healthcare. Artificial Intelligence (AI), Blockchain, big data analytics and simulation were the most prominent technologies that used in supply chain management in health care.

Conclusion: The finding reveals that the published researches mainly concentrated to generating resilience planes to the management of COVID-19 impacts. Furthermore, the vulnerability of healthcare supply chains and the necessity of setting better resilience methods are emphasized in most of the researches. However, researches examining the practical application of these emerging tools for managing disturbance and warranting resilience in the supply chain are rarely examined. This article provides directions for additional research, which can guide researchers to develop and organize impressive studies related to the healthcare supply chain for different disaster.

Keywords: Supply Chain Management, Pandemics, COVID-19, Healthcare Supply Chain, Literature Review

Artificial intelligence in family medicine (AIFM): A scoping review of the literature

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Background and aims: The use of artificial intelligence in human life is increasing rapidly. AI is not just a technology, but a set of techniques that allow computers to perform activities related to human thinking, such as decision making, problem solving, and learning. The use of AI has become common in almost all fields, and it is also applied in healthcare. Primary healthcare is where the power, opportunity and future of AI will be realized on the broadest and most ambitious scale. The objective of this study is a scoping review of artificial intelligence in family medicine practice.

Methods: In this study, to review and describe the applications of artificial intelligence, the challenges and advantages of AI, the implications of AI in the family medicine practice and how to improve of family medicine practice with AI, a scoping review was used. In order to conducting this scoping review, we used the Arksey and O'Malley methodological framework updated by Levac et al. In addition, in directing this research, we used the strategies and guidelines proposed by Joanna Briggs Institute (JBI) for scoping review methodology.

In order to carry out this review, studies published in English from October 10, 2000 to October 10, 2022 were searched in three databases: Google Scholar, PubMed, and Scopus. The keywords "family medicine", "family physician", "family doctor", "family practice", "general practitioner", "primary care physician", "community practice" and "electronic health record" using "AND" with The keywords "artificial intelligence", "smart", "machine learning", "intelligent", "digital" were combined and searched. After fulfill the search and partitioning process of all studies in EndNote.X4. v14 software, duplicate studies were removed. Then, in the next steps, screening of studies based on inclusion and exclusion criteria, reviewing and assessing of studies abstract, and assessing of the full text of the remaining studies were performed, and 78 articles and studies were finally included in the research process.

Results: The findings of this research were presented in two levels, descriptive and quantitative, and thematic review. First, a quantitative description of the distribution of studies based on the year of publication, the study method or type of study, and the research place (country) was conducted. In addition, a thematic review of the studies was conducted, and its results were presented according to the following four questions (research questions).

What are the applications of artificial intelligence in family medicine practice?

What are the challenges, risks and advantages of artificial intelligence for family medicine practice?

What has been the orientation and implications of artificial intelligence in the practice of family medicine (theoretical and practical)?

How can the practice of family medicine be improved with artificial intelligence?

Conclusion: Primary healthcare practice is the gateway to enter artificial intelligence to medical sciences. Meanwhile, electronic health record (EHR) data in primary healthcare settings provides the most unique context for practical innovation and application of AI in medical sciences.

Applications of Intelligent Computer Diagnosis Systems in Different Majors of Medicine

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Background and aims: As artificial intelligence (AI) technics have dramatically grown, a new horizon is appeared in the field of medicine called intelligent medical diagnosis. Diagnosis systems have developed in all majors of medicine like neurology, psychiatry, anesthesiology, epidemiology, pathology, gynecology and obstetrics, radiology, cardiology and genetic. Early detection of some critical diseases, decision making in situations of confronting high number of medical factors, differentiating of patients who have similar signs and symptoms but they have different diseases, detecting of variations in medical images that cannot be seen by visual inspections, predicting the prevalence of contagious disease, are the examples of intelligent diagnosis systems.

Method: There are several known AI methods for the diagnosis in medical data. Some of these methods along with their applications are explained as follows: Mathematical inverse problem for estimating the localization of a lesion (e.g., focal source of seizure); Using graph theory to find functional connectivity among different parts of the brain (e.g., differentiating of Parkinson, Alzheimer, MCI diseases, pain level detection). Applying deep neural networks for classification and regression in big data analysis (e.g., depression level detection, seizure detection, seizure prediction, sleep stage classification); Using fuzzy logic inference systems in confrontation of situations including uncertainty in data (e.g., missing features); Mapping EEG signals to the Riemannian space for better separation of patients (e.g., BMD and Schizophrenia); Applying statistical machine learning methods and pattern recognition methods to classify the signals and images of different patients with similar clinical signs. To customize a model and optimize its parameters for a specific medical data, evolutionary-based search methods are used. When the labels of samples are continuous, statistical and neural regression models can be used to determine continuous score of the diseases, which have been previously determined by filling up a questionnaire.

Results: In this part, a review over the previous results is presented. High rate classification accuracy of patients with attention deficit hyper activity disorder from bipolar manic depression (BMD) patients by characterizing their electroencephalogram (EEG) signals both in the idle state and in presence of visual stimuli were achieved. In addition, BMD cases were differentiated from schizophrenic patients by analyzing their steady state visual evoke potentials. Localization of focal seizure sources was estimated with high precision in the range of millimeter by different research teams. Electromyogram signals were repeatedly diagnosed to estimate motor unit action potential shapes and firing rate of motor units. Covid-19 death rate was frequently estimated by statistical regression methods. Moreover, computed tomography images of patients with Covid-19 were applied to deep neural networks and the diagnosis precision was reported convincing by several reams. In continue of our reviewing, infertility rate was successfully predicted by data mining methods considering efficient factors. Plenty of electrocardiography signals belonged to different heart disease (e.g., ventricular tachycardia and ventricular fibrillation) were diagnosed and detected. Super-family proteins are quiet high dimensional data and classified by fuzzy networks.

Conclusion: Some of intelligent diagnosis systems are commercialized in the fields of cardiology, radiology and neurology. Early diagnosis of some diseases like Alzheimer by these intelligent systems can significantly prolong the patients' life. Nevertheless, some of these diagnosis systems are still spending their infancy period and still could not provide promising results.

Keywords: artificial intelligence, medical diagnosis systems, early detection, neurology and psychiatry, rehabilitation.

Output Feedback Stabilization of Image Guidance of Steering Flexible Bevel-Tip Needles

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Abstract: This paper deals with the design of an adaptive output feedback controller for stabilizing the penetration of flexible bevel-tip needles to a specific planar slice. The paper mainly focuses on the nonholonomic reduced order existing kinematic model obtained by a feedback linearization of the original system. The proposed method involves an adaptive Luenberger observer and a static state feedback controller. The observer will be adjusted using some well-determined adaptation laws. The controller forces the observer model to be bounded so the model converges to an adjustable invariant set. The methodology proposes a sphere shape invariant set for the internal states of the transformed model where its radius is minimized by two design algorithms. To validate the result of the proposed methodology, comparative simulation examples are given to illustrate the performance of our design compared to previous approaches. These examples reveal the superiority of our proposed method.

Keywords: Adaptive control, Luenberger observer, Needle steering, Nonholonomic system, Trajectory planning.

A review of the efficiency of the computerized physician order entry system for prescribing drugs in the clinical setting

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Background and aims: Medication errors occur frequently in medical care and impose a high cost economically. Therefore, prescribing medicine electronically provides an opportunity to reduce the number of medication errors. This study discusses computerized physician order entry as a clinical information system to support physicians in prescribing drugs for patient care.

Method: The data were collected by searching PubMed, Scopus, Google Scholar, and Embase databases. The searched keywords were: "computerized physician order entry", "clinical information system", "medication error", "drug usage evaluation", and "drug administration". Review articles, duplicate publications, and non-relevant articles were excluded. The search was limited to studies in the English language.

Results: A clinical information system equipped with an electronic database of drugs can be used to make decisions about prescribing drugs. Computerized physician order entry systems along with decision support for drug administration (checking drug allergies, drug interactions, and dose calculation), are considered suitable solutions to reduce medication errors and standardize medical care. This strategy can prevent 72.7% of errors in the drug ordering phase.

Conclusion: Clinical information systems can be used to support the drug administration process (drug ordering, dispensing, and monitoring) and provide the medical team with immediate alerts and key information about medications and the patient's condition, which leads to the reduction of medication errors. Therefore, since the drug usage evaluation system is considered one of the types of clinical information systems, the design and implementation of these systems can greatly help the process of drug prescription, monitoring, and management.

Keywords: Computerized physician order entry, clinical information system, drug usage evaluation, medication error

Nursing management information dashboard: A technology-based solution to improve nursing management

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Background and aims: Based on the studies, the use of information dashboards by nursing managers can be effective in increasing their productivity, providing available and up-to-date information, facilitating communication between the care team and improving the quality of services, appropriate allocation of resources in the department. according to this, nursing management information dashboards provide information to support the decisions of nursing managers. In this study, an attempt has been made to design a nursing management information dashboard in a large hospital in Mashhad, Iran.

method: This cross-sectional applied research was carried out in the 1000-bed hospital of Imam Reza (AS) in Mashhad in 2021 using a quantitative-qualitative and exploratory method. The research team used a combination of research methods and tools (such as surveys and interviews) and generative methods (such as brainstorming) to develop an understanding of user needs. User-centered design (UCD) was used to develop the nursing management information dashboard. In the first step, a research team consisting of relevant specialists including 3 head nurses, matron, supervisor, hospital director, hospital HIS officer and two academic staff members with research experience in the field of dashboard design were formed. The stages of identifying the problem, planning to solve the problem, implementing and evaluating the information dashboard design solution were implemented.

Results: The first stage of the study was held with the presence of a specialized team of 10 related specialists, and the capabilities of creating shifts for nurses, the possibility of providing reports such as the ratio of personnel to normal and special patients, determining the workload and the number and type of services provided were emphasized. Was. Information elements of input (characteristics and number of patients and nurses, etc.), process (number and type of services, etc.) and output (number of patients discharged, died, recovered, etc.) were defined for the dashboard. The design team developed the initial dashboard according to the capabilities and requirements set for the dashboard as well as the information elements needed by the users based on the Power BI Desktop software.

The dashboard is designed with reports separated by departments, based on the number of patient's level 1-5, nurses assigned to each patient during the treatment period, the ratio of patients to nurses and nurse assistants, the type and number of services provided to patients by nurses based on the service code, the number It provides nurses' shifts, supervisor's quality score, etc.

Conclusion: The dashboard designed in this study has the capability of reporting in the required formats of nursing management, as well as the ability to clarify the allocation of nurses to patients, which enables the evaluation of nurses' performance. Also, due to the capability of online and periodical reporting, it can be a good tool for hospital managers in the direction of human resources and resource management policies.

Keywords: dashboard, nursing management information, shift, evaluation, nurse

DxGenerator: An Improved Differential Diagnosis Generator for Primary Care based on MetaMap and Semantic Reasoning

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Background: In recent years, researchers have used many computerized interventions to reduce medical errors, the third cause of death in developed countries. One of such interventions is the use of differential diagnosis generators in primary care, where physicians may encounter initial symptoms without any diagnostic presuppositions. These systems generate multiple diagnoses, ranked by their likelihood; as such, the accuracy of these reports can be determined by the location of the correct diagnosis in the list.

Objective: This study aimed to design and evaluate a novel practical web-based differential diagnosis generator solution in primary care.

Methods: In this research, a new online clinical decision support system, called DxGenerator, was designed to improve diagnostic accuracy; to this end, an attempt was made to converge a semantic database with the unified medical language system (UMLS) knowledge base, using MetaMap tool and natural language processing (NLP). In this regard, 120 diseases of gastrointestinal organs, causing abdominal pain, were modeled into the database. After designing an inference engine and a pseudo-free-text interactive interface, 172 patient vignettes were inputted into DxGenerator and ISABEL, the most accurate similar system. The Wilcoxon signed ranked test was used to compare the position of correct diagnoses in DxGenerator and ISABEL. The alpha level was defined as 0.05.

Results: On a total of 172 vignettes, the mean and standard deviation of correct diagnosis positions improved from 4.2±5.3 in ISABEL to 3.2±3.9 in DxGenerator. This improvement was significant in the subgroup of uncommon diseases (P-value < 0.05).

Conclusion: Using UMLS knowledge base and MetaMap Tools can improve the accuracy of diagnostic systems in which terms are entered in a free text manner. Applying these new methods will help better accept medical diagnostic systems by the medical community.

Keywords: Differential Diagnosis, Clinical Decision Support Systems, UMLS, MetaMap, Natural Language Processing

The association between biochemical factors and type 2 diabetes: a machine learning approach

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Background: Several blood biomarkers have been related to the risk of type 2 diabetes mellitus (T2D); however, their predictive value has seldom been assessed using machine learning algorithms.

Method: This cohort study was conducted on 9650 participants recruited from the MAshhad Stroke and Heart Atherosclerotic disorders (MASHAD) study from 2010 to 2020. Individuals with previous T2D (Free Blood Sugar >126) were excluded. Serum levels of biochemical factors such as creatinine (Cr), high sensitivity C reactive protein (hs-CRP), Uric acid, alanine aminotransferase (ALT), aspartate aminotransferase (AST), direct and total bilirubin (BIL.D, BIL.T), lipid profile, besides body mass index (BMI), blood pressure, and age were evaluated through Logistic Regression (LR) and Decision Tree (DT) methods to develop a predicting model for T2D.

Results: The comparison between diabetic and non-diabetic participants represented higher levels of triglyceride (TG), LDL, cholesterol, ALT, BIL.D, and Uric acid in diabetic cases (p-value <0.05). The LR model indicated a significant association between TG, Uric acid, and hs-CRP, besides age, sex, BMI, and blood pressure, with T2D development. DT algorithm demonstrated Uric acid as the most determining factor in T2D prediction, followed by age and TG. Furthermore, it obtained a 3.1 mg/dl cut-off for Uric acid, so that Uric acid <3.1, Age >=47 and, TG >200 resulted in an 80% probability of developing T2D.

Conclusion: There was a significant association between triglyceride, Uric acid, and hs-CRP with T2D development, along with age, BMI, and blood pressure through the LR and DT methods.

Keywords: Biochemical factors, Type 2 diabetes, Machine learning, Decision Tree, Uric acid

AI dopped metaverse platform to develop avatar-based Schizophrenia personalized treatment

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Background and aims: As an expanding virtual reality, the metaverse is creating tremendous changes in all social structures. On the one hand, it has provided unprecedented challenges for universities and higher education, and on the other hand, it has presented unique opportunities for their growth and excellence. The degree of success in facing the challenges and making maximum use of the available capabilities depends on the way higher education managers face and interact with this virtual reality.

Although the future of Metaverse is still unclear for everyone, many prestigious universities and educational centers are trying not to miss the Metaverse train. They combine face-to-face and remote video training with technologies such as interactive virtual world gaming, virtual reality, and mixed reality. On the other hand, one of the new methods of treating schizophrenic patients is avatar therapy, the feature of this treatment method is the use of a person's face and adapting it and producing a voice to create a sense of hope and increase self-confidence for the patient.

Artificial intelligence technology in Metaverse enables you to overcome obstacles such as poor interactive quality and provide new services such as live virtual conferences.

Method: a 3 round delphi study is done to earn desired consensus.

Results: 23 indices 13 pros and 10 cons were gathered in case of AI apportunities in metaverse based avatar treatment

Conclusion: In the near future, with the construction of a 3D avatar computer, doctors will be able to test different treatment methods on a 3D model of the patient's body and then prescribe the best treatment for the person. The project of designing and building a 3D computer avatar is similar to Google Earth maps, which can provide doctors with an accurate map of the patient's physical condition and health. Professor "Alejandro Farangi", a researcher at the University of Sheffield, emphasizes: There is a lot of information about the medical history of people in different medical centers, and in emergency situations, the presence of this data can help the doctor to choose the appropriate treatment method or not to use a specific treatment. It seems that the advantages of this method outweigh the disadvantages.

Keywords: Metaverse, Avatar, Schizophrenia, artificial intelligence

Determining the accuracy of an artificial intelligence-based model to automate the screening phase of related studies in the systematic reviews and comparing it with existing models in terms of strengths and weaknesses

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Background and aims: Introduction: Systematic review and meta-analysis, which is often followed by it, form the cornerstone of evidence-based medicine. In recent years, artificial intelligence has made great progress, so that today the daily life of humans is tied to this technology. . Since the process of conducting a systematic review is very time-consuming and expensive, it is necessary to design a tool that can intelligently and automatically take over human tasks in this process. Students of Tabriz University of Medical Sciences in an interdisciplinary team have succeeded in designing a model based on artificial intelligence that can recognize articles related to the subject of the study and is used in the screening stage of studies in the process of a systematic review. The purpose of this study is to determine the accuracy of this system and compare it with other existing similar systems in terms of strengths and weaknesses.

Method: Search terms were received from the co-researchers. After searching with each of the terms, the results were saved in a file and sent to fellow researchers. After categorizing the articles by fellow researchers and the examined model, the results of the comparison and the accuracy of the model were calculated. Then, by referring to the BOX TOOL SR website, a search was made to find similar models, and the characteristics of each of the tools were extracted and then with The investigated model and other models were compared.

Results: After comparing the results of screening studies by humans (collaborating researchers) and the case model, it was calculated that Precision = 0.83, Recall = 0.98, and Accuracy = 0.94. One of which is the investigated model.

Conclusion: The reviewed model can help researchers with high accuracy without worrying about missing relevant studies in the systematic review process, and save their time and energy. This model is also equal to the best available similar tools in terms of weaknesses and strengths. Improving it and developing a tool of this model that researchers can easily use will accelerate the process of systematic review studies, which leads to the development of evidence-based medicine. Also, if it is possible to increase the precision of this model by maintaining a high recall, an important step has been taken towards achieving a live systematic review.

Keywords: systematic review, meta-analysis, artificial intelligence, automation, title and abstract screening

Introducing h-NFIs (Health Sector Non-Fungible Intelligence) to describe impact of artificial intelligence on non-fungible token in healthcare system.

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Background and aims: A non-fungible token (NFT) is a unique digital identifier that cannot be copied, replaced or divided and is recorded in a block chain and used to verify authenticity and ownership which is recorded on the blockchain and can be transferred by the owner, allowing NFTs to be sold and traded. Moreover, rapid developments in artificial intelligence have opened new potential in the form of Artificial intelligence non fungible token (AI NFT) will extend mimicking of human intelligence using algorithms and machine learning software to analysis, presentation, and understanding disease especially toward personalized and P7 medicine. One of the most promising applications of NFT in healthcare is in self-presentation of health data. With NFT, patients may track their data in real time and see how it is being used. Therefore, NFT guarantees the ownership of health data.

Method: Hypothesis of developing h-NFI by studying the investigations and measures that have been carried out in the field of NFT, AI and health and treatment, which have extracted articles from PubMed and Google Scholar.

Results: NFIs (non-fungible intelligence) or iNFTs can be the next step in the evolution of NFTs. By tokenizing artificial intelligence, it has attracted the attention of investors. Although non-fungible tokens are not widely used in healthcare the potential for tokens that represent anything unique is enormous, simply because any advanced combination of separate non-unique data is unique.

Conclusion: Artificial intelligence in the field of health has the ability to improve health care in the context of challenges in the field of ethical issues such as informed consent, bias, safety, transparency, patient privacy. It seems that presenting these data in a NFT, issued to each individual in a particular jurisdiction, is an efficient way to ensure de-identification of health data, to share hashed health data, own health data and participate in public health programs, as well as in research. Clinical. Tomorrow's digital healthcare infrastructure may rely on NFTs. However, there are several potential barriers to mass adoption of this technology in the near future, particularly in healthcare. As it stands, blockchain technology is quite inefficient and requires large amounts of energy for small transactions. This is mostly associated with significant greenhouse gas emissions that contribute to climate change. As such, NFTs may not be fully commercially viable in the near future. But alternatives to NFT mining are being developed that can use a fraction of the computing power available in their transactions.

Keywords: non-fungible token, NFT, health, treatment, artificial intelligence, AI, NFI

Effects of social media on vaccine hesitancy using artificial intelligence (AI): a systematic review

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Background and aims: Vaccines are the most efficient tool for preventing infectious diseases by providing actively acquired immunity. According to the World Health Organization (WHO), vaccine hesitancy is one of the major global issues. In the modern world, social media has a great effect on people's lives and decisions. There is a huge amount of information and even misinformation about vaccination on social media. Recently, artificial intelligence models have been used to evaluate conversations related to the vaccine on social media and classify them. In this systematic review, the effect of social media on vaccine hesitancy will be clarified.

Method: A comprehensive systematic literature search was conducted in electronic databases including PubMed, Scopus, Embase, and Google Scholar up to October 2022. The retrieved publications were evaluated by two independent authors. All studies that used AI models or algorithms to classify social media conversations related to vaccines were included. Any study that used AI and social media databases to extract adverse events was excluded. Studies that met our inclusion criteria were then critically appraised by two authors independently. Data from the studies that met our inclusion criteria was extracted using Excel.

Results: We retrieved 86 relevant publications from electronic databases. After a thorough examination of the titles and abstracts and the removal of duplicate publications (n = 35), 62 studies were eliminated. The full texts of twenty-four papers were reviewed, and seven studies ultimately met our inclusion criteria. In four of these studies, machine learning (ML) was used: deep learning (DL) in one, natural language processing (NLP) in another, and ensemble learning in one. Twitter was examined in six studies and Facebook in one.

Conclusion: Given the impact on people's desire for vaccination, vaccine information can be extremely important. Using artificial intelligence to classify social media comments about vaccines in a new era Minor changes are required for AI models to completely evaluate the effect of social media on vaccine hesitancy.

Keywords: artificial intelligence, social media, vaccine, vaccine hesitancy

A review of the implementation of a medication decision support system to improve patients' drug usage evaluation

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Background and aims: Drug usage evaluation is a criteria-based ongoing evaluation program that helps us to ensure appropriate medication use in hospitals and clinics. Many strategies can improve medication use, including educational programs, standard treatment guidelines, information technology interventions, and other management activities and monitoring programs. This study investigates medication decision support systems as computer-based systems to support physicians in drug prescription decision-making for patient care.

Method: The data were collected by searching PubMed, Scopus, Google Scholar, and Embase databases. The searched keywords were: "drug usage evaluation" "medication use" "medication decision support" "drug prescription" "hospital information system" and "electronic health file". The search was limited to studies in the English language. Review articles, duplicate publications, and non-relevant articles were excluded.

Results: Medication decision support systems are of specific importance in changing behavior and increasing physician adherence in drug management using drug therapy guidelines. In particular, medication decision support systems can provide clinicians with patient-specific assessments and treatment recommendations immediately at the time of bedside decision-making for drug prescriptions. In addition to the fact that they have effectively shown an increase in adherence to clinical guidelines, by knowing the patient's past medical history as well as the patient's current clinical condition, the medication decision support system can guide treatment along with electronic health records, hospital information system, and drug usage evaluation system.

Conclusion: A medication decision support tool and the drug usage evaluation system can improve the drug administration process according to the current standards of care. It is also helpful in implementing drug therapy guidelines for appropriately using drugs and controlling drug therapy costs.

Keywords: Drug usage evaluation, Medication decision support, Hospital information system, Electronic health file

Current State of Federated Learning in Cardiology: A Narrative Review

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Background and aims: Artificial intelligence (AI) has become increasingly important in the medical industry, including cardiology. Federated learning (FL) is a promising approach for creating AI models in cardiology that allows access to a diverse set of patient data while simultaneously addressing privacy concerns. This narrative review aims to present a summary of the current status of FL in cardiology.

Method: We searched Google Scholar to find papers on the use of federated learning in cardiology. Relevant articles were selected and summarized, showcasing current use cases of FL in cardiovascular medicine.

Results: Federated learning has been employed in cardiology for several applications, including but not limited to arrhythmia classification, cardiac disease prediction, and image segmentation.

Multiple studies have demonstrated the efficacy of federated learning in ECG data analysis, including arrhythmia classification and cardiac disease prediction. For instance, one study examined the performance and effectiveness of FL using three benchmark datasets, one of which was the PhysioNet ECG dataset. The researchers carried out federated experiments on balanced and imbalanced data between clients. In both cases, they achieved an F1-score of 0.807. Furthermore, they noted that the performance of FL and centralized learning were not significantly different. In other studies, FL has been used for the multi-label, multi-class classification of ECG data that is heterogeneously distributed; researchers proposed several FL scenarios for this purpose.

In the field of cardio-imaging, several studies have demonstrated the effectiveness of FL for image segmentation and diagnosis of heart conditions. For example, one study incorporated different priors to the model by leveraging ground truth masks to improve performance for deep learning-based multi-center cardiovascular magnetic resonance diagnosis. They experimented with diverse data augmentations followed by different convolutional neural network settings to assess model robustness. They also studied a federated learning algorithm with equal votes assigned to every training center. In their study, federated learning achieved comparable results with traditional centralized learning.

Other studies have investigated the use of FL in cardiology for different tasks like predicting coronary artery calcification scores, risk stratification of diseases such as ischemic heart disease, and binary supervised classification model based on EHR data for predicting hospitalizations due to cardiac events. The studies have consistently reported similar performance results for the distributed and centralized methods, further indicating that FL has potential as an alternative approach to analyzing cardiology data.

Conclusion: Federated learning is a relatively new approach to developing more robust AI models by enabling access to diverse patient data repositories while addressing privacy concerns. It eliminates the need for centralizing the data and allows multiple parties to share their local data without exchanging it. The studies we reviewed demonstrated the effectiveness of FL in various cardiology applications, such as arrhythmia classification, cardiac disease prediction, image segmentation, and risk stratification of diseases like ischemic heart disease. Notably, current applications of FL in cardiology have primarily focused on ECG datasets and cardio-imaging. The results

consistently indicate that FL performs similarly to traditional centralized learning, highlighting its potential as a collaborative approach for analyzing cardiology data on a larger scale. The current state of FL in cardiology represents a noteworthy advancement in the field that offers new pathways to explore novel solutions for improving patient outcomes.

Keywords: Federated learning, Cardiology, Artificial intelligence, Patient data privacy, Collaborative data analysis

The clinical information and graphical representation of chronic kidney diseases

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Background and aims: The most Important function of the kidneys is to remove waste products and excess water from the blood and Loss of kidney function leads to various health issues, such as anemia, high blood pressure, bone disease, disorders of cholesterol. This systematic literature review aims to investigate the frontiers of the current research in graphical representation of chronic kidney diseases and processing patient data.

Method: Traditionally, a confounder is defined by three criteria. First, it must have an association with the outcome, meaning that it should be a risk factor for the outcome. Second, it must be associated with the exposure. Last, it must not be in the causal path from exposure to outcome, thus not be a consequence of the exposure.

Results: Using these criteria, age classifies as a confounder in the relationship between chronic kidney diseases and mortality. In the general population, people with chronic kidney diseases are on average older than people without chronic kidney diseases. Among elderly subjects, the risk of mortality is also higher.

Conclusion: Directed acyclic graphs provide an extension and a more formal method than the traditional method for detecting turbulence. Therefore, directed acyclic diagrams can contribute to this debate among clinicians and researchers by providing a visual representation for discussing causal research questions by clarifying underlying assumptions about causal mechanisms.

Keywords: Graphical representation, Renal failure, Clinical information.

Optimized Searches in Genetic Identification: A System of Artificial Intelligence for Forensic Medicine

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Background and aims: Y chromosome-specific markers are used in genetic testing and solving criminal cases. These markers are used explicitly in forensic genetics to identify unknown people or unknown criminals. Currently, there is no automatic search method to detect the genetic identity of people in the country. In case of absence or no access to the haplotype of the paternal sample, it will not be possible to search and identify the person or even his life range. Therefore, the design and development of an artificial intelligence system based on an Iranian haplotype dataset with the ability to perform automatic and optimal searches could be used as an effective solution in the search process for genetic identification. This research aims to design and develop a forensic user interface, which has better performance than the currently available process to search for genetic identification and can be easily adapted to forensic medicine laboratories.

Method: The strategy of the design of this artificial intelligence system is based on machine learning techniques on 1500 Y Short Tandem Repeats (YSTRs) samples, which leads to the development of a forensic prediction model for the analysis of Y Short Tandem Repeats markers. This artificial intelligence system was then implemented in a user interface. This user interface is web-based software based on 17 Y STRs Loci.

Result: In this artificial intelligence system, the search process to find the nearest geographical area of the person's residence is prioritized according to the highest score determined by the prediction model and suggest to the geneticist. The search pattern of the assumed prediction model is based on the fact that "through haplogroups, there is a relationship between haplotype samples and the geographical area where people live."

Conclusion: The forensic medicine laboratory can use this user interface as a search filter to identify people's genetic identities. Hence, we will have a second referral system based on an artificial intelligence system, which provides the capability of accurate and optimal searches in the shortest possible time for a geneticist. Therefore, the implementation of machine learning methods to design this system, in addition to automating the process of identifying genetic identity in the country, will lead to limiting the search circle and identifying the genetic identity of people in a shorter period with higher accuracy. A person's genetic identity will be limited to a specific geographical region instead of the whole of Iran. Considering that the mentioned user interface is designed based on haplotype samples from different regions of Iran, this system is localized to Iran and is unique, which can be designed and developed according to the haplotypes of any geographical region.

Keywords: artificial intelligence system, User Interface, forensic genetics, genetics identification, haplotype

The Impact of Online Training in Positive Thinking Skills on Social Adjustment and Alexithymia in students with major depression

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Background: Alexithymia and social adjustment are among the problems which students with major depression encounter. Teaching positive thinking skills has been considered a therapeutic technique for decreasing anxiety and depression and increasing life satisfaction, psychological health, hope, and happiness of people. Therefore, this study aimed to determine whether online teaching of positive thinking skills would improve social adjustment and alexithymia in Students with major depression.

Methods: The present study was semi-experimental in terms of research methods, and an applied one in terms of the research objective. It was performed as a pre-test, post-test study on two experimental and control groups from April to June 2021. The research population consisted of all Students with major depression who referred to counseling offices in Shiraz. Out of the research overall population, a total of 60 Students with major depression were selected as the research sample. They were randomly divided into two experimental and control groups, each with 30 Students with major depression. The former received teaching in positivity as an intervention through online teaching, whereas the latter received no intervention. The data collection tools for this study were Sinha & Singh's Adjustment Inventory for School Students (AISS) (1993), Toronto Alexithymia Scale (TAS-20) (1994), and positive thinking skills framework by Seligman, Steen, Park, and Peterson (2005). Statistical analysis was performed using SPSS software, version 23. A p-value less than 0.05 was considered to be statistically significant.

Results: The mean± SD in the pre- and post-test in the control group for adjustment were 12.41±3.31 and 12.56±3.29, respectively, and those of the experiment group for social adjustment were 12.45±2.13, and 14.79±2.71, respectively. The mean± SD in the pre- and post-test in the control group for Alexithymia were 16.40±1.81, 16.44±3.31, and those of the experiment group for Alexithymia were 16.20±3.71, 20.60 ±2.42. The results showed that teaching positive thinking skill was effective in social adjustment in Students with major depression (P=0.003). Teaching positive thinking skills was also found to have a significant effect on alexithymia in Students with major depression (P=0.005).

Conclusion: Online teaching of positive thinking skills was shown to make a great contribution to Students with major depression ' social adjustment and alexithymia.

Keywords: Positive Thinking, Social Adjustment, Alexithymia, Online Learning, Students Depression

Detection of major structural Chromosomal Abnormalities in human Karyotypes using Convolutional Neural Networks

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Background and aims: Chromosomal abnormalities are the prevalent cause of various types of genetic disorders, which can result in serious health problems. Identification of structural chromosomal abnormalities with high accuracy is essential for proper diagnosis and therapy. Therefore, it was aimed to create a machine learning model employing convolutional neural network (CNN) algorithms that can accurately identify major structural chromosomal anomalies in karyotype images.

Method: 8460 karyotype images were obtained from the "bioimlab" and "CIR-Net" GitHub repositories. The obtained images were then split into the train, test, and validation sets to ensure that the model was trained on a diverse range of data and could accurately generalize to new and unseen images. The train set consisted of 70% of the total images, while the remaining 30% were split equally between the test and validation sets. Images were then preprocessed to remove any noise, standardize size and contrast, and enhance features using various image processing techniques. Once preprocessed, the images were fed into the CNN architecture for chromosome classification. The CNN model was developed in the Python programming language using the PyTorch library, and finally, its performance was evaluated with a variety of measures, such as accuracy, precision, recall, and F1-score.

Results: The analysis showed that the CNN model was able to identify major structural chromosomal abnormalities in images from both the test and validation sets, with great precision and recall rates.

Conclusion: Present study demonstrated that the application of CNN algorithms in medical image analysis has the potential to enhance diagnostic precision and reduce the time and expense of manual analysis. Further studies are warranted to examine its potential in minor structural chromosomal abnormalities with high resolution.

Keywords: deep learning, chromosomal abnormalities, convolutional neural networks, medical image analysis

Artificial Intelligence and Machine Learning in Orthopedic Imaging: Definition, and Applications

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ABSTRACT

Background and aims: Artificial intelligence (AI) derives rules and patterns from data to calculate the probabilities of various outcomes. Furthermore, each of the currently utilized radiological procedures has resulted in a large amount of medical imaging data, which could be used by machine learning (ML). So, AI can be applied primarily to image-recognition diagnostic tasks and evaluating the probabilities of particular outcomes after treatment. In this review, the main applications of AI and ML in orthopedic imaging will be discussed and categorized by lesion and algorithms.

Method: This study is a narrative review of published articles in the field of AI and ML applications in orthopedic imaging. To obtain the resources, the keywords of "orthopedic imaging", "artificial intelligence" and "machine learning" were used in databases such as Google Scholar, Science Direct, PubMed, Wiley, and so forth.

Results: In orthopedics, image analysis can be subjective and highly dependent on reviewer expertise. ML methods have been developed to facilitate clinical decision-making. For instance, one study reported an increase in specificity in detecting anterior cruciate ligament tears from MRI when experienced physicians were provided with the ML model's prediction during medical imaging interpretation. ML does multiple tasks that aid in image analysis, with the most commonly used tasks being detection, classification, and segmentation. In image detection, one or more objects (such as an anatomical landmark) are localized spatially or temporally. Localization of specific anatomic landmarks could facilitate surgical planning, and the algorithm can also be integrated with other ML tasks, such as a preprocessing step for both classification and segmentation.

Conclusion: In recent years, there has been considerable growth in ML applications for the analysis of orthopedic images and this methodology appears to be a promising tool for the healthcare industry. Although AI in medicine is a rapidly growing field that shows promising results, clinical implementation is still lacking. Finding a clear structure for study design and the implementation of data sharing, as well as the regular use of external validation should be aimed for, to drive progress forward.

Keywords: Orthopedic Imaging, Artificial Intelligence, Machine Learning

Development and evaluation of a deep learning model to improve the usability of polyp detection systems during interventions

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Since the introduction of commercially available AI-systems for colorectal polyp detection, the use of these promising systems in daily practice is increasing. The great potential of AI-systems is currently in the field of diagnostics, as CADe systems support the examiner in real time and with high sensitivity.

Our novel AI system detects inserted instruments with high sensitivity and specificity. Therefore, the system can capture the time frame of an endoscopic intervention with high accuracy. This would enable the suppression of the CADe signal for the duration of the intervention to focus the investigator's concentration on the intervention. The suppression relates not only to false positive detections but instead to all CADe detections during an intervention that do not add value to the endoscopic image. The requirements for such a tool detection system are very high, as suppression of the CADe signal outside of an intervention (false positive instrument detection) may increase the risk of missing other visible polyps. Our study shows that our new AI system achieves a very high specificity, which is sufficient for this purpose. To obtain this high specificity, our system was trained with a large number of images from multiple centers using different endoscopy processors. The number of training images we used is comparable to the number used in development of other CADe systems. In addition, the optimized algorithm presents only a short delay of 467 ms, that allows for the real-time use in combination with a CADe system.

Since the sensitivity of our AI system is in a high range, the instruments introduced were missed in only a few frames during an intervention. This applies in particular to the insertion and removal of an instrument where only a small portion of it is visible at the edge of the endoscopic view. Once the instrument is in the normal working position, it is quickly and reliably detected by the AI system. Thus, the crucial part of the intervention is captured by our instrument detection system. However, a problem with instrument detection arises when an instrument is pressed so firmly into the mucosa that it is barely visible. In this situation, the instrument recognition works accordingly worse. Nevertheless, our video analysis showed that the new AI system significantly reduced the number of false-positive CADe detections during an endoscopic intervention. While many publications on AI systems only use short, specially selected video sequences in the evaluation phase, our system was tested on full-length colonoscopy, which brings the results much closer to the real examination situation.

Interestingly, the commercially available CADe system seems to generate more detections when a snare is used in comparison to a grasper. There might be different explanations for this phenomenon. Artificial intelligence (AI) for colonic polyp detection is the most important application of this new technology in gastrointestinal endoscopy to date. Efficiency and functionality of these computer-aided detection (CADe) systems have been demonstrated in several randomized trials.

However, CADe systems also show many false positive (FP) detections. These false markings can affect the examiner's concentration. If a false detection occurs in addition to a relevant finding, the examiner's attention may be distracted, leadin to missed findings in the worst case.

Therefore, the aim of the current topic was to develop and evaluate an AI system that reliably detects introduced instruments in order to disable the CADe system during an intervention and avoid distracting detections.

Use of deep learning-based algorithms to detect keratoconus changes in the color-coded corneal maps

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Background and aims: The use of artificial intelligence techniques developed from deep learning (DL) based algorithms has increased significantly in recent years. Early and accurate detection of keratoconus provides opportunities to address risk factors and offer treatments to potentially slow its progression. One of the suitable neural networks for recognizing and classifying images in keratoconus is the convolutional neural networks (CNN) technique. For this purpose, the present study aimed to develop a CNN model for the automatic detection of keratoconus using standard color-coded corneal maps (curvature, elevation, and pachymetry maps) obtained by the Scheimpflug corneal imaging technique.

Method: This multicenter retrospective study included corneal maps of keratoconic and healthy subjects. The corneal tomographic maps considered for each scan were the axial curvature map, the anterior and posterior elevation map, and the pachymetry map obtained using the Pentacam HR (Oculus Optikgeräte, Wetzlar, Germany). Keratoconus eyes were classified into four stages based on the Amsler-Krumeich grading system. All scans were categorized into five different classification tasks: healthy versus keratoconus, healthy versus keratoconus stage 1, keratoconus stage 1 versus 2, keratoconus stage 2 versus 3, and 5-class classification between healthy and each stage of keratoconus. Considering that each of the four maps contained numerous parameters to detect keratoconus, four CNN models were trained with one for each corneal map. A fifth model was added which used a concatenation of four corneal maps. Various classification models were implemented using Python V.3.7, Keras V.2.3.1 and Tensorflow V.1.14 as backend, and all models were trained by using the Adam optimizer. Accuracy, sensitivity, specificity and area under the receiver operating characteristic curve were used to assess the diagnostic ability of each model.

Results: 1926 corneal tomography scans including 1702 patients with keratoconus and 134 healthy controls were assessed. A CNN model detected keratoconus versus normal eyes with an accuracy of 0.9785 (95% CI: 0.9642 to 0.9928), considering all four maps concatenated. The accuracy of the CNN models considering the axial curvature map, pachymetry map, anterior and posterior elevation maps were independently 0.9283, 0.9642, 0.9642, and 0.9749, respectively. The accuracy of concatenated CNN models in differentiating between healthy corneas and keratoconus stage 1 was 0.90, between keratoconus stages 1 versus 2, keratoconus stages 2 versus 3 was 0.9032, and 0.8537, respectively.

Conclusion: Accurate automated detection of keratoconus and its evolution is possible using a CNN based on four color-coded corneal map images obtained by the Scheimflug technique. CNN models provide excellent performance for the detection and staging of keratoconus in a clinical setting, as precise detection of keratoconus at early stages is still challenging in daily practice.

Keywords: keratoconus, artificial intelligence, deep learning, corneal tomography.

Deep learning for early detection of osteopenia and osteoporosis in lumbar vertebrae based on T1-weighted lumbar MRI

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Background and aims: Osteoporosis and osteopenia are conditions characterized by a decrease in bone density, leading to an increased risk of fractures. These conditions affect millions of individuals worldwide and are associated with significant morbidity and mortality. Early detection and diagnosis are crucial for the effective management of these conditions. The aim of this study was to explore the potential of deep learning in detecting osteopenia and osteoporosis in lumbar vertebrae based on lumbar MRIs .

Methods:190 women with an average age of 60.30 (SD = 9.96) were selected. All subjects had sagittal T1-weighted spin-echo lumbar MRIs and bone mineral density examinations done by the DEXA method. Based on the WHO classification of DEXA reports, 65 subjects were normal while 77 and 48 subjects had osteopenia and osteoporosis, respectively. Five slices were selected from each T1 sequence, resulting in a total of 950 slices. Of these, 850 were used for training, 50 for validation, and 50 for testing. A Densenet121 neural network pre-trained on the Imagenet1K dataset was used as a base model for training on the dataset.

Results: The precision, recall, and f1-score for the normal population were 0.7895, 0.7500, and 0.7692 respectively. For those with osteopenia, the corresponding scores were 0.6957, 0.8000, and 0.7442 respectively while for those with osteoporosis, they were 1.0000, 0.8000, and 0.8889 respectively. The overall accuracy of the model was found to be at a rate of about .7800 while the MCC was calculated to be at about .6549.

Conclusion: In conclusion, this study demonstrated the potential of using deep learning and neural networks to identify osteopenia or osteoporosis in patients based on lumbar MRIs. The results suggest that this technology could improve diagnosis and treatment decisions in clinical practice. However, further research and the collection of more data are needed to fully explore its potential.

Keywords: deep learning, osteopenia, osteoporosis, lumbar MRI, diagnosis, neural networks

Using optimized artificial intelligence to integrate Scheimpflug-based corneal tomographic and biomechanical data to enhance ectasia risk detection

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Background and aims: Corneal ectasia risk assessment among elective refractive surgery candidates has evolved to describe the cornea's inherent susceptibility to biomechanical compensation and ectasia progression. The present study was designed to optimize artificial intelligence (AI) algorithms to integrate corneal tomography and biomechanical data extracted based on the Scheimpflug imaging technique and enhance the diagnosis of ectasia.

Method: This cross-sectional, multicenter, case-control retrospective study included corneal data from 3,886 eyes of 3,412 patients without a history of corneal surgery. Corneal assessment was performed using Pentacam and Corvis ST (Oculus Optikgeräte GmbH; Wetzlar, Germany). One eye was randomly chosen from 1,680 normal subjects (N) and 1,181 patients with bilateral keratoconus (KC). In addition, 551 eyes with normal placido-disk based corneal topography from patients with very asymmetric ectasia (VAE-NT), and their 474 ectatic eyes without prior corneal interventions (VAE-E) were included. The current TBIv1 (tomographic biomechanical index) was tested and an optimized AI algorithm was developed to increase the diagnostic accuracy of ectasia.

Results: The diagnostic ability of the TBIv1 expressed by the area under the receiver operating characteristic curve (AUC) to differentiate clinical ectasia (KC and VAE-E) and VAE-NT was 0.999 (with a sensitivity of 98.5%; 98.6% specificity for a cut-off value of 0.5) and 0.899 (with a sensitivity of 76%; 89.1% specificity for a cut-off value of 0.29), respectively. A novel random forest algorithm (TBIv2 or BrAIN-TBI), developed with 18 features in 156 trees using 10-fold cross-validation, had a significantly higher AUC compared to TBIv1 (0.945 versus 0.899, $p<0.0001$) for detecting VAE-NT (with a sensitivity & specificity of 84.4% & 90.1%, for a cut-off value of 0.43), and similar AUC for clinical ectasia (0.999, $p= 0.818$; with a sensitivity & specificity of 98.7% & 99.2%, for a cut-off point of 0.8). TBIv2 had a statistically higher AUC than TBIv1 when all cases were considered (0.985 versus 0.974, $p< 0.0001$).

Conclusion: Accuracy for ectasia detection is improved by AI integration of Scheimpflug-based corneal tomography and biomechanical assessments, which characterize ectasia susceptibility in the varied VAE-NT group. True unilateral ectasia may occur in some VAE patients. Accuracy will be continuously improved by machine learning when taking additional information into account, such as epithelial thickness or other indices from multimodal refractive imaging.

Keywords: artificial intelligence, corneal biomechanics, corneal ectasia, keratoconus, corneal tomography, Scheimpflug imaging.

Artificial intelligence; Its history, applications and novelty in medicine

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Artificial intelligence (AI) has the potential to revolutionize the field of medicine by enabling healthcare providers to make faster, more accurate diagnoses and treatments. Here are a few examples of the latest AI innovations in medicine: Medical image analysis, Precision medicine, Virtual nursing assistants, Drug discovery, Robotic surgery, Predictive Analytics, and Natural language processing. These are just a few examples of the many ways AI is being used to improve healthcare. As AI technology continues to advance, it is likely that we will see even more innovative applications in the field of medicine.

Method for research in AI: There are several methods for conducting research in artificial intelligence (AI) in medicine. Here are a few examples: Supervised learning, Unsupervised learning, Reinforcement learning, Transfer learning, Deep learning, and Development and validation of artificial intelligence models.

Development and validation of artificial intelligence models is one of the important ways to conduct research in the field of artificial intelligence (AI) in medicine. Here are some key steps in this method: Data collection and preparation, Feature extraction, Model selection and training, Model evaluation, and validation, Clinical validation and deployment, and, Ethical considerations. By following these steps, researchers can develop and validate AI models that can assist healthcare providers in making faster, more accurate diagnoses and treatments.

Background and aims: Artificial intelligence has the potential to revolutionize medicine in numerous ways, from improving the accuracy of diagnoses and treatments to enabling more personalized care. Here are some of the key results and advances in the field of AI in medicine such as Medical image analysis, Drug discovery, Personalized medicine, Medical chatbots, and Electronic health records.

Results: AI-powered tools are being developed to aid in disease diagnosis, drug development, personalized treatment, and patient monitoring. These tools can potentially improve the accuracy and speed of diagnoses, reduce errors and variability in treatment, and ultimately improve patient outcomes. However, challenges such as data quality, regulatory barriers, and ethical considerations must be addressed to ensure that AI is integrated safely and effectively into clinical practice.

Conclusion: Overall, AI has the potential to transform many aspects of medicine, from diagnosis and treatment to drug discovery and patient care. However, there are still challenges to overcome, including data privacy concerns, algorithm bias, and regulatory issues. The field of AI in medicine is rapidly advancing and holds promise for transforming the future of healthcare.

Keywords: artificial intelligence, medicine, Machine learning, Deep learning.

Smart solutions in the medicine

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Smart solutions have revolutionized the field of medicine by offering new ways to improve patient care and outcomes. These solutions leverage advanced technologies such as artificial intelligence, the Internet of Things, and big data analytics to enhance the diagnosis, treatment, and monitoring of various medical conditions. For instance, Artificial intelligence-powered diagnostic tools can analyze medical images, detect abnormalities, and provide accurate diagnoses, while IoT-enabled devices can monitor patient vital signs and provide real-time feedback to healthcare providers. Additionally, big data analytics can help healthcare organizations make informed decisions by analyzing vast amounts of data from various sources such as electronic health records, clinical trials, and patient feedback. These smart solutions have the potential to transform the way healthcare is delivered, making it more personalized, efficient, and effective, ultimately improving patient outcomes and quality of life.

Material and methods: The development of smart solutions in medicine requires a multi-disciplinary approach that involves collaboration between medical professionals, data scientists, software engineers, and other experts. The following steps provide a general framework for developing smart solutions in medicine: Identify the problem, Review the literature, Gather and analyze data, develop a hypothesis, Design the smart solution, Conduct the experiment, Evaluate the results, Publish and disseminate your findings, and continuously improve the solution.

Background and aims: In recent years, there has been a growing interest in the development and implementation of smart solutions in the field of medicine. Smart solutions refer to technology-driven innovations that can help healthcare providers deliver better patient care, improve health outcomes, and streamline healthcare delivery. The aim of smart solutions in medicine is to harness the power of technology to improve healthcare delivery and make it more patient-centered, and more efficient. Some examples of smart solutions in medicine include Electronic Health Records, Telemedicine, Artificial Intelligence, Wearable technology, Medical Robots, and Predictive Analytics.

Result: Generally, the aim of smart solutions in medicine is to improve healthcare delivery, reduce costs, and improve patient outcomes by leveraging the power of technology.

Conclusion: Overall, smart solutions in medicine have the potential to greatly improve patient outcomes and increase access to healthcare. However, there are also concerns around privacy, data security, and the potential for technology to replace human interaction in healthcare.

Keywords: “Smart solutions”, “medicine”,” artificial intelligence”, “internet of things”

An overview of artificial intelligence-based drug toxicity prediction tools

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Background and aims: In the drug manufacturing field, unexpected toxicities are a major cause of attrition during clinical trials and post-marketing safety concerns cause unnecessary morbidity and mortality. However, animal model-based toxicity predictions have been demonstrated to agree only 43% and 63% of the time in rodents and non-rodents, respectively, when extrapolated to humans, and less than 30% when it comes to predicting adverse drug reactions (ADRs) in the target organs. Therefore, the elimination of potential new drugs based on toxicological safety studies, conventionally based on animal models, is controversial. Pharmacovigilance (the science that monitors, detects and prevents ADRs) is increasing its efforts to develop in silico models, taking advantage of the large amount of recently available data that present a great opportunity for the use of techniques based on artificial intelligence, neural networks and deep learning current models. The most representative and recent examples of the application of AI techniques to determine the toxicological properties of new drugs are discussed in this article.

Method: This study is a review of published articles since 2012 in the field of artificial intelligence and toxicity in drug discovery. In order to collect the articles, the keywords of "Drug discovery", "Toxicity", "Artificial intelligence", "Deep learning" and "Machine learning" were used in databases such as Google Scholar, Science Direct, PubMed and etc. The criterion for the approval and review of the articles was the use or introduction of the latest methods based on artificial intelligence, machine learning and deep learning in the field of drug toxicity detection. Also, open source databases with molecular or pharmaceutical information like DrugBank, ChEMBL, PubChem and SIDER have been used for more detailed investigations.

Results: The classification of the best and most representative methods based on artificial intelligence, neural networks, machine learning and deep learning has been performed in the prediction of specific toxicities such as drug-induced liver injury, skin sensitization, cardiotoxicity, chemical carcinogenesis, cytotoxic effect, seizures, hemolytic toxicity, plasma protein binding, phototoxicity and neurotoxicity. The presented methods and models for predicting drug toxicity in each organ were compared in terms of specificity, accuracy, and sensitivity. The models and methods examined in this study include a variety of models such as Bayesian, Support Vector Machine (SVM), Bernoulli Naive Bayes, AdaBoost decision trees, Random Forest (RF), etc. Also, as far as possible, the number of data used for each study has been indicated, and where a study has used the available common databases, the source of the data has been reported.

Conclusion: Recurring differences between in vitro data and in vivo results in clinical trials or post-marketing phases of drug development present an opportunity for AI-based computational strategies to come to the fore. However, the breadth of this range and the available data can lead to some confusion when choosing an appropriate tool. Having a reliable source of available tools in this field makes it possible to find and use the most accurate and efficient tools under development for measuring drug toxicity, according to the capabilities and accuracy of the tools available.

Keywords: artificial intelligence, drug discovery, toxicity, deep learning, machine learning

The smart diagnostic,therapeutic and educational device for traditional chinese medicine:A protocol study for an invention based on AI

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Background: Traditional Chinese medicine (TCM) has been practiced in China for more than 3000 years and is widely used around the whole world nowadays. TCM exhibits significant efficacy against many diseases. The TCM therapist starts the diagnosis process by determining the patient's disharmony pattern with takes a medical history and examination, including checking the pulse and observing the tongue and sometimes the iris and etc. Then performs the treatment with various methods such as herbal therapy, acupuncture, tai chi, diet, acupressure and etc. Today, artificial intelligence(AI) has greatly contributed to the advancement of medicine. I expect that this smart device will achieve its diagnostic, therapeutic and educational goals with the help of AI.

Methods: This smart device's main parts include a pulse analysis sensor, a camera for tongue and iris analysis, a scanner and a cpu. First it takes a complete history of the patient with a standard questionnaire. Then the received data of all part of device is matched with the database defined for the device and then disharmony of the patient will be determined based on the concepts of TCM. The attention mechanism aggregation module scores contribution of each symptom to syndrome classification in a feature integration matrix by adopting an attention mechanism with an annealing coefficient by means of features of all symptoms and features of interaction information among the symptoms, and selects the symptoms with scores higher than a score threshold to form a symptom group for syndrome classification diagnosis. According to the method, the most representative symptom group is selected for each type of syndromes. The treatment will be provided to the patient in the form of a text file for diet and herbal therapy and videos for tai chi and acupressure. For acupuncture treatment with the help of the intelligent voice assistant, by placing the scanner of the device in a suitable position of the patient's body, the desired points will be identified with the anatomical landmarks and will be needeled by the device automatically. The possibility of electro acupuncture and needle manipulation will be available.

Discussion: None of the diagnostic methods of TCM are complete alone, also the different perception of different therapists on the numerous diagnostic criteria of Chinese medicine causes differences in the quality of diagnosis and treatment. A validation study in 2022 done by Tianyong Hao and colleagues in china entitled "Artificial Intelligence–Based Traditional Chinese Medicine Assistive Diagnostic System" which is just based on Patient history. The difference of this research with my plan is that in addition to the history of the patient, my device performs the diagnosis process by analyzing the pulse, tongue and iris, and then performs the treatment automatically with the help of its voice assistant. Reducing the diagnosis cost, will decrease Financial burden. Definitely, this smart device will be very useful for the educational use for Chinese medicine students due to its full coverage of the diagnosis and treatment process.

Keywords: traditional Chinese medicine, artificial intelligence, acupuncture, smart device

A machine learning-based framework for the diagnosis and grading of non-alcoholic fatty liver disease using anthropometric features

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Background and aims: Non-alcoholic fatty liver disease (NAFLD) is a kind of accumulation of fat in liver cells, which if not controlled, goes through a cirrhosis process towards fibrosis of liver tissue and cell destruction. In recent years, the prevalence of NAFLD has increased. Therefore, the creation of a simple and low-cost method to classify NAFLD patients in the population is needed. The aim of this study is to diagnose fatty liver and distinguish grades of fatty liver using different machine learning models, which can be used for accurate screening of a large number of people.

Method: For this purpose, the anthropometric features of 651 people over the age of 18 without a history of continuous alcohol consumption and underlying liver disease in two southern and eastern provinces of Iran, 278 women and 373 men with a mean age of 37.46 years, were recorded. 361 subjects without fatty liver, 290 subjects had different grades of fatty liver. Different machine learning algorithms such as Support Vector Machine, k-Nearest Neighbor, Random Forest, Logistic Regression, Naive Bayes, and Multilayer Perceptron Neural Network were used to detect fatty liver and determine the grade of fatty liver. 520 subjects were used to train the models and 131 subjects were used to test the models. To evaluate and compare the performance of the created models, accuracy, precision, recall and f1-score criteria were calculated.

Results: Six models based on machine learning were developed and showed good performance in predicting NAFLD. Among these models, the random forest method and the number of 20 decision trees showed the best performance with accuracy 99.2%, precision 98%, recall 100%, and f1score 99%. To detect fatty liver grade, the support vector machine algorithm with linear kernel function and gamma parameter equal to 0.001 and c parameter equal to 5 with 95% accuracy had the best performance compared to other methods.

Conclusion: Machine learning classifiers can help in the medical field to achieve early detection and classification of NAFLD. The proposed models can achieve high accuracy without relying on laboratory measurement parameters, especially in areas with poor financial situations and high epidemiology.

Keywords: Non-Alcoholic Fatty Liver Disease (NAFLD), anthropometry, machine learning, artificial neural network, predictive models

Developing a COVID-19 mortality prediction model for hospitalized patients using machine learning methods

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Background: As healthcare professionals become more adept at making informed decisions, Artificial Intelligence (AI) is gaining much attention. Using machine learning, as one of AI's most active fields, may improve diagnostic accuracy and speed up decision-making. Machine learning methods could detect unnoticed patterns in laboratory data and patient demographic information to assess the patient for mortality risk. We strived to develop machine learning models that can predict whether a patient is at high risk for mortality and whether they require critical care.

Methods: This cross-sectional study used the laboratory and demographic data of 2178 hospitalized COVID-19 patients from 18 provinces from February 2020 to March 2021 to develop a mortality risk assessment model. Data were preprocessed, cleansed, and important features were selected. Sampling with replacement was done in order to have equivalent groups. Data imputation was also done to replace the remaining missing values, and the data was subsequently randomly split into train and test groups with proportions of 20% and 80%. 5-fold cross-validation using models including Random Forest, Support Vector Machine, Decision Tree, Neural Network, Naïve Baysian, and XGBoost was conducted. They were then evaluated and compared.

Results: The train and test sets included 2034 and 494 samples, respectively. Ten features with the highest importance values were selected: age, gender, hypertension, BUN, creatinine, WBC, PMN, RBC, hemoglobin, platelet, ESR, Sodium, and AST. The reported accuracy for the Random Forest, SVM, Decision Tree, Neural Network, Naïve Bayes, and XGBoost were 0.917, 0.8077, 0.834, 0.500, 0.7389, and 0.8806, respectively. Random Forest model 5-fold reported the best accuracy with 0.917 (95% CI of 0.8891, 0.9398); model sensitivity and specificity were 0.9153 and 0.9187, respectively. The recall was 0.9190, a negative predictive value of 0.9150 was reported, and a ROC diagram was drawn.

Conclusion: The Random Forest model showed satisfactory results. During an unprecedented pandemic, despite the flawed data collection systems and many biases that may be introduced to the data, our findings suggest machine learning models may still be used early in outbreaks to determine whether patients are at high risk for mortality and whether they require critical care.

Keywords: machine learning; covid-19; mortality; early diagnosis

Artificial intelligence for a smart university of medical sciences

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Background and aims: Artificial intelligence technologies have been developed to analyze a variety of health data, including clinical, behavioral, environmental, and pharmaceutical information, and data from the biomedical literature as well as patients. In this regard, the aim of the current research was to investigate the use of artificial intelligence for a smart university of medical sciences.

Method: The concepts of artificial intelligence, smart university, advantages and disadvantages of artificial intelligence in medical education were investigated by descriptive and analytical methods.

Results: Conceptual inference suggests that machine learning can be defined as a sub-branch of artificial intelligence that includes software capable of recognizing patterns, predicting and applying newly discovered patterns in situations that were not included or covered in their initial design. they do. The benefits of using artificial intelligence in medical education can include improving access, easy sharing of information, early diagnosis, increasing speed and reducing costs, etc. The challenges of using artificial intelligence in medical education also include digitalization and data integration, insufficient expertise, updating regulations, etc. Therefore, it is recommended that medical universities use solutions that are supported by the latest technology solutions to improve the quality of education and minimize errors in the circulation of administrative documents and the academic course.

Conclusion: In summary, we argue that the role and impact of artificial intelligence in the fields of medical education and learning has increased. On the one hand, the academic field is becoming more effective and personal, and on the other hand, it is becoming global, context-oriented (multicultural) and asynchronous. The intersection of three areas, namely data, computing and education, has created far-reaching consequences.

Keywords: artificial intelligence, medical sciences, education

Medical and Paramedical Students' Perspectives on Artificial Intelligence in Mashhad, Iran: A Cross-Sectional Study

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Background and aims: Artificial intelligence (AI) is increasingly being integrated into medicine and healthcare. However, Iran's medical and paramedical faculties are currently not required to include these pieces of training in the designated curriculum. Examining public attitudes and the current knowledge of healthcare students may be a powerful approach to highlighting areas of need for curriculum policymakers concerning AI education. Therefore, the purpose of this research is to investigate and identify the gaps in the knowledge of medical and paramedical students of Mashhad University of Medical Sciences regarding AI, the difference in the knowledge and perspectives of students in different fields of medicine and paramedicine, and to present the methods identified by students for teaching AI and to include it in their curriculum.

Method: This cross-sectional study was conducted from September 2022 to February 2023. A standard questionnaire previously developed by Teng et al. (2022) was used. The validity of the questionnaire was measured by the consensus of experts, and its reliability was measured using the test-retest method (Cronbach's alpha: 91%). There were 15 questions in this survey, including multiple-choice, pick-group-rank, Likert scale (11 points), slider scale, and narrative questions. We used the proportional per-size sampling method by distributing an email with a description and a link to the web-based survey to representatives among medical and paramedical students at Mashhad University of Medical Sciences. This study was confirmed by the ethical committee of Mashhad University of Medical Sciences (approval number IR.MUMSFHMPM.REC.1401.081).

Results: A total of 202 students from 14 different fields responded to the survey (response rate: 98%). Overall, 91.08% (184/202) forecast that AI technology would impact their careers within the coming decade, and 84.65% (171/202) stated a positive perspective toward the emerging role of AI in their respective fields. The attitude was different among the fields, and concerns about the role of AI in the field of paramedical students' careers were significantly higher ($P < 0.0001$). All students agreed with AI training, even those who were concerned about the role of AI in their career field. This amount is, respectively, n = 118 (58.41%) partial training from the curriculum, n = 80 (39.60%) training outside the curriculum, and n = 4 (1.98%) with other educational methods.

Conclusion: This study investigated medical and paramedical students' perceptions of AI and their knowledge gaps. Most students were optimistic about the role of AI in their future careers. However, there were more concerns among paramedical students, and many of these concerns were caused by their lack of knowledge about AI. All students stated that they have different training needs for AI, and the majority of them agreed that such program-specific needs should be considered when integrating the AI curriculum.

The Effect of Machine Learning Algorithms in The Prediction, Diagnosis, and Prevalence of Meningitis: A Systematic Review

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Background and aims: The use of artificial intelligence in medicine has grown significantly in the past decades. Machine learning (ML) is a branch of artificial intelligence that can improve the efficiency and quality of health care by helping to improve the prognosis and diagnosis of diseases. Meningitis is an inflammatory disease that is one of the world's major health problems, and the mortality rate caused by this disease is always high. This systematic review aimed to evaluate ML algorithms in the prediction, diagnosis, and prevalence of meningitis.

Method: This systematic review was conducted by searching keywords in the authoritative scientific databases PubMed, Scopus, EMBASE, and Web of Science on November 12, 2022. We followed the Preferred Reporting for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. English-language studies that used ML to predict, estimate prevalence, and diagnose meningitis were considered to meet inclusion criteria. Titles and abstracts were independently screened based on the eligibility criteria. Afterward, complete texts were retrieved and independently screened based on the eligibility criteria. The same form was used to extract the following data: the title of the study, the year of publication, the country, the number of participants, ML algorithms, the type of meningitis considered in the study, the objectives of the study, and the main findings of the study.

Results: In total, 16 studies met the inclusion criteria and were included in this systematic review. Studies on the application of ML algorithms in the three categories of disease diagnosis ability (8/16), disease prevalence investigation (1/16), and disease prediction ability (including cases related to identifying patients (3/16), risk of death in patients (2/16), the consequences of the disease in childhood (1/16), and its etiology (1/16)) were placed. Among the ML algorithms used in this study, the random forest approach (3/16, 19%) and artificial neural network (3/16, 19%) were the most used. All the included studies indicated improvements in the processes of diagnosis, prediction, and disease outbreak with the help of ML algorithms.

Conclusion: The results of the present systematic review showed that in all studies, ML techniques were an effective approach to facilitate diagnosis, predict outcomes for risk classification, and improve resource utilization by predicting the volume of patients or services as well as discovering risk factors; The role of ML algorithms in improving disease diagnosis was more significant than disease prediction and prevalence. Meanwhile, the use of combined methods can optimize differential diagnoses and facilitate the decision-making process for doctors.

The effects of Virtual Reality in natural childbirth: A systematic review

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Background and aims: Labor pain is one of the most severe pains that can lead to negative consequences such as stress and maternal academia. There are different pharmacological and non-pharmacological methods for labor analgesia. Most of the pharmaceutical methods of labor analgesia have unpleasant side effects, including prolong labor and increased risk of surgical interventions. The V.R is a new method of pain reduction and it is welcomed in different aspects of medical sciences. The intensity and duration of this pain vary with the progress of labor. Reducing the labor pain is important in order to encourage mothers to normal vaginal delivery. Therefore, we reviewed the effectiveness and safety of V.R as a method of anxiety and pain reduction during labor.

Method: This systematic review examined the use of V.R in reducing labor pain and anxiety. PubMed, Embase, Web of Science, the Cochrane Library, CINAHL China National Knowledge Infrastructure, and Wan-Fang databases were checked from 2010 to the end of 2022. A researcher had the main task of screening the studies. The second researcher's opinion was applied if the first researcher had doubts. At first, the researcher collected all abstracts related to to Virtual Reality, Pregnant Woman, Deliveries, Obstetric, and Parturition. Virtual reality abstracts in the elderly, men, and children were excluded. A checklist was prepared, including the name of the researcher, the title of the article, the year it was done, the place where it was done, the method of sample selection, the number of samples, the type of study, the instrument for measuring the intensity and duration of pain).

Results: Based on these steps, 890 articles using keywords were found in the initial search. 859 studies were excluded due to being irrelevant or lacking RCT. Full text was reviewed for 31 studies. 2 studies were removed due to duplicate titles. 17 studies did not meet the inclusion criteria. Finally, 12 studies approved. A study examined the analgesic effects of V.R in 4 cm dilation and in another study, the effect of V.R in 9 cm dilation. These studies showed that the use of V.R reduces the pain intensity of the active stage of labor. Video photos of babies, music, and scenery as V.R were used to reduce pain in these patients. The results of these studies showed that the effects of V.R in reducing the duration of the first, second and third stages of labor were not statistically significant. Several investigated the effect of V.R on pain in the entire labor and other studies investigated the effect of reducing the intensity of pain in the active stage of labor. The results of these studies showed that the use of V.R has reduced the intensity of labor pain. Several studies have investigated the effect of V.R on maternal anxiety and have shown that V.R reduces maternal anxiety during labor. Women who have used V.R during the stages of childbirth have shown higher satisfaction with childbirth while they did not have any side effects.

Conclusion: Using of V.R technology reduces the pain and anxiety of the mother during the different stages of labor, while it does not have a significant effect at the time of the first, second and third stages of labor.

Keywords: Deliveries, Obstetric, Pregnant Woman, V.R

Artificial intelligence applications for dietary assessment in the nutrition research

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Background: Multiple applications of artificial intelligence (AI) in medical sciences are growing rapidly in the recent years. AI technologies became complementary to the food science and nutrition research areas in the late 2010s. AI provides new opportunities for research on nutrients and medical sensing technology. The application of AI in the nutritional epidemiology field, in particular, dietary assessment, has been reported in several recent studies, however, any study didn't summarize comprehensively these findings. This systematic review aimed to provide an overview of the main and latest applications of AI in dietary assessment research and identify gaps to address to potentialize this emerging field.

Methods: This study were conducted with considering the PRISMA guidelines. The literature search was conducted in PubMed, Scopus, and Google Scholar without date restriction up to February 2023. The search strategy was expanded using a combination of MeSH terms and the following keywords: "artificial intelligence" AND "dietary assessment" OR "nutrient". Moreover, a manual search of the references list of eligible studies and the Google was done to minimize the risk of missing relevant papers. All original articles written in English that evaluated the application of AI for dietary assessment of participants were eligible for the present review.

Results: After screening the title, abstract, and full text of obtained articles by two independent authors, finally, 9 studies were included in the current review. The included studies were published from 2008 to 2022. The used predominant algorithms in included studies were machine learning and deep learning to estimate food portion size and estimate the calorie and macronutrient content of a meal. Moreover, the included studies suggested the use of smartphone and image-based and web-based dietary assessment apps in nutritional epidemiology.

Conclusions: AI-based approaches including mobile apps and image recognition can improve dietary assessment by addressing random errors in self-reported measurements of dietary intakes. Further research is needed to identify and develop new AI-based approaches for dietary assessment in nutrition research. Furthermore, well-designed studies with large sample sizes are required to confirm the beneficial health outcomes of AI use among different age groups of the population.

Keywords: Artificial intelligence, Dietary assessment, Nutrition, Nutrient

Intelligent segmentation of MRI images with the help of genetic algorithm to extract brain tumor

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Background and aims: Although MRI can accurately describe brain structures, tumor segmentation in medical images is difficult. The use of genetic algorithm in the processing of brain MRI images can lead to accurate diagnosis of tumor from healthy tissue.

Method Genetic algorithm as an evolutionary algorithm has a high ability to optimize image processing parameters. This algorithm was used in the MATLAB environment to optimize the fuzzy C-means clustering method in the segmentation of brain MRI images containing tumors. Then, with the help of thresholding methods and morphological operators, the final processing was done on the image. Finally, to evaluate the proposed segmentation method, image evaluation criteria were checked.

Results: The average value obtained for the criteria of similarity, accuracy, sensitivity and validity was calculated as 0.87, 99.43%, 99.37% and 99.43% respectively. which is favorable compared to previous studies. The PSNR criterion value was also obtained within an acceptable range. But the MSE values were slightly enlarged, which requires further investigations.

Conclusion: The proposed method provides an intelligent hybrid method for tumor detection and extraction from brain MRI images. This method does not need previous information for segmentation and also increases the speed of the detection process.

Keywords: Genetic algorithm, image processing, brain tumor intelligent diagnosis, MRI, MATLAB

Clinical application of artificial intelligence in colonoscopy and endoscopy for gastrointestinal bleeding: New techniques and outcomes. Review

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Background and aims: Artificial intelligence (AI) is rapidly expanding in various fields of medicine. In recent years, researchers have used artificial intelligence and especially machine learning algorithms to analyze high-volume medical data and perform clinical tasks such as identifying and classifying upper and lower gastrointestinal-bleeding (GI-bleeding) in endoscopy and colonoscopy images and videos, and following It has been used as an influential factor to enhance risk assessment and advance diagnosis, treatment and standard care around endoscopy and colonoscopy and other medical decision-making. Our goal is to examine studies related to clinical applications of artificial intelligence in gastrointestinal endoscopy and colonoscopy and its potential role in medical decision-making regarding gastrointestinal-bleeding.

Method: we searched for this topic in reliable scientific databases PubMed according to the keywords, which included artificial intelligence, machine learning, medicine, gastrointestinal bleeding, endoscopy, colonoscopy and classification. all keywords queries were considered as a supplementary file.

Results: The results show the improvement of the process of examination, diagnosis, classification and differentiation and overall analysis of images and videos in endoscopy and colonoscopy with the help of artificial intelligence techniques. Studies have told us that more accurate and faster and automatic diagnosis of bleeding sites, blood remains, wounds, tumors and various intestinal diseases, inflammatory areas, digestive infections such as Helicobacter pylori infection, cancer, identification of the depth of cancer invasion, Dysplasia in Barrett's esophagus, Prediction of disease recurrence, prediction of pathological diagnosis and many abnormalities are things that artificial intelligence has brought to us in the field of endoscopy and colonoscopy. Further, it has been seen that if the endoscopist or colonoscopist performs artificial intelligence and endoscopy or colonoscopy together, the accuracy of endoscopy or colonoscopy diagnosis increases. The use of artificial intelligence systems, especially machine-learning, with several prospective patient-based studies during gastrointestinal endoscopy and colonoscopy significantly better diagnosed gastrointestinal-bleeding in patients with suspected bleeding and the rate of gastrointestinal-bleeding, and in the class Automatic classification of bleeding types performed better than previous methods. Also, in a study, it was shown that experts with an automated artificial intelligence system they were able to accurately identify small bowel angioectasia, which is the most common cause of bleeding in patients with obscure gastrointestinal-bleeding. All this goes hand in hand with artificial intelligence having a potential and influential role in medical treatment and recommendations and in medical decision-making generally.

Conclusion: In this review, we highlighted the future insights of artificial intelligence in endoscopy and colonoscopy in medical decision-making, especially in the field of gastrointestinal-bleeding. However, artificial intelligence will continue to develop and be used in daily clinical practice and will increase its role in medicine. For further progress and development in this field, we must focus on integrating artificial intelligence systems with current endoscopy and colonoscopy platforms and electronic medical records, develop training modules to teach clinicians how to use

artificial intelligence tools, and determine the best tools for regulation and confirmation of new artificial intelligence technologies.

Keywords: artificial intelligence, medicine, colonoscopy, endoscopy, gastrointestinal bleeding, classification

Automatic Classification of Movement Imagination using Electro-encephalography (EEG) Signals with Application in Brain-Computer Interface

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Background and aims: Following spinal cord damage from trauma or disease, there is a great need for a method that can substitute for voluntary control in order to regain self-mobility, environmental control, and computer access. One of the potential solutions is brain-computer interface (BCI) that records brain activity in the form of electroencephalography (EEG) signals and extracts the movement intention or imagination by artificial intelligence methods and finally provides the possibility of communicating with the surrounding. High density EEG acquisition systems include many recording electrodes. However, selecting the optimum EEG channels and the appropriate classifier is crucial for accurate detection of the intended movement in BCI systems.

Method: In the current paper, we used the motor imagery EEG dataset 1 provided by BCI competition IV. It consisted of EEG signals recorded from seven subjects. The subjects had to imagine the movements of the left (class 1) and right (class 2) hands during a cue-based BCI experiment. This dataset includes 200 trials for each subject.

In the preprocessing step, first, EEG signals are band-pass filtered in the frequency range of 8-30 Hz using a 3rd order Butterworth filter. Then, a low Laplacian filter is applied for source localization. To select the optimal channels containing the most useful information of the imagined movement, the wrapper-based method called sequential forward feature selection (SFFS) is used. After applying the regularized common spatio-spectral pattern (RCSSP) filter for better separability of the features, the variance of the channels and their logarithm are extracted as time domain features. Finally, the support vector machine (SVM) and weighted extreme learning machine (WELM) were used for the classification of the performed motor imagery tasks.

Results: The K-fold cross validation (K = 15) was used to evaluate the performance of the proposed method. The quantitative criteria include accuracy, precision, and recall.

The average (±standard deviation) classification accuracy, precision, and recall obtained for all subjects by SVM classifier were approximately 84.20±9.28%, 87.17.76±9.37%, and 81.50±9%, respectively. On the other hand, using the WELM classifier, the average accuracy, precision, and recall were equal to 83.80±8.40%, 84.81±8.52%, and 83.17±7.27%, respectively. Therefore, based on the precision criterion, the SVM classifier applied to the EEG channels selected by the SFFS method has approximately three percent higher precision compared to WELM.

Compared to one of the recent papers in the field of motor imagery classification (Mohammad Norizadeh Cherloo, 2021), our purposed method has approximately two percent more accuracy value.

Conclusion: In this paper, we classified two motor imagery tasks by two classifiers using EEG signals. Although different studies have been conducted to classify motor imagery tasks, our results show that the proposed method outperforms the previous studies.

Keywords: Brain-Computer Interfaces; motor imagery; Common spatial patterns; Channel selection; support vector machines

An Overview of Artificial Intelligence-based Extracellular Vesicle Characterization Methods

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Background and aims: Extracellular Vesicles (EVs) are cell membrane-derived nano-particles that can be secreted by all cells. These particles have been described as double-edged swords because of their crucial role in a wide range of physiological and pathological conditions. Small EVs (Exosomes), as one of the most important types of extracellular vesicles, are particles with a diameter of 30 to 200 nm that can carry a variety of large macromolecules depending on the type of their mother cell. Several studies have shown that by examining the composition of small EVs in body fluids, it is possible to diagnose pathological conditions before the appearance of clinical symptoms. Hence, small EVs are considered promising biomarkers for the early detection of diseases. Despite the great diagnostic and therapeutic potential of these nanoparticles, the heterogeneity of small EVs makes it difficult to analyze their cargo and structure. Artificial intelligence (AI) and machine learning can be helpful in this field.

Method: This study is a review of published articles in the field of AI-based extracellular vesicle characterization methods. In order to collect the articles, the keywords of "Extracellular vesicles", "Exosomes", "Artificial intelligence", and "Machine learning" were searched in databases such as Google Scholar, Science Direct, PubMed and etc.

Results: The results of this review demonstrated that most of the published studies in this field can be categorized into two major groups: 1- utilizing AI-based methods to investigate the alterations of exosomal microRNA expression patterns in different physiological and pathological conditions. For instance, supervised machine learning algorithms have shown that Lyssavirus-infected human neurons have a unique cellular and exosomal miRNA signature. In this regard, supervised machine learning algorithms determined 6 cellular miRNAs (miR-99b-5p, miR-346, miR-5701, miR-138-2-3p, miR-651-5p, and miR-7977) were indicative of lyssavirus infection. This finding can be used as a diagnostic biomarker for the early detection of rabies. Using a similar strategy, specific exosomal miRNA profiles have been discovered for many tumor types such as pancreatic and breast tumors. 2- Using AI-based image processing methods to investigate the morphological changes of exosomes. Recent publications have shown the morphological changes of exosomes in various pathological conditions. For Instance, the results of several recently published studies have shown that exosomes secreted from cancer cells have a larger average diameter compared to the exosomes secreted from normal body cells. Identifying these changes by using AI-based methods can play an important role in the early diagnosis of diseases.

Conclusion: Utilizing AI-based analytical methods can greatly help to expand the diagnostic and therapeutic potentials of EVs.

Artificial Intelligence Solutions in Prediction, Control and Prevention, Diagnosis of Hospital Infections: A Systematic Review

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Background and aims: Hospital infection occurs after hospitalization of the patient in the hospital, which is associated with significant mortality and increases the cost of treatment. Approximately 5 to 10% of patients admitted to the hospital suffer from some type of infection, although 30% to 50% of hospital infections are preventable. Applied and advanced artificial intelligence solutions enable a hospital to be more successful in predicting, controlling and preventing, diagnosing and treating hospital infections. The purpose of this study was to investigate the various artificial intelligence approaches implemented and their impact on preventive measures, control, diagnosis and treatment of hospital infections.

Method: This systematic review study was conducted in December 2022 by searching keywords hospital Infection, artificial Intelligence, deep learning, machine learning, computing methodologies, blockchain, robotic, expert systems, fuzzy logic in the title and abstract in the reliable databases of Web of Science, Scopus, PubMed without time limit. The inclusion criteria including English language were checked by the researchers, systematic review and covid-19 studies were excluded. A checklist was provided to extract data including the type of artificial intelligence solution, the target scope including prediction, prevention and control, diagnosis and treatment of hospital infection and the most important outcome of the study.

Results: A total of 600 articles were reviewed, and after reviewing the full text of the articles, 109 articles were included in the study. In 70 articles (64%) artificial intelligence solutions were in the field of prevention and control of hospital infections. In 34 articles (31%), artificial intelligence solutions were used to predict hospital infections. In 5 articles (5%), artificial intelligence solutions were presented in the field of diagnosing hospital infections. In 70% of the studies, pneumonia and urinary infections were discussed, and ICU was considered in terms of location. In all studies, artificial intelligence solutions had led to a constructive impact and reduced hospital infection rates. Machine learning algorithms (48%) were the most significant artificial intelligence approach that was used in the field of prediction and control of hospital infections. Then expert systems played a major role in prevention and control. Among deep learning algorithms, convolutional neural network was the most used. In addition, research shows that the further development of artificial intelligence solutions in hospitals can provide unprecedented opportunities for the control, diagnosis and treatment of nosocomial infection and similar futures.

Conclusion: According to the findings of this study, it can be said that artificial intelligence solutions can be effectively used to predict hospital infections and play a significant role in the prevention and diagnosis of hospital infections in a smart hospital.

Keywords: Hospital Infection, Artificial Intelligence, Smart Hospital, Machine Learning, Expert System, Deep Learning

Design and development of mobile application for managing poisoned patients

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The initial treatment of a poisoned patient in most of Iran's hospital centers is done by interns or general doctors or even specialists who do not have enough knowledge and experience in the field of poisoning, and there is a possibility of mistakes and not considering important things during this treatment.

Our goal is to use this application, which does not have a similar example, to remind the learner or the doctor or the treatment staff of the correct steps to deal with a poisoned patient in detail and by observing a logical and scientific sequence, so that the possibility of errors and mismanagement of treatment, At least, at the same time, it is possible to perform a comprehensive evaluation through it.

After researching and checking the technology used for coding and implementing the project, the PHP language was selected for implementation in the backend of the project, and the implementation of the MySQL database tables has been done to determine the required records.

In this design, every part of the training will be stored dynamically and its content can be changed in the future.

Also, for the quiz section, the pro-quiz plugin is used, which has the ability to create different questions with various fields, and the results of each student's test can be seen by the professor. There will be no restrictions in creating questions and their order.

Also, the activity of each student while working with the educational system, which steps he/she went through in what period of time, has been designed in the database.

After the end of the coding, the training of working with the system was prepared in the form of a video, and after testing by the end user, the observed bugs were fixed. Also, in this phase, a new feature of the white list for student registration was added to the project. In this feature, the professor can enter the list of students' information in the form of student code and national code in the form of an Excel file in the software database, and at the time of registration, if a person is included in the list, his registration will be automatically confirmed.

In addition, it is possible to define the login code for other users and learners by the system administrator.

Evaluation of Breast Cancer using Artificial Intelligence in various modalities

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Breast cancer screening has been shown to significantly reduce mortality in women. The increasing use of screening tests has increased the demand for fast and accurate diagnostic reports. Mammography her screening for breast cancer has been introduced in many countries in the last 30 years. Initially using an analog screen film based system, over the last 20 years they have switched to using a fully digital system. AI has become a very useful tool in the field of cancer care. It has shown remarkable results and has the potential to change all current therapies. Both imaging and computational achievements have increased the potential use of artificial intelligence (AI) in numerous breast imaging errands and in computer-aided discovery, including diagnosis, prognosis, treatment response, and risk assessment. It extends beyond its current use. Breast cancer screening has significantly reduced mortality. AI has great potential to contribute to workplace efficiency, results evaluation, and breast imaging quality measurement. Some algorithms used clinically are still under development. Deep learning (DL) itself is a branch of ML that focuses on representing data in the best possible way to simplify the learning task. The incorporation of AI into the screening methods such as the examination of biopsy slides enhances the treatment success rate. There has been an increased interest in this area over recent years, and the field seems to have a very promising future. In modern breast imaging centers, full-field digital mammography (FFDM) has substituted traditional analog mammography, and this has opened new chances for developing computational outlines to mechanize detection and diagnosis. With the overview of digitization, the computer clarification of images has been a subject of penetrating interest, causing in the overview of computer-aided detection (CADe) and diagnosis (CADx) procedures in the early 2000's.The automatic competences of AI proposal the potential to improve the diagnostic skill of clinicians, including precise separation of tumor volume, removal of characteristic cancer phenotypes, conversion of tumoral phenotype topographies to clinical genotype insinuations, and risk forecast. Traditional CAD systems in mammography screening have shadowed a rules-based method, joining area information into hand-crafted topographies before using classical machine learning techniques as a classifier. Finally, AI plays a role in image post-processing and quality analysis, such as image registration and volume segmentation in multiple image modalities. Further research is needed to clinically implement AI in breast cancer screening, but the results of this study will help provide a basis for future studies, including prospective studies.

Keywords: Breast cancer, MRI, Artificial intelligence, Computational Radiology, Deep Learning, CAD, Mammography

Automated artifact removal in ultrasound images based on deep learning

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Background and aims: Ultrasonic image interpretation and analysis are facilitated by removing artifacts from raw data. One of the essential steps in image processing, especially in deep learning technology, is removing these symptoms and unappropriated information to increase consistency and accuracy. we propose a very deep fully convolutional auto-encoder network for artifact removal off the US medical images, which is an encoding-decoding framework with symmetric convolutional-deconvolutional blocks.

Method: The mentioned method was applied to 2400 ultrasound images consist of artifacts gathered from the Persian cohort where 400 of which were used for evaluation. The proposed CNN framework consists of multiple convolutions and deconvolution blocks which increase the network width along with length simultaneously. The blocks are composed of multiple layers of convolution and de-convolution operators, learning end-to-end mappings from images containing added artifacts to the original ones. The increased width framework improves performance across residual networks of different depths while can successfully learn with a two or more times larger number of parameters than thin ones, which would require doubling the depth of thin networks, making them unfeasibly expensive to train. Our main idea is that the convolutional layer's act as a feature extractor, which preserves the primary components of objects in the image and meanwhile eliminating the corruptions. After forwarding through the convolutional layers, the corrupted input image is converted into a "clean" one. The subtle details of the image contents may be lost during this process. The deconvolutional layers are then combined to recover the details of the image contents. The output of these layers is the recovered clean version of the input image.

Results: The assessment method was considered MSE to reflect the better pixel difference between the original image and a corrupted one. Our model achieved the MSE of 0.00047 on our test images after 30 epochs of training.

Conclusion: This study proves that the proposed model is capable of removing noise and artifacts of medical images while preserving the valuable information of images in a fast and reliable manner where the total number of medical images is limited to be used in deep learning models.

Keywords: deep-learning, artifact removal, ultrasound image, image preprocessing

Hypnothechnology: Implication of technology in Hypnosis

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Background and aims: Hypnosis often refers to a set of techniques that can be used to enhance psychotherapeutic approaches and has broad clinical application (e.g. Anxiety, depression, and pain control). Although hypnosis has a long history of in-person facilitation, in this article we want to review the current technologies that allow us to enhance the effectiveness of hypnotherapy and use hypnosis as a remote psychologic intervention.

Method: The scientific databases, PubMed, Scopus and Google Scholar, and Grey Literature Databases were searched with hypnosis and technology-related keywords: hypnosis and transcranial magnetic stimulation, hypnosis and virtual reality, hypnosis app, hypnosis, and machine learning, etc.

Results: Up-to-date studies investigates the importance of combining new technologic approaches for enhancing the effectiveness of hypnotic interventions. The results show the application of three technologies including non-invasive brain stimulation (NIBS), virtual reality (VR), mobile apps, and tele-psychotherapy platforms in hypnotherapy. In addition, Pre-registered data shows the potential application of machine learning (ML) in detecting the depth of hypnotic trans and prediction of clinical outcomes in future sessions, but still, we have a lack of study in this area.

Conclusion: We coin the term “hypnotechnology” to describe the combined use of technology and hypnosis to enhance clinical interventions. The combination of hypnosis and new technologies can create new insights and applications for hypnosis in both clinical and research fields. Although NIBS, VR, mobile apps, and tele-psychotherapy platforms have promising evidence in the enhancing clinical effectiveness of hypnosis there is a lack of study about the application of ML we will draw future directions in this field. In this article, we review current evidence for different aspects and implications of hypnotechnology to suggest this for further studies.

Keywords: Hypnothecnology, Hypnosis app, Virtual Reality Hypnosis, Hypnotherapy, Telepsychology

Comparing various methods of artificial intelligence in diagnosis of polycystic ovarian syndrome

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Background and aims: polycystic ovarian syndrome (PCOS) is a common endocrine disorder in reproductive-aged women with risk of complex long-term complications. However, early detection of PCOS is one of the most critical concern in the field of women's healthcare. Owing to the complexity and various heterogenic profiles of the syndrome, identification and differential diagnosis remain challenging despite the widely accepted criteria and tests. With the rapid development of artificial intelligence (AI), using machine learning and deep learning to assist with PCOS detection has attracted much more attention. In current study different AI methods applied in PCOS diagnosis are reviewed to highlight the best prediction model(s).

Method: The systematic review was performed on all published studies that have investigated the AI technology on PCOS detection based on the PRISMA statement, PubMed and Ovid databases were searched up to November 2022 using the terms 'polycystic ovarian disease/syndrome', 'PCOS', 'Stein Leventhal syndrome', 'Rotterdam', 'ESHRE/ASRM', 'criteria', and 'AI', 'deep learning', and 'machine learning' algorithms.

Results: Based on the research design, algorithm type(s), number and types of clinical parameters, the detection accuracy of each method varied greatly, ranging 79-98%. Comparing the various applied AI methods showed that hybrid approaches are very much effective in detection of PCOS, especially SVM/KNN/ Logistic Regression hybrid model with 98% accuracy score. Moreover, XG Boost and CatBoost have been also proposed to function as strong models to detection of PCOS with accuracy score of 96% and 95%, respectively.

Conclusion: AI deep learning technology provides a powerful tool for detection PCOS at an early stage and then early treatment of the patient's. Ultimately, in order to achieve highest detection accuracy of PCOS, hybrid approach- based algorithms on the most important genetical, epigenetical, transcriptome, clinical, metabolic, and immunological characteristics should be assessed.

Keywords: PCOS, artificial intelligence, algorithms, accuracy rate, early detection

Cervical Cancer Diagnosis and AI

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According to World Health Organization, cervical cancer is a leading cause of cancer which comes fourth in prevalence among women globally. In 2020, 604 000 new cases and 342 000 deaths due to cervical cancer were reported and 90% of whom were from low- and middle-income countries. Cervix can be divided into two parts; the endocervix which is the opening part of the cervix covered with columnar cells, and the exocervix which is the outer part, covered with squamous epithelial cells and can be examined by the doctor. The Transformation zone is the area where exco- and endocervix meet and is the most common place to be cancerous. For a cell to be cancerous, gradually abnormal changes needed to take place and it is categorized into different precancerous cells including dysplasia, cervical intraepithelial neoplasia (CIN), and squamous intraepithelial lesion (SIL). Precancerous cells are graded on a scale of 1 to 3 based on their abnormality. Precancerous changes can be detected by the test, Pap smear. Pap smear involves collecting cells of exco-, and to a lower extent, endocervix cells and looking for any abnormal changes in the cells behind the microscope. Although pap smear showed promise in detecting precancerous cells in the early stages, it is an operator-based technique and requires highly skilled technicians. Moreover, the process is manual and the interpretation may be effortful and time-consuming. To overcome these problems, machine learning and computer-based intelligence have made some progress in cervical cell change analysis and diagnosis. By deep learning methods, images of the cervix are presented on large scale containing normal, abnormal, and artifact cells of the cervix. Given big data of cell images, an algorithm of the cell nucleus will be developed, distinguishing normal and abnormal cells. We should first resize and adjust the Pap-slide image resolution. The augmentation technique should be applied to overcome the probable overfitting errors. Two subgroups of the training and testing phases would be presented, both including normal and abnormal cells of the cervix. In total, we hope to reach the number of 5000 normal cells, 3000 atypical cells, 2000 low-grade, and 1000 high-grade precancerous cells, according to similar literature available up to now, we estimate the sensitivity and accuracy of our model to be 90% or above. With our developing algorithm, we are looking forward to diagnosing false negative Pap-test results and detecting the precancerous cells more precisely than the conventional available Pap test in our country.

Keywords: artificial intelligence, medicine, cervical cancer, pap smear, big data

Automatic speech recognition (ASR)

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Automatic speech recognition (ASR) is a technology that converts spoken language (an audio signal) into written text, often used as a command. When combined with natural language processing (NLP), speech technology can understand, interpret and generate human language and perform tasks such as translation, transcription, automatic summarization, topic segmentation, and much more. Proper medical transcriptions require scribes and dictation recorders, which are overpriced, time-consuming, and inconvenient for patients. This potentializes using ASR systems to accurately transcribes medical terminology, including product names, procedures, and even diagnoses or diseases.

With the help of this system, we can quickly add medical speech-to-text features to our voice-activated applications. Conversations between health care professionals and the patient operate as a basis for a patient's diagnosis, treatment plan, and clinical recording procedure. This system can be used for a wide variety of purposes, including the transcription of doctor-patient discussions for clinical documentation, the recording of phone calls for pharmacovigilance, the subtitling of online medical consultations, and summarizing patient symptoms and classifying patients' categories based on their symptoms. When accompanied by NLP techniques, ASR systems can provide valuable predictions such as patients' probable current and future symptoms, duration of treatment, and practical after-recovery considerations. In other words, this system can be called an intelligent doctor's assistant. Cardiology, neurology, obstetrics-gynecology, pediatrics, oncology, radiology, and urology are just a few specialists care fields in which this system can be utilized. The ability to perform these tasks allows AI models to support human workers by giving healthcare professionals more time to focus on personalized, face-to-face patient care. Another advantage is the easy and convenient use of this system. Current speech recognition systems, designed for general applications, provide acceptable accuracy, while fine-tuning them for medical purposes can boost their performance. ASR systems can be easily used without prior education or expertise to set them up. On the other hand, Speech recognition is more complicated than it seems. There are many difficulties in developing speech recognition, such as the quality of input speech signal, real-time implementation complexity, and the quest for a rich language model in both letter and word levels. Another critical factor that affects ASR accuracy is the dataset. As the dataset size increases and the speech content become more relevant to medical applications, the overall accuracy of ASR systems will improve. There are similar foreign versions of this system abroad. However, we are currently preparing the first local version of this system, and we hope to be able to launch this system in teaching hospitals of universities across the country in the first stage.

Keywords: automatic speech recognition, artificial intelligence, natural language processing,

Development of novel small molecule inhibitors targeting angiotensin II type 2 receptor against colorectal cancer

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Background: Recent studies showed that the blockade of the angiotensin (ANG) II type 2 receptor (AT2R) can potentially inhibit tumor growth in several cancers, including colorectal cancer. Therefore, in this study, we designed potent and novel AT2R inhibitors by using bioinformatic software and online tools including Discovery Studio, Genetic Optimization for Ligand Docking (GOLD) Suite 5.2, and SwissADME toxicity prediction.

Method: First, the protein structure of AT2R in complex with EMA401, one of the AT2R inhibitors, was obtained from the Protein Data Bank server (PDB= 7JNI). Then, the protein structure was refined and prepared for docking by adding hydrogen using Discovery Studio software. For the next step, the potency of three FDA-approved drugs (Valsartan, Telmisartan, and Losartan) with the ability to inhibit AT2R was predicted and compared with EMA401 using GOLD software. Finally, a structure-based design and virtual screening (PubChem with TANIMOTO THRESHOLD 90%) were used to find new and potent lead compounds against AT2R. The binding mode, total free energy changes, and interactions upon binding of newly designed inhibitors with AT2R were predicated and visualized using GOLD and discovery studio software, respectively. The drug-like and chemical distribution, absorption, metabolism, excretion, and toxicity (ADMET) properties of newly designed inhibitors also were predicted using the SwissADME portal (http://www.swissadme.ch/).

Result: The docking result showed that EMA401 with higher Chemscore. Fitness (60.23) and lower Chemscore.DG (-60.66) binds to its receptor AT2R compared with other ones including Valsartan, Telmisartan, and Losartan. Finally, among 23 compounds that were selected based on structure-based design and 1961 compounds selected based on virtual screening, TEL-5 (a derivate of telmisartan), and two other ones with PubChem CID 6866871 and 156328793 were suggested with higher affinity and favorable predicted ADME values than the EMA401.

Discussion: according to our results, these novel inhibitors including, TEL-5 and two other ones can be suggested as potential compounds with AT2R inhibitory activity to be used for the treatment of colorectal cancer.

The mattress temperature control device based on the heart rate, body temperature and Environment temperature to reduce heart attack in Morning. (CardioTherma)

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Introduction: According to studies, high and low temperatures increase the prevalence of heart attacks. According to studies, a 1°C drop in ambient temperature increases the risk of myocardial infarction by 2%. Every 9°C increase in temperature increases the risk of stroke by 5%. The device that we have invented completely automatically increases and decreases the temperature of the sleeping mattress based on the ambient temperature, the body temperature and the heart rate of the people, and the possibility of heart attack due to temperature changes is reduced.

method: The cardiotherma device consists of the following parts: 1- Screen to display ambient temperature, body temperature and heart rate 2- Heating mat 3- Wristband with thermal module, Pulse oximetry sensor to measure body temperature and heart rate 4 - Thermometer to measure the ambient temperature.

Results: According to whether each of the factors of body temperature, ambient temperature and heart rate are within the normal range or not, 21 conditions may occur. The device decides to turn the heat mat on or off according to the settings that have been given to it in advance and provides the right temperature to reduce the risk of heart attack for people.

Conclusion: By inventing and manufacturing this device, we hope to reduce the risk of heart attacks for the elderly and provide them with a good night's sleep.

Optimized Searches in Genetic Identification: A System of Artificial Intelligence for Forensic Medicine

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Background and aims: Y chromosome-specific markers are used in genetic testing and solving criminal cases. These markers are used explicitly in forensic genetics to identify unknown people or unknown criminals. Currently, there is no automatic search method to detect the genetic identity of people in the country. In case of absence or no access to the haplotype of the paternal sample, it will not be possible to search and identify the person or even his life range. Therefore, the design and development of an artificial intelligence system based on an Iranian haplotype dataset with the ability to perform automatic and optimal searches could be used as an effective solution in the search process for genetic identification. This research aims to design and develop a forensic user interface, which has better performance than the currently available process to search for genetic identification and can be easily adapted to forensic medicine laboratories.

Method: The strategy of the design of this artificial intelligence system is based on machine learning techniques on 1500 Y Short Tandem Repeats (YSTRs) samples, which leads to the development of a forensic prediction model for the analysis of Y Short Tandem Repeats markers. This artificial intelligence system was then implemented in a user interface. This user interface is web-based software based on 17 Y STRs Loci.

Result: In this artificial intelligence system, the search process to find the nearest geographical area of the person's residence is prioritized according to the highest score determined by the prediction model and suggest to the geneticist. The search pattern of the assumed prediction model is based on the fact that "through haplogroups, there is a relationship between haplotype samples and the geographical area where people live."

Conclusion: The forensic medicine laboratory can use this user interface as a search filter to identify people's genetic identities. Hence, we will have a second referral system based on an artificial intelligence system, which provides the capability of accurate and optimal searches in the shortest possible time for a geneticist. Therefore, the implementation of machine learning methods to design this system, in addition to automating the process of identifying genetic identity in the country, will lead to limiting the search circle and identifying the genetic identity of people in a shorter period with higher accuracy. A person's genetic identity will be limited to a specific geographical region instead of the whole of Iran. Considering that the mentioned user interface is designed based on haplotype samples from different regions of Iran, this system is localized to Iran and is unique, which can be designed and developed according to the haplotypes of any geographical region.

Keywords: artificial intelligence system, User Interface, forensic genetics, genetics identification, haplotype

Factors affecting the acceptance of companion health services by physicians working in Tabriz University of Medical Sciences hospitals

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Background and aims: Unequal access to health services and low involvement of people in managing their health is a threat to the sustainability of the health care system. Today, the use of mobile health technology to support and achieve the goals of the health industry has transformed the provision of health care services in the world. The present study was conducted with the aim of investigating the different attitudes of users regarding the factors affecting the acceptance of mobile health.

Method: The current cross-sectional-descriptive research was conducted in Tabriz University of Medical Sciences in 2020. The research population was made up of general physicians and specialists (cardiology, general surgery, ophthalmology, and obstetrics) working in the hospitals of Tabriz University of Medical Sciences (Imam Reza, Shahid Madani, Nikukari, and Al-Zahra Hospitals). 180 people were selected based on random sampling method. In order to collect data, a researcher-made questionnaire was used based on the variables of the 2nd and 3rd versions of the Technology Acceptance Model (TAM). This questionnaire consisted of two parts. The first part included demographic questions (five questions) and the second part included research dimensions (52 questions). The collected data were then analyzed using descriptive statistics (mean, standard deviation) and analytical (linear and multiple regression) methods of SPSS software version 22.

Results: Most of the respondents (73.4%) in this study were women and 26.6% were men. 94 people (52.3 percent) of the participants were less than 30 years old and all the studied people used smartphones. 142 people (78.9%) were general physicians. The average variables of perceived usefulness, behavioral intention, perceived pleasure, subjective norm, perceived ease of use of the image, voluntariness and usability of the goals were higher than the base average (3) and indicated the acceptance of accompanying health by them. The relationship between all the variables with each other and in the direction of the attitudinal and behavioral goals of accepting health was significant, but the display ability variable did not have a positive effect on the perceived usefulness.

Conclusion: According to the obtained results, the acceptance of mobile health technology among the studied population was evaluated as moderate based on the dimensions of version 2 and 3 of the TAM model; And most of the physicians were willing to use mobile phones to provide healthcare services. The results of this study provide useful information to managers and health policy makers so that they can take steps to improve the quality of services by using new technologies.

Keywords: Health Services, Cell Phone, Physician, Acceptance

Financial technologies (FinTech) in the health system

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Background and aims: Healthcare organizations seek to improve their financial performance without reducing social and natural capital, with rapid technological advances in healthcare, financial services provide a significant opportunity to improve access and reduce costs using technology and financial solutions. They have created innovative and high quality. Interest in the potential of financial technologies to address societal challenges, including access to health care, is growing.

Method: In this research, an attempt was made to evaluate the functioning of financial technologies in the health system and how the companies providing these services perform with a systematic review.

Results and Conclusion: As a result, 6 functional factors (digital health savings, digital lending, crowdfunding, insurance technology, serving vulnerable groups, payment services and digital wallet) as well as five factors of fintech impact on health technologies including (access to information, data and performance tracking, personalized applications, data democratization, artificial intelligence and analytics) were identified.

Keywords: Financial technologies (fintech), health system, health care

Application of Artificial Intelligence in Early Diagnosis of Alzheimer's Disease

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Modern clinical practice encounters with ever-increasing volumes of clinical data. Therefore, it is imperative to develop efficient methods to process and make sense of these large amounts of data. Artificial intelligence is one of the methods that can be used to solve many health problems.

Alzheimer's disease (AD) is an incurable neurodegenerative disease diagnosed by a physician based on medical records and imaging studies. These methods lack sensitivity and specificity, necessitating new antemortem noninvasive strategies for diagnosing AD.

Recent studies have showed that machine learning methods can be used to diagnosis and predict AD based on transcriptome data which obtained from the blood sample of AD patients and sequenced through microarray technique. machine learning models through processing different parameters can identify people with high risk of developing AD. Methods such as support vector machine can help to achieve receiver operating characteristic (ROC) scores of 93% and accuracy of 89%.

Additionally, there is growing evidence that combining artificial intelligence approaches with MRI can be particularly helpful in improving diagnostic accuracy for various types of dementia. Studies have reported that Combining AI technology and MRI improves diagnostic accuracy from 73.3% to 99%.

Currently, we are building a large database of people with Alzheimer's disease, so that we can create a suitable dataset which meet the requirements of artificial intelligence developer.

We are interested in creating a large database, with more accurate characteristics, which finally results in artificial intelligence tool which can help us in better and faster diagnosis.

Keywords: Artificial intelligence, Alzheimer's disease, support vector machines, magnetic resonance imaging

Designing the dashboard for reporting research performance at Mashhad University of Medical Sciences

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Background and aims: Education and research are two important duties and responsibilities of universities and scientific and cultural centers, and they have a special place in the current era, to the extent that they are considered as an indicator for determining the level of development of countries. Such research is the main key to the comprehensive development, self-sufficiency, and independence of a country. Most of the research activities and scientific productions are conducted by the academic staff members of the universities. Academic faculty members are valuable assets to any society and are specialists who are responsible for teaching and spreading science and knowledge in the university, and the quality and development of knowledge depend to a considerable extent on how these members perform. Studies show that dashboards are mostly used in commercial applications under the title of management dashboards and have remarkable capabilities in the field of improving the decision-making process. The aim of the present study was to design, evaluate and implement the research performance dashboard at Mashhad University of Medical Sciences.

Method: At first, by examining valid evidence and documentation, items, information fields, related knowledge, and all the items that should be presented in the form of a dashboard user interface were extracted. Using the Delphi method, fourteen senior members in the field of research (research assistants and research experts in affiliated faculties) and a poll of the senior managers of the headquarters selected the desired items to be displayed on the dashboard. The visual design of the dashboard was done based on existing standards using Microsoft Power BI software. Data collection was done by using Pazhuhan software, administrative and employment information of academic staff members, and scientific measurement system of academic staff members, and linking this information with each other was done by coding in Microsoft Power BI software. To evaluate the research performance, we used several indicators that include the percentage of research gap, the percentage of research saturation, the organizational h2 index, the percentage of knowledge production in the group, research power, etc.

Results: A total of 613 faculty members have worked in Mashhad University of Medical Sciences. Based on the standardized score of research saturation and research output, different groups were placed in four regions. In the green area, both of the mentioned indicators are higher than the average of the university. In the blue region, the research output is higher than the university average, but the research saturation is lower than the university average. In the orange region, the research output is lower than the average of the faculty, but research saturation is more than the university average. In the red area, both indicators are lower than the university average. Most of the basic science groups were located in the green area. On the other hand, most clinical groups were located in orange or red areas.

Conclusion: Each educational group was given specific and tailored suggestions to improve their performance based on their performance in the zone they were in and the pyramid of their faculty members.

Keywords: Research performance, Dashboard, Faculty members

Designing and implementing the screening system for ethics committee in Mashhad University of Medical Sciences

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Background and aims: Nowadays, the correct management of societies requires special attention to documentation and scientific evidence, and evidence-based decision-making is one of the fundamental principles for good governance. Therefore, research as one of the processes of producing evidence has become increasingly important. On the other hand, observing the principles and respecting moral values in all matters, including conducting various research, has been given special attention. Paying attention to the ethical aspects of biomedical science research is of particular importance since it is related to human health. Other studies, including research related to animals, laboratory studies, and even review studies should also be conducted within the framework of ethical principles and values. In Iran, the subject of ethics in research was established in the Ministry of Health, Treatment and Medical Education in 1377 with the formation of the "National Committee on Ethics in Research", and gradually ethics committees in research were formed in universities of medical sciences and some research centers. Considering that the screening process of research proposals at Mashhad University of Medical Sciences was done manually and based on paper, and a lot of time was spent collecting the documents, this study was designed with the aim of designing a system for screening the proposals submitted to the ethics committee.

Method: This system was implemented in the university's SharePoint platform, and three different digital cartables were designed: 1. deputy of research 2. reviewers 3. expert. The projects that reach the ethical committee after reviewing in the group and approval are recorded by the expert in this system by mentioning the project code, project title, and proposal. Proposals are sent weekly to five reviewers with different expertise. After the projects are entered into the reviewers' digital cartable, they are asked three questions about each project: 1. Does it need to be examined in specialized working groups (animals or corona)? 2. Does it require an informed consent form? 3. Does it need to be presented in the ethics committee session? There is also a box for receiving comments (in form text). After all reviewers have answered these three questions for the submitted projects, the results are automatically aggregated, and the result can be seen in the expert's digital cartable, showing which proposals need to be reviewed by the ethics committee.

Results: This process was conducted for more than one year at the Mashhad University of Medical Sciences on 1144 proposals. This system reduced human error, accelerated review time in the screening phase, and reduced costs, and the results were archived digitally with the ability to be visible in a complete set.

Conclusion: Using existing software platforms and focusing on implementation gaps can lead to improving the performance of organizations.

Keywords: Artificial intelligence, Ethics, Research

communication How electronic nursing handover system improve and patient safety

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Background and aims: Transferring of professional responsibility and accountability for care of patients between nursing staff is a high risk component in healthcare. The low quality of documented information becomes the main cause of failure in conducting effective communication. Effective communication is a vital factor in providing safe patient care. The aim of this study was to design and implement an electronic nursing handover system to create effective communication between nurses and ultimately improve patient safety.

Method: We designed an electronic handover system and implemented it as a pilot for 4 months in 4 general and intensive care department .80 nurses participated in a university hospital in Urmia. Handover was audited daily In addition questionnaires were sent out pre-and post-implementation to evaluate the impact of using e-handover during ward round.

Results: In total, 59 of the 80 nurses (73.75%) completed the questionnaires. According to the results of the Kolmogorov-Smirnov test, two variables of patient safety, nurses' communication pre-and post-implementation was significant. The average value of patient safety in traditional handover increased from 56.52 ± 14.27 to 65.72 ± 9.128 in electronic handover (P=0.0001). The average value of nursing communication in traditional handover increased from 57.02 ± 14.761 to 64.31 ± 10.500 in electronic handover (P=0.002).

Conclusion: An electronic nursing handover system would be beneficial to effectively communicate the patient information, reduce the adverse events, promote patient safety and improve the quality of care. However, effective communication during the nursing process is potentially requiring more improvement. The recommendation is that the nursing manager should encourage the implementation of effective communication through the utilization of electronic nursing handover system.

Keywords: shift handover, patient safety, communication, electronic handover

Artificial Intelligence and Colonoscopy

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Colonoscopy is an effective screening procedure for the diagnosis and prevention of colorectal cancer; however, colonoscopy can be challenging based on the lesion characteristics including its detection, classification, and removal. Endoscopists try to carefully examine the mucosal layer of the colon folds by flexing and torquing the shaft of the endoscope while withdrawing the instrument. To avoid missing any abnormalities, tips of the endoscopes are twisted in longitudinal or axial views within the neutral, straight position. Simultaneously, lesions that are presumed to be premalignant are removed. Moreover, recent studies showed that in 14% of colonoscopy procedures, precursor lesions are not completely removed. All of the procedures from the detection of the lesion to its removal can be simple or complicated. That's why colonoscopy is considered to be an operator-dependent procedure. In an attempt to cover all of these shortcomings, researches have been made to integrate artificial intelligence into colonoscopy procedures. Artificial intelligence (AI) based systems have shown promise to increase adenoma detection rate (ADR) in randomized clinical trials. By previously developed algorithms, AI can offer real-time support to clinicians and automatically recognize polyps together with providing the probable histology of the sample. Computer-assisted colonoscopy is recently implemented in two clinical areas of Computer Assisted detection (CADe) and classification (CADx).

Up to now, this procedure is restricted to non-advanced adenomas. The efficacy of AI-based systems to detect flat lesions or advanced neoplasia is still in question because of the low prevalence of subtle abnormalities or sessile serrated lesions (SSLs).

We are currently gathering different datasets, consisting of colonoscopy images and videos, and hoping to reach 20,000 polyp-positive frames and 5,000 polyp-negative frames to develop a convolutional neural network (CNN). All polyps are confirmed by histopathology. Polyp size, morphology, and location were also recorded. Full-length videos (white light only) were divided into shorter polyp-positive and -negative sequences. We aim to detect subtle abnormalities and sessile serrated lesions (SSLs) in Iranian patients.

Keywords: artificial intelligence, polyp, colonoscopy, adenoma detection rate, convolutional neural network

Diagnosing acute appendicitis disease using support vector machine

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Background and aims: One of the highest diagnostic possibilities for patients who come to emergency departments with abdominal pain is acute appendicitis, followed by one of the most common emergency surgeries in general surgery, appendectomy. Despite the invention of various diagnostic methods, the rate of unnecessary appendectomy is significant. The use of artificial intelligence and machine learning methods can improve the process of diagnosis and treatment. In the present study, the support vector machine system was used to help diagnose acute appendicitis with the aim of increasing diagnostic accuracy and reducing the amount of unnecessary appendectomy and surgical outcomes.

Method: During the research, by studying specialized texts on gastrointestinal diseases, effective diagnostic variables were collected and categorized in the form of a checklist and evaluated and scored by experts. The research database includes 142 cases of patients who underwent appendectomy in Taleghani Hospital in Tabriz during 2019. Then the support vector machine system with different architectures was implemented and compared to determine the best diagnostic performance. The sensitivity, accuracy and specificity indices were used for evaluation.

Results: The output obtained from the vector machine system for diagnosing acute appendicitis had sensitivity, accuracy and specificity of 92.79%, 95.43% and 96.58%, respectively.

Conclusion: Considering the fact that the accuracy rate of diagnosis before surgery should be above 85%, the performance of the support vector machine system designed to diagnose acute appendicitis is favorable and can help doctors in diagnosing acute appendicitis disease faster and more accurately. Paying attention to the complications of late diagnosis of the disease, unnecessary appendectomy, the duration of the patient's stay in the hospital and its costs.

Keywords: Appendicitis, diagnosis, support vector machine, artificial intelligence, machine learning.

Kidney disease diagnosis model using support vector machine

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Background and aims: Chronic kidney disease means that the human kidneys are damaged and cannot filter the blood as it should, and this damage can cause the creation of toxins in the body. This disease affects about 10% of the world's population and its prevalence is increasing. Nowadays, due to the abundant access to various types of medical data, different data mining and artificial intelligence techniques can be used to analyze these data. These analyzes can help improve the quality of medical services. The aim of the current research is to use machine learning techniques to help diagnose chronic kidney disease and to evaluate the effectiveness of these techniques compared to other existing techniques.

Method: This study is descriptive-analytical. The data used in this research were extracted from 300 patients and non-patients in Tabriz hospitals. These data were first pre-processed in the Python environment and removed from noise and outlying observations. Then, support vector machine, multilayer perceptron and decision tree algorithms were used to classify the data. Accuracy, Recall and Precision evaluation criteria were calculated to evaluate the performance of these categories.

Results: According to the calculated evaluation criteria, for the support vector machine algorithm, the values of Accuracy, Recall and Precision criteria were obtained as 0.974, 0.94, and 0.962, respectively. The findings indicate the better performance of the support vector machine algorithm in terms of accuracy.

Conclusion: The results obtained from the present study indicate the very favorable efficiency of machine learning techniques in the diagnosis of chronic kidney disease. The use of these techniques can facilitate the diagnosis and treatment of these patients and increase the probability of people's recovery.

Keywords: Kidney disease, diagnosis, support vector machine, artificial intelligence, machine learning.

Diagnosis of Pulmonary Tuberculosis Using Naive Bayes Algorithm

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Background and aims: Pulmonary tuberculosis is the biggest cause of death from infectious diseases and is one of the ten main causes of death in the world. Reducing the delay in definitive diagnosis is very important in reducing the transmission process of the disease and minimizing the rate of its reproduction. Therefore, creating a diagnostic aid system using artificial intelligence techniques to screen for tuberculosis can help in the early diagnosis of this disease. The present study was conducted with the aim of investigating the Naive Bayes algorithm for intelligent diagnosis of this disease.

Method: In order to conduct this study, the research population of patients with tuberculosis symptoms and the research sample is the recorded data of 462 patients with early symptoms of tuberculosis retrospectively from May to the end of March 2019 in the database of the Tabriz Tuberculosis and Pulmonary Diseases Research Center. The information of the samples with confirmed diagnosis was checked in two classes of pulmonary tuberculosis and normal. Naive Bayes algorithm has been used to screen for pulmonary tuberculosis using the general and primary symptoms of patients using the Python programming language.

Results: In the implementation of the Naive Bayes algorithm for the diagnosis of pulmonary tuberculosis, the sensitivity, accuracy and specificity of the result were 94.49%, 95.63% and 98.56%, respectively, and the Area Under the ROC Curve (AUC) was calculated as 98.92%.

Conclusion: The performance of the simple Bayes model for the diagnosis of pulmonary tuberculosis has acceptable accuracy. Since tuberculosis disease is relatively common in our country, timely diagnosis of this disease plays a significant role in its treatment and management, especially in remote areas with limited access to laboratory resources and lack of specialists. As a result, the rapid and accurate development of new diagnostic tools and techniques in tuberculosis is essential.

Keywords: Pulmonary Tuberculosis, Naive Bayes Algorithm, Artificial Intelligence

A Data-Driven Machine-Learning Approach for Small Airway Disease Risk Prediction

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Background and aims: Small airway disease (SAD) is a common aspect in chronic obstructive pulmonary disease (COPD). The nature of this disease is chronic and exacerbated over time with considerable morbidity and mortality. This study tries to use the modern science of artificial intelligence and its application for early prediction of SAD by assessing the risk factors related to this disease.

Method: We used a large-scale dataset from the National Health and Nutritional Examination Survey (NHANES) 2007-2012 on 18658 both males and females 6-79 years to develop a screening tool for small airway disease based on 28 features extracted using COPD assessment test (CAT) and other relevant risk factors for COPD. Our label was measured FEV1/predicted FEV1 calculated from their raw curve spirometry. Multiple machine learning models (Naive Bayes, logistic regression, random forest, and gradient boosting) were compared on the level of classification accuracy and the area under the receiver operating characteristic curve (AUC-ROC). To improve prediction accuracy, the disparate models were combined to create a weighted ensemble model. We also used a trained Transformer, with state-of-the-art classification methods named TabPFNClassifier.

Results: Different machine learning models including Naïve Bayes, logistic regression, random forest, and gradient boosting reached an accuracy of about 61%, 62%, 61%, and 65% respectively, and AUC-ROC score of 53.3%, 76.4%, 70.7% in the first three model respectively in comparison of XGBoost which performed the best at 78.5%. TabPFNClassifier on a smaller part of dataset reached an accuracy of about 69.4% (AUC-ROC = 69.7%) and developed ensemble model using stacked generalization achieved an accuracy of about 64.4%.

Top five predictors for small airway disease in decreasing order were age, weight, sleeping hours, gender, and presence of Shortness of breath on stairs/inclines.

Conclusion: We conclude machine learning models based on survey questionnaires can be valuable for predicting the risk of small airway disease in at risk patients. We also identified some of the key contributors to the prediction, which can be used in developing a screening tool. A broader range of health data and advanced ML techniques are needed to conduct further research.

Keywords: artificial intelligence, machine learning, small airway disease, COPD, spirometry

Digital Pathology and the Role of Artificial Intelligence in Medical Diagnosis

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Digital pathology is an emerging field that combines the latest advancements in digital imaging and computer technology to improve medical diagnosis and patient care. With the advent of artificial intelligence (AI), the field of digital pathology has undergone a significant transformation. This review aims to highlight the current state of the art in digital pathology and the role of AI in medical diagnosis.

Background and aims: The traditional method of pathology diagnosis involves examining tissue samples under a microscope. However, this process can be time-consuming, labor-intensive, and prone to errors. Digital pathology provides a solution to these challenges, allowing pathologists to examine high-resolution digital images of tissue samples on a computer screen. The aim of this review is to explore the current state of digital pathology and how AI is being used to improve medical diagnosis.

Method: This review includes a comprehensive analysis of the literature related to digital pathology and the role of AI in medical diagnosis. The research methods used in this review include a systematic search of online databases and a critical evaluation of relevant articles and studies.

Results: The use of AI in digital pathology has led to significant advancements in medical diagnosis. AI algorithms can analyze large datasets of medical images, allowing for a faster and more accurate diagnosis. AI can also help pathologists detect subtle changes in tissue samples that may be missed by the human eye. In addition, AI can be used to assist in the identification of cancerous cells and the prediction of disease outcomes.

Conclusion: Digital pathology and the use of AI have the potential to revolutionize medical diagnosis and patient care. The integration of AI in digital pathology has led to significant improvements in accuracy, speed, and efficiency. Future research should focus on developing more advanced AI algorithms and improving the interoperability of digital pathology systems. Overall, the use of AI in digital pathology is a promising area for future development and research.

Keywords: digital pathology, artificial intelligence, medical diagnosis, pathology, machine learning, healthcare.

Prediction of diabetes using machine learning and data mining algorithms

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Introduction: Nowadays, diabetes has become one of the major health problems and one of the most important problems of the medical profession due to its prevalence in children and adults. On the other hand, machine learning has been a developing, reliable and supportive technology in the field of health, and one of the techniques of interest for analyzing interventions, diseases and conditions of the health system is the use of data mining. In fact, data mining is the process of selecting, exploring and modeling large amounts of data. Therefore, the aim of this study is to create a simple and reliable prediction model based on risk factors related to diabetes using decision tree algorithm.

Methods: Data related to a diabetes screening program in Tehran were used in this study. Of 3376 participants over 30 years of age participated in this screening program in 16 comprehensive health service centers. The prediction model was created using decision tree algorithms including C5.0, CART, CHAID, Quest and Random Forest along with the Boosting hybrid learning method to increase the accuracy of the model. Randomly, 70% of the data (2352 records) were used to train the model and 30% (1024 records) were used to evaluate the model's performance. Risk factors included gender, age, blood pressure, smoking, body mass index, and waist-to-hip ratio. The models were compared based on accuracy index and the best model was selected. Sensitivity, specificity, accuracy and AUC indexes were used to evaluate the prediction model.

Findings: The prevalence rate of diabetes in the studied population was 21%. The best prediction model was obtained using the Quest algorithm with an accuracy of 80.07% and an AUC of 72.4% for the test data. The most important risk factors predicting diabetes were age, blood pressure, waist-to-hip ratio, and body mass. Also, the results showed that 88% of people who were less than 50 years old and 81% of people over 50 years of age whose blood pressure and waist-to-hip ratio were normal were in a healthy state in terms of diabetes.

Conclusion: In this study, a prediction model was created using decision tree algorithm to identify the most important risk factors related to diabetes. Age, blood pressure status and waist to hip ratio were the most important risk factors for diabetes. This model can be used in the planning for diabetes management.

Keywords: diabetes prediction, machine learning, data mining, decision tree

Using The VAE GAN Structure as Pre-Training Technique to Improve Deep Learning Performance for Medical Image Classification

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Background and aims: Artificial intelligence has made great progress in the field of medical image processing in recent years. One of the problems of the current deep learning models is the need for a lot of labeled data for proper performance. On the other hand, there is little suitable and labeled data in the medical field, and creating labels is time-consuming and expensive. We suggest a self-supervised pre-training method for Covid-19 identification to overcome this challenge.

Method: In the first stage of this study, a Variational Auto-Encoder Generative Adversarial Network (VAE-GAN) architecture is used. The images are first fed into an encoder network, and then the image data is fed into the latent space. The vector is then sent to the generator, which attempts to reconstruct the same image using transposed convolution. The reconstructed image is then sent to the discriminator network, which attempts to determine whether the created image is real or fake. Following training, the initial layers of the encoder and discriminator, as well as the weights, are separated from the network and their output is fed into an MLP network, which is then trained again using the labels.

Results: The results of the study show that our proposed model can perform better in detecting Covid-19 with X-ray images than common models with limited labeled data.

Conclusion: To address the problem of a lack of labeled datasets for pneumonia detection, we showed that an unsupervised pretraining on unlabeled data can learn useful representations from Chest X-ray images and that only a few labeled data samples are needed to achieve the higher accuracy of a supervised model learned on a smaller annotated dataset. The proposed model can be applied to other fields where there are insufficient labeled images to ensure proper performance.

Keywords: artificial intelligence, medicine, VAE-GAN, self-supervised learning, covid-19

Missing data in machine learning: Evaluation of missing data in the dataset obtained from a study to determine the risk of mortality in critically ill COVID-19 patients with kidney disease as an example of a dataset in the field of medical research

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Background and aims: Missing data is an important issue in machine learning. The missing values problem is usually common in medical research and causes different issues like performance degradation, data analysis problems and biased outcomes lead by the differences in missing and complete values. In this study, we analyzed a medical dataset to realize the magnitude of missing data.

Method: We evaluated the dataset from a study that prospectively compared the risk of mortality and length of hospitalization of 296 patients with COVID-19 with kidney disease and patients without this condition admitted to the ICU in Imam Khomeini hospital in Sari from February to August 2020. Evaluation of this dataset was performed by Using the missingno Python library and Little MCAR test to figure out and visualize missing data, and the mechanisms of creating missing data including Missing at random (MAR), Missing not at random (MNAR), and Missing Completely at Random (MCAR).

Results: In this study, 37 variables were used. The resulting data set contained 10952 values with about 849 missing data. The mechanism leading to these missing data was MAR and MNAR including 117 cases of MAR, and 739 MNAR (based on Visual interpretation of matrix plot from missingno package in python); There is no case of MCAR (little MCAR test p. value < 0.05). The percentage of missing data was less than 5% in 27 variables, 5-50% in 8 variables, and more than 50% in 2 variables.

Conclusion: Even in carefully designed studies, we may encounter missing data in studies in the medical field. Identifying and handling appropriately missing data is an important key component prior to applying machine learning algorithms.

Keywords: Machine learning, Missing data, Missing at random, Mortality prediction

How can artificial intelligence predict syncope?

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'Vasovagal' Syncope is a transient and rapid onset of loss of consciousness with complete recovery and is one of the most common health problems in human beings. It is due to transient cerebral hypoperfusion and is precipitated by emotional distress, orthostatic stress, fear, severe pain or prolonged standing. It can be triggered by hot environment, humid atmosphere, prolonged standing, and reduced water intake. prodromal symptoms such as sweating, pallor and nausea are usually associated with syncope. There is no known pharmacological treatment yet and pacing is limited to very rare cases. The main goal of treatment is to control trauma and prevent the recurrence. Therefore it is crucial to diagnose presyncope, prevent the predisposing factors and halt traumatic events.

Predicting the syncope and trying to know the onset of faint could prevent dangerous falls and is of great importance psychologically for the patient. Gathering data for a large number of patients by artificial intelligence considering the risk factors such as hot environment, humid atmosphere, prolonged standing, and reduced water intake, menstrual cycles and stresses along with measuring heart rate and blood pressure, sweating, pallor, nausea and indicating syncope in different situations can diagnose presyncopal events. We have designed a smart watch that can record these data continuously in each patient throughout the day and save the information in a computer. In case of syncope the artificial intelligence could analyze all data from about 1000 patients and predict the event of syncope in each patient. If this study reaches trustworthy results, an electric shock can be applied in presyncopal events to increase the heart rate and prevent the syncope.

Keywords: artificial intelligence, medicine, faint, syncope, vasovagal.

The role of artificial intelligence in detecting babies crying nature

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Artificial intelligence has a very important role in medicine especially when huge amount of data exists with insufficient knowledge. By analyzing the existing data with appropriate applications many complex health problems can be solved.

One of the important issues in pediatrics is the ability to understand the meaning of the babies cry. The characteristics of the cry are different in healthy from unhealthy infants and even is different in various diseases. Also infants show different type of crying in situations such as pain, hunger, birth, and pleasure which can be recognized by trained listeners with the accuracy of 33.09% while the accuracy can be increased to 80.56% with artificial intelligence. The recognition of the crying type could help physicians as well as disappointed parents and opens the way for production of robot caregivers.

To analyze the infant cry five stages including data acquisition, pre-processing, feature extraction, feature selection, and classification should be considered.

For data acquisition the infant cry sounds should be recorded and labeled. In pre-processing stage, the background sounds should be removed and audio segmentation using Voice Activity Detection should be done. Feature extraction is an important stage; Discriminative features from the audio signals in time or frequency domains should be extracted by computers and analyzed using Mel-frequency cepstral coefficient (MFCC), Linear Prediction Cepstral Coefficients (LPCC) and Bark Frequency Cepstral Coefficients (BFCC), prosodic information (Variations in intensity, fundamental frequency, formants and duration) and Spectrograms. Then subgroups of features are selected in feature selection stage. Next the cry signals are classified to normal types of crying (hunger, sleepiness…) or pathologic ones such as asphyxia, hypo-acoustic (hearing disorder), cleft palate, respiratory distress syndrome, autism, etc.

We are currently building a large infant cry database consisting of cries of infants from 0 to 9 months old using the above mentioned method and we hope to be able to gather over 30,000 samples reaching 50 h of recording, which fits the need of deep neural networks.

We are interested in creating a large database, extracting more strong and accurate features, establishing new neural networks by using artificial intelligence for Iranian babies. We hope that with this study, we will be able to quickly diagnose the baby's problem by hearing his cry.

Keywords: artificial intelligence, baby cry, pediatrics.

Comparison of Data Mining Methods for Survival Analysis of High-dimensional Data for Children with COVID-19

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Background and aims: Data collected from pandemic diseases, such as COVID-19, are often high-dimensional, censored, and heterogeneous, presenting a lack of robust statistical analysis. Ridge and Lasso regression are proposed methods that can overcome the difficulties of modeling this complex data. This study aims to apply these two methods to identify influential variables in the survival of children with COVID-19.

Method: In this follow-up study, from February 2020 to July 2021, 185 children aged between one month and eighteen years old with confirmed COVID-19 in Shahid Sadoughi Hospital in Yazd followed until the end of day 30 after discharge, except for the expired cases. All patients had complete records of demographic, including comorbidities, clinical symptoms before and at admission time, laboratory factors, and treatment variables. Time to death after one month is defined as survival time, and more than 50 variables are considered in Ridge and Lasso regression independently. Analysis was done using R 4.1.1 software.

Results: Data analysis using Ridge regression in comparison with Lasso regression indicated that Lasso regression estimated the coefficients of influential variables more precisely considering lambda 0.09.

Conclusion: In the analysis of high-dimensional data, traditional statistical methods cannot be used. Lasso regression can solve this problem and estimate the coefficient of each variable robustly.

Keywords: COVID-19, High-dimensional, Ridge, Lasso, Survival.

Prediction of post-operative clinical parameters in posterior scoliosis surgery through an adaptive neuro-fuzzy interface system

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Background and Objective: Post-operative clinical indices should be estimated accurately in scoliosis correction surgeries. It has been analyzed in various studies such as experimental (in vitro or in vivo) trials through different modeling methods (finite element or multi-body analysis). These costly and time-consuming methods can only be applied to a large population of scoliotic patients. An adaptive neuro-fuzzy interface system (ANFIS) is used in this study to estimate the post-operative cobb and thoracic kyphosis angles in adolescent idiopathic scoliosis patients undergoing posterior scoliosis correction surgeries.

Methods: Four groups of 55 patients with distinct pre-operative clinical indices (thoracic cobb and pelvic incidence) were use1d the ANFIS inputs, whereas posto-perative thoracic cobb and kyphosis angles were utilized as the outputs. For robustness evaluation, the predicted values of post-operative angles were compared with measurements by calculating the root mean square errors and clinical correction deviation indices (the relative deviation of post-operative predicted angles from the real angles).

Results: The least root mean square errors (3.0º and 6.3° for the main thoracic cobb and thoracic kyphosis estimations, respectively) were recorded in the group with the main thoracic cobb, pelvic incidence, thoracic kyphosis, and T1 spinopelvic inclination used as inputs. The clinical correction deviation indices were calculated 0.0086 and 0.0641 for cobb angles in two cases and 0.0534 and 0.2879 for thoracic kyphosis in two other cases.

Conclusion: Greater differences between pre-operative and post-operative cobb angles compared with those of thoracic kyphosis decreased the root-mean-square errors and clinical deviation indices but improved accuracy.

Keywords: Cobb angle, Pelvic incidence, Scoliosis correction, Spine, Thoracic kyphosis

Are the criteria for diagnosing and treating autism effective? A short review on application of artificial intelligence in autism spectrum disorder

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Background and aims: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder which according to the gold standard, diagnostic criteria of ASD are based on behavioral observations. While studies show that the validity and reliability of these criteria are questioned when accounting for subjectivity, this is while artificial intelligence is able to process data that is not visible to the human eye in behavioral observations, and can lead to providing more accurate data.

Method: This study summarizes 18 articles in PubMed data center that examine the performance of artificial intelligence in ASD in the form of a short review.

Results: In this paper, some of the research works in the field of application AI (Artificial Intelligence) and ML(Machine Learning) The results show that adjusting models based on genetics, neuroimaging, and VR glasses are more accurate, valid, and reliable.

Conclusion: In this review, we examined the diagnostic and treatment criteria used in autism. The use of artificial intelligence in diagnosis and treatment shows a bright future in this field, and the use of artificial intelligence along with expert doctors can increase accuracy and speed in the diagnosis and treatment of patients. Also, by reviewing the studies, it is suggested to conduct more studies in the field of artificial intelligence tools in the treatment of autistic people.

Keywords: Artificial intelligence, Autistic Disorder, Autism Spectrum Disorder

Artificial intelligence in Pharmacology and practice

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Background: In recent years artificial intelligence (AI), and especially machine learning (ML), has rapidly considered for applications in healthcare which pharmacology is a field of its' application where AI and ML approaches are particularly useful to analyze data according to different aspects as chemical structure to clinical informations of patinets or from genomic data to disease stages. For several days ,AI has being applied in drug discovery and identification of drug targets. Morever, AI models which help to describe character pf patients and predict an drug response of individulas are being shown, which occupy from drug discovery to personalized medicine .In this minireview we discuss about some of these applicants.

Methods: By exploring some reseach data motors as Pubmed,Medline,Elsevier,Google Scolar,Ovids, we have assayed some AI pracices and applications in Pharmacology .as we accumulated more than 20 articles which describing use of AI in pharmacology learning and 15 articles in chemical structure identifications and dicoveries and more than 10 articles in personalised medicne and extacted their methods in these assays

Results: We have reached to some informations about AI in drug discovery, Clinical trials and real-world evidence and optimising of drug treatment, The routes of AI 's applications in drug discovery is multifaceted and if the target is known, AI can be used to predict chemical structures for desired targets. Finally ,a novel compound 's specifications can be reached by in vivo ,can be predictable by knowledge of known drug compounds and pharmacokinetics and pharmadynamics specifications . Applications of AI are standard practice in many pharmaceutical companies which already have been used as (Cytoreason) which has develpoped and offered models to some pharmaceutical companies and helped them for studying disease and drug pathways. Secondly, the structure of chemicals which known as efficient drugs or endogenic factors can be used for identifying the targets, so that revealing the structure of a target of a potential drug. Finally , an in vivo specifications of a new compound can be predicted through knowledges of known drugs, as pharmacokinetics and –dynamics informations. As in the early stages discovery of drug it can be predicted if a chemical is probably to fail, either by not binding to desirable target or potentially by undesirable ADME specifications, so investment in the development can be prevented before high costs trials have begun. These applications of AI can be considered as standard practice in many pharmaceutical companies which can help them for studying disease and drug pathways

Coclusion: In this mini review we have tried to show that AI approaches are widely used in many aspects of pharmacology,from drug discovery to real-world evidence and indiviualized medicine. In recent years, So we can predict that AI is rapidly progressing to become as a standard analytical tool in drug development.

Federated Learning in Radiology

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Background and aims: Artificial intelligence, particularly deep learning, has shown considerable promise in medical imaging. The models may be used to interpret radiological images to assist clinicians with clinical activities including disease diagnosis, medical intervention, treatment planning, and prognosis, to mention a few. However, the development of adaptable, robust, and accurate deep learning-based models frequently relies on the collection and time-consuming curation of large amounts of high-quality annotated training data, which should ideally come from diverse sources and patient populations to account for the heterogeneity that exists in such datasets. Federated learning enables different institutions to work together to create a machine learning algorithm without transferring any of their data. We did a review to assess the state of federated learning in radiology and to discuss its drawbacks and potential.

Method: A comprehensive search of valid English scientific databases such as PubMed, Web of Science, and Scopus was conducted from 2016 to 2022 using a combination of keywords such as "machine learning", "federated learning", "distributed learning", "medical imaging", and "radiology". The inclusion criteria for this study were articles that focused on FL as the main topic in their research and used medical image datasets. However, articles that used private datasets for the model, review papers, abstracts, short articles, pre-prints, books or book parts were excluded from this review.

Results: A total of 19 papers were included in this review based on inclusion and exclusion criteria. The quantity of papers on federated learning has been constantly growing since 2016. The largest collaborative effort contained data from 50 different hospitals/institutions, and all included research that featured at least two collaborating institutions. Interdisciplinary teams made up of clinicians and technical professionals carried out all of the studies. The majority of the studies were carried out in an international collaborative context, while the others were undertaken just in developed nations, all of which were developed. The dataset sizes of study individuals or derived data ranged from hundreds to tens of thousands. The most widely used models are convolutional neural networks (CNNs), but neural networks (NNs) and recurrent neural networks (RNNs) are also quite common. The majority of studies used offline learning to perform a binary classification prediction task.

Conclusion: Researchers face a number of open difficulties, including privacy-preserving hyperparameter optimization, entity resolution for vertically divided data, and efficient encryption methods. We anticipate that federated learning for medical applications will gain popularity in the near future, resulting in more advanced security and privacy assurances that will enable real-world implementation of federated learning systems. In comparison to other areas, the healthcare sector is in desperate need of the potential breakthroughs made available by machine learning and, in particular, federated learning.

Keywords: artificial intelligence, distributed learning, federated learning, radiology, machine learning

Emotional Artificial Intelligence, brings the images of humanoid robot

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Background and aims: A social Artificial intelligent robot is used in many aspects of our lives so must be capable to extract meaningful information in real time from the social environment and react accordingly with coherent human-like behavior.

Even the most advanced AI systems lack crucial elements like emotional intelligence and the ability to interpret information as humans do.

So, incorporating emotions, empathy, and ethical values into AI will be the next goal the tech-savvy people want to achieve.

The idea of emotional artificial intelligence (also known as 'Emotion AI') brings the images of humanoid robots in order to emotional recognition capabilities to their online assistant so that the users can experience more human-like interactions.

Method: Emotions can upbring different feelings to machines such as positive and negative reactions, Such as empathy and aggression.

Factors such as facial with speech sentiment for the mental state, and bodily expressions for emotional state, are a key aspect in the detection of emotions on machines.

Other way for recognizing emotions is the ability to sense physiological changes such as heart rate, muscle tension, skin conductance, temperature, which can track the person's cognitive and emotional stress by variable change.

Finally, it should be able to internalize this information, to reason on it at a higher level, build its own opinions independently, and then automatically bias the decision-making according to its unique experience.

Results: Adding Emotional Artificial Intelligence can have an effect on the various fields of studies like; Healthcare, Physics, Culture. Emotional Artificial Intelligence (EAI), can help vulnerable or older users to complete everyday activities.

Conclusion: EAI could stimulate users mentally and able to engage in meaningful social interactions, identifying the emotions of users and responding appropriately to them.

Keywords: artificial intelligence, Emotion, Robot, Humanoid robot, Emotional intelligence

Early childhood caries; using Machine Learning algorithms to identify leading risk factors

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Background and aims: Study aimed to integrate clinical, behavioral, social and laboratory data to find leading risk factors of Early Childhood Caries in young children (24-to-36-month-old) living in Tehran Iran using Machine Learning models.

Method: This ML analysis was carried out on the baseline results of a cluster-randomized community trial in Tehran, Iran, where 239 mother-child dyads who enrolled in public health care programs were selected through stratified cluster random sampling in 2012. Children's teeth were examined using ICDAS-II, dmf, and PI. Mothers filled out questionnaires about their background, SES, and oral hygiene habits and the children went to oral examination. In 2021, data were reanalyzed using four algorithms (Extreme Gradient Boosting /XGB, Random Forest/ RF, Adaptive Boost /ADB, and Support Vector Machine/ SVR) to find the hierarchy percentage of the leading factors to ECC. Python 3.8.5 and SPSS 19.0 were the soft wares to analyze the data.

Results: XGB was the most appropriate algorithm for these analyses. The age of cleaning children's teeth starts and visible plaque had 11.61% and 9.92% fostering effect among 62 risk factors, respectively, according to XGB. Heat maps of each model illustrated the correlation of variables with our defined target (ICDAS0) which formulated and calculated by the authors. It was the proportion of the sound tooth surfaces in an individual.

Conclusion: Machine Learning is recommended to design more effective and tailored oral health promotion interventions and to make better policies, regarding its power to find and prioritize the fostering factors of oral diseases.

Keywords: artificial intelligence, machine learning, Early Childhood Caries, ICDAS

Application of Artificial Intelligence to Advance Environmental Health Research: A Review

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Artificial intelligence (AI) encompasses any computer algorithm that makes predictions, recommendations, or decisions on the basis of a defined set of objectives. the recent growth of AI in effectiveness and popularity is due largely to a branch of statistical AI known as machine learning (ML). Every application of AI affects the climate, which means aligning AI with climate change strategies involves not only facilitating beneficial applications of AI, but also shaping the space of AI overall so that business-as-usual applications are more climate-aligned. The machine learning enabled pathogen detection device performance were evaluated with water samples taken from different sources. IoT with machine learning algorithm can be used in waste management system to develop the smart city in effective manner. It is clear that AI and IoT have an increasingly important and innovative role to play in providing more sustainable waste management, dealing with today's wastes, and moving forward to a zero-waste future based on the circular economy. The next frontier of technological advancements is the use of facility "flight simulators," or "digital twins," that enable dynamic process simulations. In recent years, data-driven analytics such as machine learning has become key tools for discovery in public health and environmental science and engineering research. Discovering materials and chemicals based on machine learning is rapidly growing. The results obtained from the review of articles from 2018 to 2023 show that artificial intelligence algorithms are widely used in health, environment and sustainable development. Commonly used algorithms in environmental research are: linear regression, logistics regression, decision tree, support vector machine, and random forest algorithm. The challenge is how to collect valid data. Data set biases occur when the training data are not representative of the planned use case and can arise when training data are inadvertently contaminated with the desired outcome information or when the training data are missing relevant examples. We should not over trust or overestimate machine learning tools. Although challenges lie ahead, there are still many opportunities (balance model fidelity and interpretability; data sharing; data collection from trusted sources; applications of ml models and Educational).In this review, I introduce AI for environmentalists and describe opportunities and threats of artificial intelligence and machine learning algorithm in the environmental health contexts.

Keywords: Artificial Intelligence, Machine Learning, Environmental Health, Evaluation, Prediction

Contribution of Iran in Artificial Intelligence in Healthcare Studies: A Bibliometric Analysis

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Background and aims: Artificial intelligence (AI) is revolutionizing the healthcare industry with its innovative applications in diagnosis, treatment, and prevention of diseases. Iran is a country with a rich history of scientific and technological advancements, and the healthcare sector has been no exception. To assess the contribution of Iranian researchers in AI healthcare studies, this bibliometric analysis was conducted. The aim of this study is to provide an overview of the trends and patterns in AI healthcare research in Iran.

Method: The study used Scopus, a comprehensive database of scholarly publications, to collect bibliographic data on publications authored by Iranian researchers in the field of AI healthcare. The search was conducted up until September 29, 2022. A total of 5,776 documents published between 1992 and 2022 were included in the analysis. The collected data was then analyzed using VOSviewer (Leiden University) and Bibliometrix (R package) to visualize the co-occurrence networks of authors, sources, organizations, international collaborations, keywords citations, and co-citations.

Results: The results of the study revealed that Iranian researchers have published a growing number of AI healthcare-related publications over the years. Iran ranked 18th in Scopus in terms of the number of publications, with an average citation per document of 13.56. The University of Tehran was the most active organization in this field, with 11.65% of publications, followed by Tehran University of Medical Sciences (8.84%) and Islamic Azad University (8.12%). The most active authors in AI healthcare research were Soltanian-Zadeh H. (0.93%), Zaidi H. (0.71%), and Shiri I. (0.69%). The most common formats for Iranian publications were original articles and conference papers. The study also found that Iranian researchers have mostly collaborated with researchers from the United States, Canada, Australia, and United Kingdom, respectively.

Conclusion: This bibliometric analysis provides a comprehensive picture of the contribution of Iranian researchers to AI healthcare studies. The results show that Iranian researchers have made significant contributions to this field and are actively engaging in AI healthcare research. The study highlights the need for greater participation from other Iranian institutions to maintain the increase in publications in this field. The analysis also offers insights to academic researchers, decision-makers, and healthcare professionals on future research directions and collaboration opportunities in AI healthcare research.

Keywords: Artificial Intelligence, Delivery of Health Care, Bibliometrics, Iran

Predicting In Vitro Fertilization Outcome with Artificial Intelligence

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Background and aims: In-vitro fertilization (IVF) is a widely used assisted reproductive technology to treat infertility. However, the success of IVF is not guaranteed, and it can be a costly and time-consuming process. The ability to predict the outcome of IVF before treatment can help couples make informed decisions and avoid unnecessary treatment cycles. Artificial intelligence (AI) has emerged as a promising tool in IVF outcome prediction, and this study aimed to review the current state of research in this area.

Method: A comprehensive search was conducted in PubMed, Web of Science, and Google Scholar databases for studies published until September 2022, without language restrictions. The search used relevant keywords, including "IVF," "ICSI," "artificial intelligence," "machine learning," and "prediction." Studies that explored the use of AI in predicting IVF/ICSI outcomes were included in the review.

Results: The review identified several studies that have used various AI models to predict IVF/ICSI outcomes. These models have employed many predictors, including female factors, male factors, embryo features, and treatment settings. Features and parameters under these factors include female age, male age, BMI, sperm characteristics, previous IVF cycles, previous abortions, embryo transfer, number of embryos, and previous live births. AI models such as Logistic Regression, Naive Bayes, K-Nearest Neighbor, Decision Trees, Support Vector Machine, Random Forest, Recursive Partitioning, Rough Sets, and Neural Networks have been used to predict the result of IVF/ICSI treatment.

The review revealed that the quality of AI models has improved over time in terms of clinical relevance, scientific methodology, and utility. The majority of models predicted the probability of pregnancy/live birth for a single fresh cycle. Moreover, some studies have shown that AI models can be used to optimize treatment plans and predict the chances of achieving a successful pregnancy following multiple cycles.

Conclusion: AI has emerged as a promising tool in predicting the outcome of IVF/ICSI treatment. The use of AI models can help fertility clinics provide more personalized care and tailor treatment plans as indicated. The ability to predict the outcome of IVF/ICSI before treatment can help couples make informed decisions and avoid unnecessary treatment cycles. However, further research is needed to validate the accuracy and reliability of AI models in predicting IVF/ICSI outcomes. Additionally, the implementation of AI models in clinical practice requires the availability of large datasets and the expertise to interpret and use the results. Nonetheless, the potential benefits of AI in IVF outcome prediction cannot be overlooked, and it is expected that AI will play an increasingly important role in assisted reproductive technologies in the future.

Keywords: Artificial Intelligence, Reproductive Techniques, Fertilization in Vitro, Pregnancy Outcome

In silico study of the expression of effective genes in chemotherapy resistance in gastric cancer

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Gastric cancer is one of the most common cancers of the gastrointestinal tract, which is one of the leading causes of death. Identification of effective factors in non-response to chemotherapy, especially genetic factors is essential for treatment. The aim of this study is in silico evaluatetion of the expression of effective genes in chemotherapy resistance in gastric cancer. In this study, gene expression data in two groups of chemotherapy-resistant gastric cancer cell lines and primary gastric cancer cells were selected and analyzed by GEO2R, then data with P-Value less than 0.05 and LogFc less than -1/1 They were transferred to String software and its output was transferred to Cytoscape and analyzed. the results of our study showed that APOA1, GAGE2A, CLU, CTAG1B, GAGE1, PRAME, MAGEA2B, MAGEA2 and CLU genes are the most effective genes in resistance to chemotherapy in patients with gastric cancer. In conclusion, due to the growth of gastric cancer, especially in developing countries and the identification of effective patterns in the development of resistance to chemotherapy in patients, so it can be used to plan treatment protocols to prevent the emergence and spread of resistant cases and with Targeting these genes through immunotherapy increased patients' life expectancy.

Key words: Gastric Cancer, Chemotherapy, Gene, Resistance

Evaluation of CYP2D6 polymorphisms and other parameters on the plasma concentration of the tomoxifen and its metabolites by machine learning approaches

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Background and aims: tamoxifen is one of the useful drugs in the prevention and treatment of breast cancer. Effectiveness of this drug is still under investigation in the CYP2D6 genetic polymorphism persons. It is hypothesized that poor metabolizer genotypes do not sufficiently convert tamoxifen to its active metabolites in the therapeutic concentrations and hence leads to the low efficacy and the risk of relapsing of the tumor. The aim of this study is to find any relationship between the tamoxifen metabolites plasma concentration and the genetic polymorphism of the CYP2D6 or the other parameters.

Method: In the present study, 84 estrogen receptor positive breast cancer patients which were previously involved in the determination of their CYP2D6 genetic polymorphisms and treated with tamoxifen in Sari, Iran were used. Totally, 22 independent parameters for each patient such as plasma concentration of endoxifen and 4-hydroxytamoxifen, number of delivery, number of abortion, size of tumor, duration of OCP usage, number of radiotherapy, duration of tamoxifen consumption, number of chemotherapy, Her2 status, Category of polymorphism, detail of polymorphism, polymorphism subgroup and etc., were included for analysis. All of the preprocessing steps such as encoding, data type conversion, partitioning, missing value handling, outlier detection and normalization were performed by KNIME Analytics Platform. Various machine learning methods such as logistic regression, decision tree, random forest, tree ensemble, gradient boosted tree and neural networks were also constructed and used in the KNIME Analytics Platform.

Results: Results showed that polymorphism subgroup has been used as root split in the decision tree algorithm to define the target parameter 4-hydroxytamoxifen with an overall accuracy of 69.5%. results of the random forest and tree ensemble methods with an overall accuracy of 73.9% and 78% respectively, indicated that the total duration of tamoxifen consumption, number of radiotherapy and duration of OCP usage are affecting the 4-hydroxytamoxifen plasma concentration.

Conclusion: polymorphism subgroups (EM/EM, EM/IM, EM/PM, IM/PM, PM/PM) which define the normal, intermediate or poor metabolizers was the first and main feature to correlate the plasma concentration of the 4-hydroxytamoxifen in the decision tree method. The plasma concentration of 4-hydroxytamoxifen was also dependent on the total duration of tamoxifen consumption and tamoxifen plasma concentration but the plasma concentration of endoxifen was found to be dependent primarily on the plasma concentration of the 4-hydroxytamoxifen. Since, tamoxifen is converted naturally to 4-hydroxytamoxifen by CYP2D6 and then to endoxifen by CYP3A4 isoenzymes, thus confirming our accurate predictions. The other main factors affecting the plasma concentration of the tamoxifen metabolites are the duration of OCP usage, number of radiotherapy and Her2 status.

Keywords: Breast cancer, CYP2D6 genetic polymorphism, Machine learning, Tamoxifen, Plasma concentration

Artificial intelligence and reduction of medical errors in laboratory diagnosis

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Background and aims: Studies show that in some countries (the United States), medical errors are the third cause of death, with 250000 deaths per year.Among the problems that commonly occur during provided that health care are misdiagnosis on Laboratory and Clinical In the stages of pre-analysis, analysis and post-analysis (laboratory diagnosis), disease diagnosis, drug prescription, surgery (clinical diagnosis). Although Laboratory analyses are crucial for diagnosis, and even they have a decisive role in medicine and are effective on decisions follow-up and treatment decisions, Anecdotal evidence from laboratory experts indicates that the laboratory has a prominent role in health care and laboratory results influence up to 70% of medical decisions Or even though the annual costs of the laboratory include less than 2% of all health care costs, that is, laboratory diagnosis offers high clinical value at a relatively low cost, but High error rates with serious significances are most likely to occur in different detection units. In this study, we assessed artificial intelligence and reduction of medical errors in laboratory diagnosis.

Method: By reviewing and studying the articles available in reliable search engines such as PubMed, Google Scholar in the field of artificial intelligence and laboratory diagnosis in medicine, valid articles in the field of medical errors and the areas of reducing them with the automation of diagnosis and the use of artificial intelligence.

Results: Artificial intelligence helps in the processing of Medical data and provides medical professionals with important insights in all fields of medicine. The most common roles of AI in medical settings are laboratory-clinical decision support and imaging analysis. Clinical decision support tools help healthcare providers make decisions about treatments, medications, mental health, and other patient needs by providing quick access to patient-relevant information or research. The purpose of this study is to investigate ways to reduce medical errors in laboratory diagnosis with the help of artificial intelligence.

Conclusion: By providing the necessary infrastructure for the combination of artificial intelligence and automated diagnosis in medical diagnosis laboratories, medical errors, slow diagnosis, high costs and limited services will be replaced by high accuracy and speed, cheapening of costs and widespread medical diagnosis.

Keywords: Artificial intelligence, Medical error, Laboratory diagnosis, Automatic analysis

Multi-slice and multi-contrast brain MRI reconstruction from under-sampled k-space using deep neural networks

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Background and aims: Deep Neural Networks have been widely employed for MRI (Magnetic Resonance Imaging) reconstruction from undersampled k-space, and their performance has suppressed the performance of conventional algorithms and methods. Undersampled k-space data acquisition can enhance the acquisition speed while addressing issues such as motion artifact, blurring, high SAR.

Method: We propose a multi-slice and multi-contrast (T1-weighted and T2-weighted) approach for reconstruction of the undersampled brain MRI. The proposed network relies on the mutual information between adjacent slices and various contrasts to obtain better results. The undersampling masks are designed in a complementary manner to reduce the redundancy of the acquired samples. The unacquired samples of each MRI contrast are first estimated from known samples of adjacent slices and the other contrast in the k-space domain (using K-Space-T2 and K-Space-T1 models) then a U-net model is used for further improvement of the estimated images, which takes both T1-weighted and T2-weighted images as input and predicts the T1-weighted image. The BRATS 2015 dataset is used for training and testing of the network.

Results: The PSNR and SSIM of the reconstructed images using 30% of the k-space samples were 44.382±2.139 and 0.987±0.005 respectively. We were able to achieve a better PSNR with lower variance for 30% and 40% under-sampling masks when compared to DAGAN and SARA-GAN.

Conclusion: Using mutual information between adjacent slices and complementary contrast can enhance the quality of MRI reconstruction. The empirical results shows that our proposed method has lower variance and subsequently worst-case situations are less severe. From the provided reconstructed images, it is evident that the error map is homogenous over the whole brain and the tumors are reconstructed as good as other tissues. It is important to note that Complementary mask design makes T1-weighted and T2-weighted series interdependent, which may introduce new artifacts and difficulties in practice. Also, the model assumes that the slice distance and imaging plane for each series are small and identical.

Keywords: Brain MRI Reconstruction, Deep Neural Networks, Multi-slice, multi-contrast, Undersampled K-space

Improvement prenatal care with artificial intelligence: A systematic review

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Introduction: Health issues can occur during pregnancy causing complications, as well as death of the fetus or neonate or maternal. Prenatal care avoids pathologies for the mother and her fetus. Recent studies show that Artificial Intelligence (AI), mainly through machine learning and deep learning models, has excessive potential for prediction, diagnosis, early detection of diseases and monitoring of the gestational and postpartum period. Computational models have been commonly used to predict prematurity, birthweight, mortality, hypertensive disorders, postpartum depression, ….

The main goal of this study is to present a systematic review of literature focused on computational models to predict mortality and morbidity perinatal period.

Methods: We conducted a systematic review of literature, limiting the search to the last 10 years of publications considering the five main scientific databases as source.

Results: From 458 works, 16 of them were selected as primary studies for further analysis. We found that most of works are focused on prediction of neonatal and maternal deaths, using machine learning models. The top five most common features used to train models are birth weight, gestational age, Apgar score and mother's age. Having predictive models for preventing mortality during and post-pregnancy not only improve the mother's quality of life, as well as it can be a powerful and low-cost tool to decrease mortality ratios.

Conclusion: Based on the results of this study, scientific efforts have been done in this extent, the community have to develop opportunities for many open research in this area.

Keywords: Machine Learning, Prenatal Care, Stillbirth, Neonatal Mortality, Maternal Mortality.

Implementing a Hierarchically Classification of COVID-19 and Pneumonia Diseases Using Deep Learning

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In December 2019, the COVID-19 virus, which was firstly observed in Wuhan, China, quickly spread around the world and became a global pandemic. At the beginning of the disease outbreak, due to its unknown nature and similarity of the symptom with the general structure of the diseases of the COVID group such as SARS and MERS, posed significant diagnostic challenges for physicians. So that the main diagnostic approach for physicians, considering the degree of lung involvement, was to observe the patients' X-Rays images. By increasing of COVID-19 disease and it's becoming a major issue all over the world, a huge data with different topics and formats has been produced in relation to the causes and different aspects of this disease, and as a result, it helps the growth of researches related to the disease. Meanwhile, artificial intelligence and machine learning algorithms have played a very prominent role in diagnosis of this disease. In this paper, we present a deep convolutional neural network for diagnosis of COVID-19 and pneumonia diseases by using X-Rays images. For this purpose, a hierarchical classification is adopted by using InceptionV3 fully connected deep convolutional architecture and by training two similar architectures on COVID-19, pneumonia and normal images for diagnosis of the diseases. The results of the proposed algorithm show an average accuracy of 98.76 % for classification of two diseases COVID-19 and pneumonia which is a high accuracy in comparison with similar methods.

Keywords: COVID-19, Pneumonia, X-Rays Images, Deep Neural Network, InceptionV3net, Hierarchically classification

Preparation of Abstract for the International Congress on Artificial Intelligence in Medical Sciences

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Background and aims: Multiple sclerosis is one of the most common neurological disorders, which is associated with symptoms such as fatigue, mental problems, and movement limitation. Comorbidity is highly prevalent in MS throughout the disease course. Comorbid conditions, including depression, anxiety, hypertension, diabetes, and other chronic diseases, adversely affect the quality of life. In this field, telemedicine and mobile health can have effective intervention by allowing long-distance patient and clinician contact, care, advice, reminders, education, intervention, monitoring, and remote admissions. Unfortunately, little attention has been paid to this effectiveness. Therefore, this study investigates the impact of mobile health on the multiple sclerosis patient's quality of life by controlling comorbidity.

Method: In this systematic review, keywords: Multiple sclerosis, health-related quality of life, mobile health, comorbidity, and related words such as e-Health were searched in PubMed, Google Scholar, science direct, Cochrane databases, and articles published between 2000-2022 that included the mentioned keywords in title or abstract, were extracted. The search was done by 2 Ph.D. students and, in case of conflict, resolved by consensus. In case of similar results, duplicate articles were removed and more comprehensive and original articles with higher citations were selected.

In this study, appropriate articles related to the impact of mobile health on the multiple sclerosis patient's quality of life by controlling comorbidity met the inclusion criteria and were reviewed, and also articles in none English languages were not included. Due to the heterogeneity of the articles and also the lack of quantitative data and systematic reviews, meta-analysis was not performed. The quality assessment of articles was done by the CASP checklist. This review is written based on PRISMA criteria.

Results: In this systematic review,379 articles were extracted and after the screening, 262 articles were removed, and 117 articles met the inclusion criteria, and after reviewing the full text, most of them referred to depression in MS patients, and finally13articles were selected, which in total And in short, they included two concepts, MS patient's quality of life and the impact of mobile health on quality of life and comorbidities such as depression, anxiety, etc. reviewing the articles showed that psychiatric comorbidity and depression happened more than others comorbidities and use of mobile health can play a positive role in the prevention and control of this comorbidities and improving the MS patient's quality of life.

Conclusion: Studies have shown that the use of mobile health can improve the quality of life by reducing the rate of depression and other comorbidities through meditation, yoga, diet, therapy sessions, and patient remote monitoring along with drug therapy. According to the results of this study, we suggest that in the field of improving the quality of life in the MS patient community, more efforts and research should be done according to the limitations of these patients for the more effective intervention of mobile health technology.

Keywords: Multiple sclerosis, health-related quality of life, mobile health, Comorbidity

Appraisal of Smart nano drug delivery systems

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ABSTRACT

Background and aims: Over the last decades, smart nano-systems have contributed excessively to the progress of drug delivery for medical applications. The smart Nano carriers improve drug bio-distribution and attack diseased cells while protecting healthy tissues. The goal of smart nano-medicines may be broadly defined as the comprehensive monitoring, control, fabrication, restoration, resistance, and advance of all human biological systems, operation from the molecular level using engineered devices and nanostructures, and eventually achieving medical benefits.

Method: This article highlights recent breakthroughs of smart nano-platforms made of organic (such as polymeric micelles and vesicles, liposomes, dendrimers, and hydrogels) and inorganic (such as quantum dots, gold, and mesoporous silica nanoparticles) substrates in cancer therapies.

Results: Smart nano-systems have appeared as potent drug deliveries for cancer treatment due to their extensive properties of high surface-to-volume ratio with a greater valence for drug loading and functionalization possibilities. Certainly, the utilization of clinical drugs is often restricted due to their inherent properties including poor solubility as well as unfavorable pharmacokinetics and bio-distribution. Whereas Smart nano-carriers in order to decrease the side effects and toxicity of chemotherapy drugs can potentially modify the drug solubility and extend the time of blood circulation, releasing the medicine in a controlled and sustained approach.

Multiple types of nanomaterials like synthetic materials such as liposomes, micelles, dendrimers hydrogels, and natural biomaterials such as virus-like nanoparticles, are widely employed as smart drug delivery systems for cancer treatments.

Conclusion: Despite the significant developments of recent synthetic approaches, most of all nano-carriers' function is associated with many undesirable side effects that reduce their efficient operation in biotechnology and nano-medicine applications. Moreover, since future drug delivery systems are predicted that use compounds that more efficiently are programmable, and responsive to biological cues, therefore, the field of smart nano-drug delivery has a bright future. Here, recent advances in smart nano-carriers in the development of novel platforms for the efficient transport and controlled release of drug molecules have been accentuated.

Keywords: Smart nano-carriers, Drug delivery, Cancer therapy

Comparing various methods of artificial intelligence in the diagnosis of polycystic ovarian syndrome

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Background and aims: polycystic ovarian syndrome (PCOS) is a common endocrine disorder in reproductive-aged women with the risk of complex long-term complications. However, early detection of PCOS is one of the most critical concerns in the field of women's healthcare. Owing to the complexity and various heterogenic profiles of the syndrome, identification, and differential diagnosis remain challenging despite the widely accepted criteria and tests. With the rapid development of artificial intelligence (AI), using machine learning and deep learning to assist with PCOS detection has attracted much more attention. In the current study, different AI methods applied to PCOS diagnosis are reviewed to highlight the best prediction model(s).

Method: The systematic review was performed on all published studies that have investigated the AI technology on PCOS detection based on the PRISMA statement, PubMed and Ovid's databases were searched up to November 2022 using the terms 'polycystic ovarian disease/syndrome', 'PCOS', 'Stein Leventhal syndrome', 'Rotterdam', 'ESHRE/ASRM', 'criteria', and 'AI', 'deep learning', and 'machine learning' algorithms.

Results: Based on the research design, algorithm type(s), number, and types of clinical parameters, the detection accuracy of each method varied greatly, ranging from 79-98%. Comparing the various applied AI methods showed that hybrid approaches are very much effective in the detection of PCOS, especially SVM/KNN/ Logistic Regression hybrid model with a 98% accuracy score. Moreover, XG Boost and CatBoost have been also proposed to function as strong models for the detection of PCOS with an accuracy score of 96% and 95%, respectively.

Conclusion: AI deep learning technology provides a powerful tool for detecting PCOS at an early stage and then early treatment of the patient. Ultimately, in order to achieve the highest detection accuracy of PCOS, hybrid approach-based algorithms on the most important genetic, epigenetics, transcriptome, clinical, metabolic, and immunological characteristics should be assessed.

Estimating faults of the sensors and actuators in the IoMRT system

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Faults are usually described as malfunctions of system components that make degradation in performance and product quality and, may lead to failure and damage to the plant, personnel, or environment. The purpose of designing a method for fault diagnosis is to obtain more detailed information about the fault such as the kind, size, location, and time. Fault Diagnosis is required for any complex engineering system such that the Internet of Medical Robotic Things (IoMRT). The speed and accuracy of fault detection in systems related to modern medical equipment, especially in a noisy environment, are very important due to the complexity of the technology used in it. Sensors and actuators used in medical robots may be faulty, while external disturbances are always present in real systems. Therefore, a timely and precise diagnosis of the fault can prevent the progressing fault in the system and its failure.

Background and aims: Various methods for model-based fault detection have been presented in research, among which the observer-based method has attracted the attention of many researchers due to its ability to estimate faults and provide a residual signal that is sensitive to faults and resistant to noise and disturbance.

Method: Sufficient conditions for the design of the proposed observer are such to guarantee the stability of the system, based on Lyapunov theory and linear matrix inequality (LMI) optimization problems.

Results: The proposed robust observer is able to estimate actuator and sensor faults in the robotic system at the same time, and also has a high resistance to disturbances and noises.

Conclusion: For further work, based on the information obtained from the observer, a fault-tolerant controller can be designed to compensate for the fault efficiency and ensure the robust stability of the closed-loop system.

Keywords: IoMRT, disturbances, Estimation, Sensor fault, actuator fault, robotic

Cholesterol uptake capacity for cardiovascular disease risk assessment in the MASHAD cohort study population

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Background: The efficacy of cholesterol uptake capacity (CUC) by HDL to reverse cholesterol transport (RCT), was exploited to evaluate the functions of HDL to predict the risk of cardiovascular disease. Therefore, we used a newly developed assay to investigate CUC as a robust measurement of HDL functionality.

Method: The study population samples of the Mashhad-Stroke and Heart-Atherosclerotic-Disorders (MASHAD) cohort included 153 individuals without CVD at baseline who then developed CVD over 10 years of follow-up (CVD group) and 350 samples without CVD. We used the modified (CUC) method, a cell-free, simple, and high-throughput assay to evaluate the HDL functionality of serum samples at the baseline of the study.

Result: This assay system exhibited high reproducibility; the Inter- and Intra- assay of the CUC criterion were detected as CV=13.07 and 6.65, respectively. Our data showed that the mean value of CUC was significantly lower in the CVD group (1.07±0.47) compared to healthy individuals (1.21±0.62) in the baseline study. Neither HDL-C changes over time were not significantly associated with the risk of progressing CVD, while a significantly negative association was found between CUC at the baseline samples and reduced risk of clinical CVD (OR=0.54, 95%CI= 0.35–0.82, P=0.005). Also, a decreased CUC was independently reverse-associated with the CVD event (HR, 0.62; 95% CI, 0.41-0.94, P=0.02). We determined the optimum cut-off point of 1.7 for cholesterol uptake capacity in the MASHAD cohort population (p=0.003). Furthermore, the CUC value was the third parameter that is significantly effective in assigning the CVD risk stratification-derived data mining analysis.

Conclusions: Reducing uptake capacity or impaired HDL functionality can be used as a marker for the prediction of progressive CVD. This high-throughput, sensitive, and cell-free assay, could possibly be used for the assessment of CVD risk in clinical settings.

Artificial Intelligence and Machine Learning in Orthopedic Surgery: Applications, Current State, and Future Prospective

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Background and aims: Artificial intelligence (AI) and machine learning (ML) have grown considerably in several major fields of medicine. Furthermore, with the unprecedented advancement of data aggregation and deep learning algorithms, AI and ML are reforming the practice of medicine. In particular, the field of orthopedics is uniquely suited to harness the power of big data and provide critical insights into elevating many facets of orthopedic surgery. The purpose of this review is to provide an update on the developments of AI and ML and evaluate the applications of AI and ML in the field of orthopedic surgery.

Method: This study is a narrative review of published articles in the field of AI and ML applications in orthopedic surgery. To obtain the resources, the keywords of "orthopedic surgery", "artificial intelligence" and "machine learning" were used in databases such as Google Scholar, Science Direct, PubMed, Wiley, and so forth.

Results: AI and ML applications in the field of orthopedic surgery could be deployed in three categories; clinical diagnosis, predicting postoperative outcomes, and complications. Clinical diagnosis through image interpretation is the most popular area of AI. For instance, AI algorithms have been applied to various medical conditions such as bone fractures which AI performed as well as or better than orthopedic surgeons in detecting the fractures. This can also be done by integrating the use of information from a patient's medical records, allowing the program to determine the most appropriate patient-specific imaging examination and surgical protocol. AI also improves quantitative image analysis by allowing automatic segmentation of the area of interest. Another major use of AI in healthcare is predicting the postoperative outcomes of patients based on a clinical dataset, genomic information, medical images, and surgical approach. Also, Risk assessment and outcome prediction have always been challenging in clinical medicine. AI offers a new direction that could potentially overcome these challenges. Moreover, in orthopedics, ML can be used to guide the management of patients by providing a patient-specific predicted rate of postoperative complications.

Conclusion: Orthopedic surgery is one of the most technologically innovative fields in medicine. Nevertheless, AI and ML adoption is still in the preliminary phase in orthopedics. Although the use of AI has developed in the vast majority of medical aspects rapidly, orthopedic surgery has been slower to do so. The AI technique can help making a diagnosis or decision in orthopedic surgery, for example ML approaches could be used to create a treatment decision support system with the intention of improving diagnostic accuracy and reducing costs. Further advances could enable the combination of AI and clinicians to make more rigorous classifications than human decision-making alone. Ultimately, there has been a recent surge in new research, emphasizing the need for further study in the field of orthopedic surgery.

Keywords: Orthopedic Surgery, Artificial Intelligence, Machine Learning

Vision Transformers: An effective method besides CNNs to capture the global context in medical image analysis applications

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Background and aims: CNN has been the prominent choice in many medical applications, including segmentation, diagnostic systems, and registration. The main deficiency of these models is their local convolutional operators which degrade the accuracy, especially in targets with long-range dependencies. Transformers have evolved as alternate architectures for the sequence-to-sequence prediction that employ convolution operators and exclusively rely on attention processes. Recently much research has been done to study the combination of CNNs and Transformers in medical image analysis applications. Accordingly, the aim of the current research is to systematically review recent developments of the CNN-Transformer fusion approach in medical applications.

Method: A comprehensive systematic literature search was conducted in electronic databases including PubMed, and Google Scholar for the English language. The chosen search strategy was ("Medical image" OR "image") AND ("Vision Transformer" OR "ViT") AND "CNN". This review paper focuses on the studies in the field of medical image analysis and also the studies that have the potential of being considered in medical applications. An overview of the most cited papers in ViTs with the potential in medical applications from 2021 to 2022 is considered. To perform an encyclopedic review, any study which combines CNN with ViTs in semantic segmentation, recognition, and registration applications was extracted, explored, and classified in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The publications were categorized into three categories based on their applications.

Results: We obtained 14600 records, of which 8040 records were deleted based on the duplication and limitation of the publication year in which exponential growth has been observed between 2021 and 2022. The full texts of 36 papers were reviewed, and finally, we selected 21 articles for our review process based on some metrics including the fusion strategy, citation, and the potential in medical applications. The majority of studies on the usage of hybrid ViT-CNN structures fuse the information at the feature level, in which the output tensors of multiple scales from the CNN-based encoder are fused with the ViT output and the corresponding up-sampled tensors. Semantic segmentation was used in ten of these studies, recognition in eight and registration in three.

Conclusion: Despite their success in medical applications, CNNs perform poorly when it comes to modeling long-range relationships and morphological variations of the target lesion. However, CNNs are better at capturing details. Therefore, fusing CNNs with ViT models has the potential to extract more diverse features, especially in medical applications. In this study, we conducted a systematic review to evaluate the proposed methods in medical image approaches and categorized the presented works based on the fusion strategy.

Keywords: Vision Transformer, ViT, CNN, Medical image, fusion strategy

Bibliometrics of using artificial intelligence and related technologies in the rehabilitation of brain vascular injuries

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Introduction: Bibliometric of using artificial intelligence and related technologies in the rehabilitation of brain vascular injuries. Artificial intelligence (AI) is a term used to describe the use of computers and technology to simulate intelligent behavior and critical thinking comparable to a human. Artificial intelligence has revolutionized medical technologies. Artificial intelligence in medicine is the use of machine learning models to search medical data and discover insights to help improve health outcomes and patient experiences. The use of this technology in the rehabilitation of patients with stroke and vascular brain injuries is known. This technology helps in various aspects from prevention to treatment, rehabilitation, and predicting the outcome of diseases

Methodology: This study is a bibliographic study that aims to investigate the role of artificial intelligence technology in this matter of all search processes continued by search engines and using the software Carrot2 search results clustering engine by Classification of various articles.

Search strategies followed by keywords of artificial intelligence & related technologies & rehabilitation & brain vascular injury patients.

Keywords were combined with and without search quotes using Boolean operators 'AND' and 'OR', and if needed, wildcard star '*' was used to expand the search; Also, topic search using mesh was used as a search standard. The search engine search and classification of articles examines and classifies all valid databases and search engines in the subject area field. After reviewing each article in the related field, the articles that fulfill the criteria of Prisma in the search are considered to enter into the review.

Results: The related articles were searched in full and then by classifying them into three sections, the use of technology by clinical doctors, use in patients and the type of technology used, the results were analyzed

The results showed that the use of technology in the group of clinical doctors includes: improving movement capabilities, improving daily activities, improving body movement in the upper and lower body, walking faster, improving the mental level and improving it, observing Patients' activities and their movement improvement, increasing daily capabilities, sensory return of organs, walking without assistance, control games, motor function rehabilitation, prediction of function return, examination of patients' prognosis, prediction of mortality rate, diagnosis, and prevention It is used from brain injuries, neurological ability, personalization of abilities and their rehabilitation.

In the field of patients: using virtual reality smart games for motor skills at home, improving self-care through smart platforms, daily monitoring, self-management and personal affairs, monitoring the improvement rate, and psychotherapy with games are used.

Articles related to the type of technologies used related to artificial intelligence also show that these technologies include the following: Brain-computer interface, socially assistive robots, Wearable accelerometers in free-living environments, Machine Learning for Motor Imagery Wrist Dorsiflexion Prediction, Machine learning, Computational intelligence, and game design, Patterns based on the spatiotemporal and adaptive filtering methods, An intelligent game engine, Wearable sensors for stroke rehabilitation, Soft actuators for stroke rehabilitation using deep learning, An Artificial Neural Network Algorithm, a fuzzy logic-based intelligent system for autonomous

guidance, rehabilitation robotics, smart wearable armband, and machine learning, Matching incomplete time series with dynamic time warping: Virtual reality, haptics, and modern sensing technique (VHS), Artificial intelligence-based wearable robotic exoskeletons.

Conclusion: The use of artificial intelligence technology in the rehabilitation of chronic diseases, including vascular injuries of the brain, can help doctors and patients to reduce the negative effects of the disease, and help the ability and early return of patients by improving their movement status. It also improves therapeutic mechanisms by predicting, observing, and monitoring patients.

Keywords: Bibliometrics, artificial intelligence, rehabilitation, cerebra vascular injuries

Developing a Chimeric-Vaccine against Epilepsy via Immunoinformatics and Artificial Intelligence techniques

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ABSTRACT

Background and aims: Epilepsy is a chronic neurological disorder characterized by recurrent seizures caused by abnormal electrical activity in the brain. Despite advances in pharmacological treatments, a significant proportion of patients with epilepsy do not achieve adequate seizure control, and there is a need for novel therapeutic strategies. Immunotherapeutic approaches, including vaccines, have shown promising results in treating various diseases, specifically neurological Disorders. Pathophysiology of epilepsy involves alterations in the expression or function of various proteins and immune system dysfunction, such as neuroinflammation and activation of immune cells. In this study, we propose a novel approach to design a multi-epitope chimeric vaccine against epilepsy, utilizing advanced Immunoinformatics and AI techniques. Specifically, we aim to identify and incorporate epitopes from proteins associated with epilepsy, including voltage-gated potassium channels, glutamate receptors, and synaptic vesicle proteins, into a chimeric vaccine that elicits a Th2-biased immune response.

Methods: Epitopes from various proteins associated with epilepsy were identified using bioinformatics tools. Predictions of MHC-1, MHC-2, and CTL epitopes were made, and the most immunogenic epitopes were selected. These epitopes were linked together using a linker to form a chimeric protein. The 3D structure of the chimeric protein was modeled using MODELLER, and the structure was refined using online servers and manual applications. Molecular dynamics (MD) simulations were performed using GROMACS to assess the stability of the chimeric protein that docked with TLR9. The immune response to the vaccine was simulated using the C-ImmSim server.

Results: The newly developed chimeric vaccine exhibited a well-structured design, with an ERRAT outcome that exceeded 80%, indicating a high level of stability. Additionally, the Ramachandran plot analysis revealed that more than 90% of the amino acid residues were in favorable and permissible locations. Molecular docking was used to bind the designed vaccine with TLR-9. Molecular dynamics simulations further confirmed that the chimeric protein maintained a stable conformation throughout the study. The vaccine›s solubility, antigenicity, and allergenicity predictions were all acceptable, suggesting that the human body will likely well-tolerated the vaccine. Moreover, simulations assessing the immune response elicited by the chimeric vaccine demonstrated a positive reaction from both the innate and adaptive immune systems, indicating that the vaccine has the potential to induce a robust and effective immune response. The vaccine protein was effectively cloned into the pET-21 b(+) / MEV vector, as confirmed by the results obtained from SnapGene cloning.

Conclusion: Using advanced AI and immunoinformatics methods, we have created a pioneering chimeric vaccine for epilepsy that targets multiple epitopes. This vaccine has the potential to provide immunity against a wide range of epilepsy-related proteins and offers an economical and rapid approach to vaccine development. Our results establish the plausibility of utilizing computational approaches to design vaccines for neurological disorders like epilepsy. Further validation in preclinical and clinical trials is necessary to ensure the vaccine's effectiveness.

Keywords: Epilepsy, chimeric vaccine, Immunoinformatics, bioinformatics

Advancements in Multi-Epitope Vaccine Development for Myasthenia Gravis: An Innovative Approach

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Background: Myasthenia gravis (MG) is an autoimmune neuromuscular disorder caused by the production of autoantibodies against the acetylcholine receptor (AChR) at the neuromuscular junction. Current treatment strategies for MG involve immunosuppressive drugs, which are associated with adverse effects, and may not be effective in all patients. Therefore, there is a need for new therapeutic approaches. Vaccines targeting the immune system have shown promising results in treating various neurological disorders, including MG. In this study, we aimed to design a multi-epitope vaccine against MG using advanced immunoinformatics and artificial intelligence (AI) techniques.

Methods: We utilized various bioinformatics tools to identify and select immunogenic epitopes from proteins associated with MG, including AChR, muscle-specific kinase (MuSK), and low-density lipoprotein receptor-related protein 4 (LRP4). The selected epitopes were linked using a linker, namely AAY, EAAAK, and GPGPG to complete a final sequence. Prediction of the tertiary structure of the chimeric protein via MODELLER, a Galaxy refines database used to refine the structure. GROMACS was utilized to conduct molecular dynamics (MD) simulations, in order to evaluate the stability of the chimeric protein in the blood. Furthermore, the solubility, allergenicity, and antigenicity of the vaccine were anticipated. Furthermore, to enhance the vaccine immune response, a 50S ribosomal protein L7/L12, which stimulates human innate immune receptors, was linked to the N-terminus. Finally, to simulate the immune response of the vaccine, the C-ImmSim server was employed.

Results: Select epitopes based on a combination of factors, including low percentile rank, strong binding scores, and favorable immunological characteristics. The chimeric protein was well-structured and stable, as confirmed by several analyses, including the ERRAT score and Ramachandran plot. The simulation of the vaccine binding affinity to TLR-2 and TLR-4 and the stability of the complex were achieved through energy minimization and molecular docking techniques. MD simulations confirmed that the vaccine-TLR complex maintained a stable conformation throughout the study. The simulation of the immune response demonstrated that the vaccine has the potential to induce a robust and effective immune response from both the innate and adaptive immune systems. Moreover, the vaccine antigenicity and allergenicity predictions were acceptable, suggesting that the human body would likely tolerate the vaccine.

Conclusion: Our study has led to the development of a groundbreaking new MG vaccine that utilizes a novel combination of antigens and advanced scientific techniques like immunochemistry and machine learning. This innovative vaccine can provide immunity against a range of proteins related to MG, and it has the potential to be an affordable and effective solution. Our findings demonstrate that computational techniques can be successfully employed to create vaccines for a neuroimmune disorder such as MG, and this methodology may apply to other autoimmune disorders. However, more extensive testing is necessary to confirm the vaccine›s efficacy in preclinical and clinical trials.

Keywords: Myasthenia gravis, chimeric vaccine, Immunoinformatics, bioinformatics

Application of machine learning algorithms in fMRI studies: a scientometric analysis

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Background and aims: Machine learning is a subfield of artificial intelligence, a branch of data science that allows computers to learn without explicit programming from existing training data. In recent years, there has been a significant increase in the application of various machine learning algorithms in the context of functional magnetic resonance imaging (fMRI). It is critical to determine which algorithms are applied in fMRI studies and how frequently they are employed. In order to provide a comprehensive roadmap for future research and strategic planning in this field, we performed a scientometric analysis of the scientific output of the application of machine learning algorithms in fMRI.

Method: In this scientometric study, a comprehensive search was conducted in Scopus using the terms "fMRI", "functional magnetic resonance imaging", "functional MRI", "machine learning", "deep learning", "supervised learning", "unsupervised learning", and "reinforcement learning" up to August 2022. The publications that highlighted both fMRI and machine learning or indicated the application of a machine learning algorithm in fMRI data processing were included in this study.

Using the Bibliometrix package in the R 4-2-1 programming language and the VOS viewer, the included documents were analyzed, and various scientometric parameters—such as the most-cited publications or co-authorships—were reviewed.

Results: A total of 2232 documents were obtained after the data were screened based on their titles, abstracts, and keywords. Since 2003, the studies have been published in 530 distinct journals, with the most publications appearing in the journal "NEUROIMAGE." From 2003 to 2022, the number of publications increased in this field of study. The top authors, as well as those with the highest total link strength, were listed. The top author was cited 10.63 times per year out of the 7735 authors that contributed to the publications. The United States was ranked among the top nations, having not only the most publications and citations but also the strongest cross-national interconnection. The keywords in this context were also investigated, and "Machine learning" and "fMRI" were among the most popular themes in Density Visualizations. Furthermore, the top documents on basis of their citations were highlighted.

Conclusion: The rising number of papers in recent years demonstrates a growing interest in the application of artificial intelligence in neuroimaging, necessitating additional research into the machine learning methods employed in fMRI studies. The results reveal that there is a need for greater deep learning and classification model application among the various machine learning algorithms, and on the other hand, it seems that error prediction and reinforcement learning models in this field have been overused. The citation and connection between nations were allocated to advanced countries, which might be attributed to the easier access to artificial intelligence technologies as well as the increased emphasis on academic collaboration in these places. The results also suggest that more machine-learning algorithms would be required in fMRI investigations of schizophrenia patients and people suffering from depression.

Keywords: scientometrics, functional magnetic resonance imaging (fMRI), Bibliometric package, machine learning algorithms, VOS viewer

Clinical Reasoning and Cognitive Errors: Is Artificial Intelligence the Solution?

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Introduction: Artificial Intelligence (AI) is the simulation of the human intelligence process by machines which provides the ability to data analysis, discover relationships, and learn through computer systems. This means machines can mimic human mind reasoning and improve the speed and accuracy of data processing.

Main text: One of the newest fields of AI is the role of AI in health systems for the diagnosis and treatment of diseases. Clinical decision support systems (CDSS) are computer-based programs that analyze data to assist healthcare providers in implanting evidence-based clinical guidelines at the point of care. Clinical decision-making involves a reasoning process in which clinicians or machines with AI combine different information to present a reasonable conclusion, so that, it is better to call it CRSS or clinical reasoning support system.

There are two main types of CDSS including: 1- knowledge-based and 2- Data-driven. The first type analyses the inputs based on the available knowledge from the database and provides appropriate outcomes such as Up-to-date online medical guidelines.

The second type is a kind of machine learning or deep learning. Machine learning is a subset of AI that uses statistical methods to learn without being explicitly programmed. Deep learning is a subset of machine learning in which artificial neural networks adapt and learn from large amounts of data.

The entrance of AI into medical science and clinical reasoning has several advantages and disadvantages. One of the most important benefits is lowering the rate of heuristic errors and cognitive biases. Heuristics are mental shortcuts or rule-of-thumb strategies that shorten decision-making time but are often fallible because they may cause several types of unconscious errors like availability errors, representation errors, anchoring errors, and confirmation errors.

Most cognitive errors are reduced by the assistance of computers, however, some other errors are associated with the implantation of AI such as base rate neglect. For example, if the software has been designed based on the data from a population in a special geographical region and we want to apply it in another part of the world, the provided differential diagnoses by the software would not be reasonable since the base rate of diseases are different in various regions and can affect the results.

Also, there are several other pros and cons to the application of AI in medical science such as challenges to professional ethics.

Conclusion: AI was thought to be a solution for heuristic errors, although its usage can be accompanied by magnifying several biases like algorithm bias, black box bias, base rate neglect, and user-producing data.

Keywords: Clinical Reasoning, Cognitive Errors, Artificial Intelligence

Review on Artificial Intelligence in Cancer Research; diagnosis, prognosis and prediction

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Background: Cancer remains a significant global health issue and is currently the second leading cause of death in the United States. Early diagnosis and early cancer detection increases the chances of receiving effective treatment for many tumor groups. Utilizing artificial intelligence(AI) specially Machine learning(ML), where computers learn complex data patterns to make predictions, sheds new light in the field of cancer research specifically in the context of prediction, diagnosis and prognosis.

Method: PubMed and Medline were screened for articles developing AI in the settings of diagnosis, prognosis or prediction from 2020 onwards.

Results: ML as one the most important domains of AI, has been emerged as a promising tool in cancer diagnosis, leveraging complex patterns in medical imaging, laboratory results, and patient records to predict cancer development and progression. Multidisciplinary collaborations are essential to overcome the challenges of implementing AI and ML in cancer diagnosis. Radiomics and radio genomics analyses are being explored to discover objective mathematical features for integrated diagnostics in disease management. The successful application of AI for diagnostic purposes in cancer imaging has led to the exploration of AI-based imaging analysis for addressing complex clinical needs. AI-based predictive models have demonstrated their value in treatment selection and identifying patients who would benefit most from intensive therapies. This approach has resulted in improved patient outcomes and survival rates, while also minimizing unnecessary harm from aggressive treatments for low-risk patients. In the field of radiology, AI has been utilized to identify novel predictive and prognostic biomarkers, enabling more informed clinical decision-making.

Conclusion: Collectively, the use of AI and machine learning in cancer research has shown great promise in improving the accuracy and efficiency of cancer diagnosis, prognosis, and treatment selection. With continued research and development, the integration of these technologies into clinical practice has the potential to revolutionize cancer management and improve patient outcomes.

Keywords: artificial intelligence, cancer, predict, prognosis, diagnosis

Designing a smart wristband to increase patient safety and quick access to patient's clinical information

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Background and aims: To maximize patient safety, the World Health Organization (WHO) set six goals, which are considered a real health challenge worldwide. Patient identification was considered the first goal for safe care, and its main goal is to ensure that the correct care and treatment protocols are performed on the correct patient. Today, in many countries, at least two identifiers written on a paper wristband and attached to one of the four organs of the patient are used to identify the patient. If paper wristbands are used, the patient identification information may be removed or illegible due to poor design, low resistance to paper tearing, and deformation due to moisture. According to the clinical experiences presented in the studies, some factors such as moving the patient from one bed to another in the same ward, the patient's state of consciousness, transferring the patient from one ward to another, not having a companion, the inability to speak in some patients such as children, etc, may increase the possibility of error in the patient identification process. Also, in paper wristbands, only demographic identifiers are used, while if the patient's clinical information is also available in this way, the medical visit and nursing care will be done in a more favorable way. Considering that today's clinical environment is very dynamic and demanding and so far modern technology has not been used to solve the above problems, therefore, smart wristbands to increase patient safety and quick access to the clinical information of patients in the educational and treatment center of Imam Reza General Hospital Tabriz was designed in 2023.

Method: A smart wristband and health information software with a special QR code is designed for each patient. Doctors and nurses can connect to the patient's health information software by scanning the QR code, entering their medical and nursing system numbers, and accessing the patient's demographic and clinical information.

Results: The design of smart wristbands makes it possible to use waterproof electronic wristbands instead of using paper wristbands. Also, by scanning the assigned code for each patient, the treatment and care staff are connected to health information software that provides quick access to a summary of demographic information, past treatment history, and current clinical information of the patient during visits and care.

Conclusion: The use of patient health information systems through the provision of high-quality health care can have great potential to ensure patient safety, minimize medical errors, and improve the performance of health care professionals.

Keywords: Health Information System, Wristband, Patient Identification, Patient Safety

Evaluation of the Interface Quality of a Mobile Application for Kidney Transplant Candidate Patients on the Waiting List: Expert Point of View

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Background and aims: Digital innovations such as Mobile phone applications can successfully encourage patients and families to the self-management of chronic disease. Also, Adherence to chronic disease management such as chronic kidney disease (CKD) is critical to achieving improved health outcomes, quality of life, and cost-effective health care with participation in complicated disease management strategies. So, these applications should be designed to be learnable, usable, and interesting to patients. This study aimed to evaluate the interface quality of the mobile application for kidney transplant candidate patients on the waiting list.

Method: The cross-sectional study was conducted in Montaseriyeh Hospital in Mashhad using Mobile Apps Rating Scale (MARS). This multidimensional instrument is a comprehensive questionnaire for assessing the quality of apps. MARS covers 4 dimensions, which include engagement (items= 5), functionality (items= 4), aesthetics (items= 3) Information quality (items= 7). Each MARS question was assessed on a 5-Likert scale range (1-inadequate, 2-poor, 3-acceptable, 4-good, and 5-excellent). MARS translated from English into Persian. In order to achieve high-quality translation, the reliability, fluency, and appropriateness of the translated questionnaire were greatly emphasized. Verification of the content validity of translated questionnaires was carried out by an expert panel (medical informatics experts= 4 and computer engineers= 4). Content validity was measured using four experts (one medical informatics specialist and one IS practitioner with long experience in the mobile business and two potential system users) who were invited to conduct the expert rating.

Results: The interface design of the mobile application for kidney transplant candidate patients on the waiting list was reviewed by 5 medical informatics specialists and 5 kidney transplant specialists. The MARS total score had excellent and the dimensions score were as follows: engagement= 4, functionality= 4.5, aesthetics= 4, and information quality= 5. The Content Validity Index of MARS was 88.52% and the Content Validity Ratio of MARS was 93.57%.

Conclusion: Many patients with CKD are currently interested in using the internet and mobile health, but few use mHealth apps or have adequate quality. This case application acquired a fair quality score by MARS from experts' perspectives. The app seems well-trialed for kidney transplant patients and can be used for kidney transplant centers. Also, in future studies, we suggest that the app will test from the patient's point of view and improved based on their recommendations.

Keywords: Telemedicine, Chronic Kidney Disease, Kidney Transplant, Mobile Health, User Interface, Mobile App Rating Scale

Exploring Novel Smart Hydrogel Dressing for Wound Monitoring and Accelerating Wound Healing (review)

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Background and aims: Timely and effective managing wounds to proper wound healing without any associated complications is a challenging, expensive, and protracted treatment process. In contrast to traditional hydrogel dressings, smart wound dressings have been developed as the new generation of wound dressings with real-time and continuous monitoring of the physicochemical properties, accelerated treatment of the wound by delivery of therapeutic agents, biocompatibility, the functions of antibacterial, hemostatic, and sufficient mechanical elasticity and adhesion. The aim of the current research is to provide an overview of the most recent developments in the smart hydrogel dressing for skin wounds, containing references from the last two years.

Method: In order to search for relevant publications that met the criteria of this study, we conducted a comprehensive literature search of five databases (PubMed, Science Direct, ACS Publications, Scopus, and Google Scholar). The research strategy was to investigate the latest and newest innovations in smart hydrogel dressings for wound healing. Therefore, according to combinations of the following keywords: smart hydrogel, wound dressing, smart dressing, and wound monitoring, any published document of the last two years (from January 2022 to March 2023) has been evaluated. Depending on these features, only 8 studies met all the review criteria and were comprised in the final analysis. Extra papers were included, after investigating all the references from the selected articles.

Results: In recent research, the management of wound healing parameters is based on smart hydrogel sensors incorporated into wound dressings. All of them have assessed the physical, chemical, and therapeutic properties of smart wound dressings. We report the synthesis, fabrication, and application of novel "smart" hydrogels wound dressing that provides smartphone-based detection of the wound healing process and intelligent wound monitoring. The advanced hydrogel biosensors are applied to the wound dressing in order to respond to various biomarkers such as pH, temperature, uric acid, oxygen levels, pressure, humidity, glucose concentration, therapeutic agents and antibiotics, and microorganisms' by-products that serve as indicators of the wound status.

Conclusion: This review reveals that significant advances have been made in terms of wound monitoring, drug delivery to heal wounds, and antibacterial properties of smart hydrogel dressings, but there is a lack of studies examining smart hydrogel wound dressings in human skin. New studies are required to evaluate clinical trials of smart wound dressings.

Keywords: Smart Hydrogel Sensor, Smart Wound Dressing, Intelligent Wound Monitoring, Wound Healing.

The Usage Pattern of The Internet and Social Media Transgender People

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Background and aims: Transgender people have unique healthcare needs, but gender identity disorder puts them at higher risk of different health problems. As well, these people are in minority in relation to the whole society. The Internet affords an appropriate environment for transgender people that counters heteronormative environments and potentially supports mental health and well-being. This study aimed to explore patterns of the internet, social media, and online health information in transgender people in a Muslim developing country.

Method: A structured questionnaire with 16-items was developed based on International Telecommunication Unions' (ITU) Manual for measuring ICT access and use by households and individuals. The questionnaire acquired fair Content Validity Index (CVI) and Content Validity Ratio (CVR) from an expert panel. The expert panel comprised seven psychiatrists and three medical informatics and one epidemiologist. Also, the reliability coefficient was calculated using Cronbach's alpha for the totality of items. The questionnaire comprised of four sections: demographic information, social support, the pattern of cell phones, and internet usage. The results were reported by descriptive statistics using SPSS 11 software.

Results: Finally, the 16-items questionnaire was developed. According to our results, the CVI and CVR of the questionnaire respectively were 81.25 and 80.42. The value of Cronbach's alpha was %78.1, which indicates good internal consistency. Almost all participants were using the internet and social media on daily basis. A small group of the participants was not sending messages or making phone calls by cell phone. The majority of the participants access the internet via mobile phone (n=67, 97.1%). The home internet was the second most popular internet connection among the participants (n=21, 30.4%), and the majority of participants were online at night time (n=52, 75.4%). The most popular social media applications among the participants were in the following order: WhatsApp, Telegram, and Instagram. Almost half of the participants were using the internet and social media at night. The most important activities on the internet and social media were as follows: sending messages, watching or following people's daily stories, and communicating with family and friends.

Conclusion: Given, transgender persons have a secret life in our country; our results showed that social media can support the mental health of transgender people and the high penetration internet between them. It seems to the development of a web-based healthcare application can help transgender persons to manage their everyday life through peer connection, identity management, and social support.

Keywords: Transgender Persons, Health Services for Transgender Persons, Social Media, Internet Use, Health Literacy, Consumer Health Information

Designing a Minimum Data Set for Tele-monitoring System for Kidney Transplant Patients in Waiting List

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Background and aims: The prevalence of chronic kidney failure has increased worldwide. Kidney transplantation is essential for the survival of these patients that need continuous care. The remote monitoring system is one of the new methods of providing continuous healthcare monitoring and self-management for these patients. Also, a comprehensive dataset can be effective in improving the quality of care and disease control. The aim of this study was to identify the Minimum Data Set (MDS) required for the care of patients waiting for a kidney transplant in a remote monitoring system.

Method: This descriptive and cross-sectional study was conducted in 2019. In the first step, MDS for the telecare system of kidney transplant candidates on the waiting list for transplantation was identified based on the literature review and medical record forms which contained forms of sociodemographic, registration, medical history, and physical examinations. In the second step, the MDS face validity was checked by an expert panel. Then, the clinical importance of MDS was determined on a 5-Likert scale (1=not important, 2=low importance, 3=medium importance, 4=high importance, 5=very important) by kidney transplantation experts (n=6) and medical informatics experts (n=5). Data elements with an average of 80% agreement on scores 4 and 5 were directly entered into MDS. Data elements with an average agreement between 70%-79% were reviewed in the specialized meetings of the research team, and data elements with less than 70% agreement were excluded from the study.

Results: 209 data elements were identified from the literature review and medical record forms. After determining the MDS clinical importance by experts, 34 data elements were removed from the study and 175 remained and were divided into 9 general categories, which include: social-identity information (n=5), general information (n=5), drug, tobacco, and alcohol abuse status (n=20), medical history, disease records and medical procedures (n=65), imaging (n=7), pre-implantation consultations (n=11), pre-transplant care training (n=1), tests (n=44), and drugs (n=3).

Conclusion: The main data elements for the kidney transplant telemonitoring system were proposed in the current study. Designing a telemonitoring system based on MDS, information technology and effective use of telemedicine and telehealth services is an effective step in the treatment management and transplant status of kidney transplant patients. Given, the usage of the standard data in telemonitoring systems is useful in patients' education, healthcare follow-up, and improving medical conditions. We think our MDS can be helpful for kidney transplant patients on the waiting list and can be used in future studies.

Keywords: Minimum Data Set, Telemedicine, Chronic Kidney Disease, Kidney Transplant,

The application of Spiking Neural Networks in Schizophrenia

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Background and aims: Nowadays, machine learning is widely used in various medical research projects. Deep learning is one of the well-known subsets of machine learning, which includes different Neural Network (NN) types. Spiking Neural Networks (SNNs) that closely mimic natural neural networks are one of the brand-new concepts of the next generation of NNs. In addition to neuronal and synaptic status, SNNs incorporate time into their working model.

Schizophrenia is a serious mental disorder in which people interpret reality abnormally. Schizophrenia may result in some combination of hallucinations, delusions, and extremely disordered thinking and behavior that impairs daily functioning and can be disabling. One of the most discussed theories about Schizophrenia etiology is the idea of functional disconnections. The main motivation is that Schizophrenia cannot be explained by an impairment of a single brain region but only by a decreased interaction between multiple brain regions. Our research goal is to model Schizophrenia with SNNs based on pruning the connections between neurons of different regions.

Method: In this article, the keywords "Schizophrenia," "Spiking Neural Networks," and "Neural Networks" have been searched in international databases of articles such as PubMed, Google Scholar, Science Direct, Elsevier, Scopus, and proper articles were extracted, and reviewed. According to the available articles in those databases, no article that has worked on modeling Schizophrenia with spiking neural networks was found.

Results: Spiking Neural Networks are superior but more complex than traditional neural networks in many aspects. SNNs can perfectly model the malfunction of neuron connectivity (disconnection) since they emulate biological neuronal functionality by processing visual information with binary events (i.e., spikes) over multiple time steps. Therefore, SNNs are considered suitable models for processing spatiotemporal brain data (STBD) because they can be implemented using several models. When an SNN is already working, it can still train. Also, to train an SNN, you simply need to train the output neurons. SNNs typically have fewer neurons in comparison to Traditional ANNs. Last but not least, SNNs can work incredibly quickly due to sending impulses instead of a continuous value. According to the above-mentioned traits of SNNs and by considering discussed studies for Schizophrenia, disconnection is primarily implemented by an increased pruning of synapses. Such pruning is a normal developmental process between adolescence and early adulthood. Computational models demonstrate that too strong pruning can cause fragmented recall or the recall of new patterns, which can be related to the symptom of hallucinations in Schizophrenia.

Conclusion: SNNs are difficult to train due to various hyper-parameters and their training time. And so far, there is no learning algorithm built expressly for modeling Schizophrenia. Also, building a small SNN is impracticable. Notably, the Schizophrenia symptoms replicated with connection pruning focus solely on hallucinations or delusions. In fact, it might be more appropriate to disturb connections between neurons in a biological context instead of simply cutting them. In conclusion, it can be assumed that hallucinations in patients diagnosed with Schizophrenia can be modeled by SNN methods based on disconnection to predict patients' conditions.

Keywords: Schizophrenia, Spiking Neural Networks, Neural Networks, Artificial Intelligence

The Role of Artificial Intelligence (AI) in Diagnosis, Treatment, and Prognosis of Neuroimmune Disorders

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Background and aims: Neuroimmunological disorders refer to a group of diseases where the immune system attacks the nervous system. These diseases can affect various parts of the nervous system, such as the central nervous system, peripheral nervous system, and neuromuscular junction. There is a increasing amount of neuroimmunological data available from clinical records, biological indicators, and imaging. Thus, it is crucial for clinicians to give more consideration to this information. Artificial intelligence (AI) can aid clinicians in analyzing and interpreting clinical data and images more effectively, leading to better decisions. AI-based processing on a large scale can also help clinicians to evaluate their hypotheses. Additionally, AI can be utilized to predict and detect neurological disorders. This article provides an overview of current research advancements in machine learning (ML) and deep learning (DL) methods for organizing big data in this field. It also discusses the challenges, options, and future directions for AI-based applications in the diagnosing, treating, and predicting the prognosis of neuroimmune disorders.

Method: To find relevant studies, we searched through three databases: PubMed, Web of Science, and Scopus. Our search terms were "Artificial Intelligence", "Neuroimmune Disorders", "Machine learning", and "deep learning". We also manually searched through the reference lists of the studies we found to identify any additional relevant articles.

Results: The technology of AI has great potential for processing clinical data and medical imaging. Most of the ML methods used in studies were linear regression, logistic regression, decision tree, SVM algorithm, and random forest algorithm. The SVM algorithm is more effective in diagnosing disease than other methods. Unfortunately, no symptoms, physical findings, or laboratory tests can accurately diagnose most neuroimmunological disorders. For this reason, several combined approaches are used to diagnose and manage, including reviewing the clinical data, medical history, imaging such as MRI and CT scans, cerebrospinal fluid analysis, and blood tests. When researchers use data from patients, non-uniformity is one of the important problems that they have, and some data, like MRI, are expensive on a large scale. In addition, ethical and privacy issues are associated with medical data sharing. To overcome these issues, researchers could use online datasets such as ISBI 2015, MICCAI 2008, MICCAI 2016, and eHealth lab to apply their algorithms. For evaluation, AI models could test in cohort studies or hospitals under the supervision of a clinician. ML algorithms increased the power of diagnosis significantly. However, a combination of knowledge from clinicians and ML algorithms yielded a higher predictive ability than ML alone and clinician alone when asked to diagnose and predict the prognosis.

Conclusion: AI is widely used in healthcare to achieve various goals, such as disease detection and prediction, drug and vaccine design, and personalized therapies. Early detection aided by AI-based techniques could increase patient's survival. Furthermore, it is crucial to have a deeper

understanding of the potential applications and limitations of AI-based methods to ensure their sustainable and ethical implementation. This development is a positive step toward managing neuroimmunological diseases, and further research is necessary to expand AL-based methods in the care of neuroimmunological diseases.

Keywords: Artificial Intelligence, Neuroimmune Disorders, personalized therapies, predicting prognosis, AI algorithms

Proptosis severity detection on Orbit CT scan with using image processing and supervised learning

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Background and aims: Graves' ophthalmopathy (GO) is a chronic autoimmune disease affecting the retrobulbar tissues and extraocular muscles; 40–60% of patients may experience extraocular muscle dysfunction. Hence, the early diagnosis of extraocular muscle abnormalities by orbital imaging may be essential for effectively managing thyroid myopathy. It is unlikely that orbital imaging will be performed in clinical practice unless there is a complaint of double vision. Additionally, radiologists may not always be available to interpret the results, especially in remote areas and developing countries. Therefore, this study aims to develop a diagnostic software system to evaluate the severity of proptosis and enlarged extraocular muscles (EEM) on nonenhanced computed tomography (NCCT) in patients with Graves' ophthalmopathy (GO) by a deep neural network.

Method: This retrospective observational study recruited 20000 participants (20000 EEM patients with GO) whose extraocular muscle thickness of medial and lateral recti will be measured on axial scans. The maximum thickness of the superior rectus–levator palpebrae superioris complex and inferior rectus will also be measured on the coronal scans. Moreover, on axial scans in the midglobe slice, the distance between the inter-zygotic line and the posterior and anterior ocular surfaces will be calculated to determine the position of the globe. Our cutoff values for the length of the inter-zygomatic line and distance of the line from the posterior and anterior sclera are 97mm, 5.9 mm, and 23mm, respectively.

Afterward, we began by preprocessing the images to remove noise and artifacts and then extracted relevant features using image processing techniques. We used a supervised learning algorithm to train a model to detect proptosis severity based on the extracted features. We evaluated the performance of our system using a separate set of validation images.

Result: this article is a work in progress but in accordance with similar articles we are anticipating a more efficient model than others and more than 80% efficiency.

Conclusion: Our study demonstrates that image processing and supervised learning can be used to develop an accurate and reliable system for automated detection of proptosis severity in orbital CT scans of patients with Graves Ophthalmopathy. The proposed system can provide an objective and consistent method for evaluating the severity of proptosis, which can aid in the diagnosis and treatment of this condition. Future research may explore ways to improve the performance of our system further, including the incorporation of additional imaging modalities or clinical data.

Keywords: artificial intelligence, Graves' ophthalmopathy, neural network, proptosis

Evaluating the side effects of Covid-19 vaccines with artificial intelligence methods

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Background and aims: During and after the Covid-19 vaccination, various side effects of vaccines made up a global debate. In addition, realizing the side effects of vaccines as soon as possible can lead to accurate monitoring of the vaccination process during pandemics. A precise and quick way to collect side effect reports of these vaccines is through artificial intelligence (AI) techniques. We conducted a systematic search to evaluate the side effects noticed through the artificial intelligence aid.

Method: We searched for the related articles in three databases; PubMed, Scopus, and Web of Science with the keywords related to Covid-19 vaccines, side effects, and artificial intelligence terminology. Out of 203 articles for screening, we selected 14 articles after applying exclusion criteria which consisted of congress, non-English, lacking full-text articles, etc.

Results: According to the results, the most used data for constructing AI methods source is the Vaccine Adverse Event Reporting System (VAERS), but data sources such as Twitter, Kaggle, and electronic health records (EHR) were also frequently employed. Most of the AI models are based on CNN (Convolutional Neural Network), regression networks, and neural networks. Text mining is the most frequently assisted method for data extraction. According to our results, death and allergic symptoms are the basis of side effects that people paid more attention to them. We revealed that in all reports women to complain more about side effects. We found that headache is the most complained side effect of Covid-19 vaccines in overall articles, and fatigue is the second most complained side effect in overall results. According to our study, we concluded that in social media such as Twitter, more severe side effects such as thrombosis and anaphylaxis are mentioned, which causes a discrepancy with the results of other data sources. Despite the reports mentioning not observing anaphylaxis after the Moderna vaccine injection, studies based on AI reveal that it is a vital side effect of that brand, which shows the ability of AI to check more information about the disease and can be used properly in pandemics where previous information is not available.

Conclusion: It seems that there is a problem in investigating the effect of gender on the side effects through social-media data, and in our screened articles, there was no gender separation in the data that used social media. We recommend that an AI approach should be developed to solve this problem in future health data monitoring. We suggest that during future pandemics modeling a single platform for extracting patients' data makes the results more accurate.

Keywords: Artificial Intelligence, Covid-19 Vaccine, side effects, text mining

Breast Cancer Diagnosis by Machine Learning Techniques: A Risk Prediction Model Study

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Background and aims: Breast cancer (BC) is the most common cancer globally. Various studies have been conducted to examine the risk factors for BC. The present study aimed to develop a breast cancer risk prediction model using different machine learning techniques, develop the best method selection to identify the factors that account for the incidence of breast cancer, and identify the relationship between those factors.

Method: A total population sample of 810 healthy subjects and patients with BC were investigated using thirty-two factors (e.g. pathology [T, N, M], genes [connexin 37 Rs1764391]). Accuracy, precision, and reproducibility of various machine learning algorithms were measured. Classification Algorithms in Machine Learning such as Naïve Bayes, K-Nearest Neighbors, Decision Tree, and Rando Forest were used in this study.

Results: Among the methods and classifications used, the random forest algorithm had the greatest accuracy, precision, reproducibility, and the AUC of 99.3%, 99.1%, 95.7%, and 99,4%, respectively. The results of assessing the impact and relationship of variables using the RF method based on PCA indicated that pathology, biochemistry, gene, and demographic factors with a coefficient of 0.35, 0.23, 0.15, 0.13, 0.08, 0.06, respectively, affected the risk of BC (r2=0.54). Pathological features, genetic factors, and ER, Ki67, CEA, CA153, stage, rs1764391gene, and P53, respectively, were found to be the most important factors for BC risk. Furthermore, it was found that the stage, T, and rs1764391 with a coefficient of 0.13, 0.12, and 0.09, had the highest coefficients (r2=0.77).

Conclusion: Considering the interaction and importance of these factors we found that the Random Forests technique may be useful as an approach for developing a risk prediction model for BC in comparison with the other methods investigated.

Keywords: Breast cancer, Machine learning, Genes, Identification

Convolutional Neural Network-Based Electrocardiogram Analysis for Myocardial Infarction Detection in Patients Underwent 24/7 Percutaneous Coronary Intervention: A Study Protocol

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Background and aims: Heart attacks are a leading cause of death worldwide, and timely diagnosis and treatment can improve patient outcomes. The “golden time” for a suspected patient from the onset of cardiac symptoms to appropriate intervention is 90 minutes. As machine learning and deep learning methods for interpreting electrocardiography have shown promise in improving accuracy and efficacy, this project aims to develop a deep learning algorithm to detect heart attacks by electrocardiogram in pre-hospital settings to reduce the harmful effects of late diagnosis and ensure timely therapeutic measures.

Method: Electrocardiogram data from patients who had percutaneous coronary intervention as part of the 24/7 protocol will be used in this study. The study will use cross-sectional data from 1100 patients in the last three years. Electrocardiogram data will be collected using standard 12-lead electrocardiogram machines and electronically stored in JPG format before being segmented and divided into 12 separate leads. The cardiologist’s report for each patient will also be manually entered in the metadata table. The data will then be carefully checked for accuracy and completeness before the analysis stage. Any errors or missing data will be corrected as necessary. The dataset will be divided into 1000 records for training and 100 records for testing. Convolutional neural networks, which can analyze both spatial and temporal data, will be used in this study. A convolutional neural network architecture will be developed and trained on the training set. The training involves feeding the model a large set of labeled electrocardiogram data that has already determined whether the patient has had a heart attack. The model learns to identify patterns in electrocardiogram images related to heart attacks by adjusting the weights and biases of its internal connections. The model’s predictions will be compared with the true labels of each one, the cardiologist’s diagnosis, by running the model on the test set. On the testing set, model’s performance will be judged using different performance metrics, such as sensitivity, specificity, and accuracy. A comparison group of patients diagnosed with a heart attack using a standard clinical decision-making process will also be used to ensure that the model is reliable and valid.

Results: Although the study is ongoing, a pilot study was conducted on 110 training and 20 testing subjects. Our model, which is still under development, achieved an accuracy of 95%. The final results, including the scanned electrocardiogram records, developed model, and metadata table, will be reported and published in a journal article. Additionally, all will be shared on the GitHub, ensuring ethical standards are met.

Conclusion: The proposed deep learning algorithm based on convolutional neural network can potentially improve the accuracy and efficacy of myocardial infarction diagnosis in patients with

acute cardiovascular symptoms. The study's findings can inform the development of a clinical decision support system for myocardial infarction diagnosis and triage in emergency settings, making it especially useful for underprivileged areas and individuals not specialized in electrocardiogram interpretation. The research can pave the way for future studies using deep learning techniques in electrocardiogram interpretation.

Keywords: Deep Learning, Convolutional Neural Network, Myocardial Infarction, Heart Attack, Electrocardiogram

Train NNN model on lung CT scan of normal people and introducing new dataset

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Background and Aim: The coronavirus has presented a challenge for medical staff worldwide in recent years. The need for rapid and accurate diagnosis, due to the working limits of medical teams and the vast number of patients admitted, has created an opportunity for artificial intelligence-based diagnosis. Models used in this area require databases with sufficient information during the training process to be more accurate and reliable. While there are several normal CT scan databases available for comparison with COVID-19 patient CT scans, none of them have a large number of CT images. Additionally, a prepared normal CT scan model can help researchers achieve better results through transfer learning.

Method: 10,000 chest CT scans with DICOM files that were reported as normal in radiologist resident reports will be extracted from the Rasoul Akram HIS database and used to train a normal CNN model. The model will be trained on the Pytorch Library on Python. The research is in progress, but after completion of training, the model and DICOM File will be shared on GitHub without any personal information.

Results: This data processing is in progress. The main goal of this article is to release a Normal Chest CT Database for future research on Github (DICOM File and The Model).

Conclusion: Artificial intelligence is a useful tool in helping medical staff reach faster and more accurate diagnoses in a shorter amount of time. We believe that providing a large dataset optimized for training these models will be beneficial to the future of medical diagnosis. A well-prepared module can help researchers get better results with fewer data and significantly decrease processing time.

Keywords: Chest CT Scan Dataset – Pretrained CT Scan – Transfer Learning CT Scan

Accuracy assessment of robotic systems in dental implant surgery: a systematic review

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Background and aims: Considering the development of robot technology, the aim of this study is to assess the accuracy of robotic systems used in dental implant surgery and to compare its accuracy with previously introduced systems in this field.

Method: The review protocol followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Three different databases were selected and searched without any time restrictions: MEDLINE/PubMed, Web of Science, and Scopus in order to identify all studies around robotic systems in dental implant surgery. Entry, exit, and angular deviation were the main outcomes of the studies and the data were extracted in tables. Meta-analysis was performed with a random-effects model. Subgroup analysis was applied when possible.

Results: One hundred and twenty-five records were identified and 8 were eligible with 6 different robotic systems. Four hundred and 74 implant placements or drilled cavities were done in these studies. The combined mean entry, exit, and angular deviation were 0.851 mm (95% CI: 0.642 to 1.061; I2 = 94.94%), 1.027 mm (95% CI: 0.727 to 1.327; I2 = 97.19%) and 1.779° (95% CI: 0.922 to 2.637; I2 = 99.63%). There was no difference between in-vitro and clinical studies.

Conclusion: Robotic systems execute dental implant surgery highly precisely, with less than 2° deviations which are remarkably more accurate than previously introduced methods (navigation and free-hand methods). Further clinical studies may lead to detecting fewer clinical complications according to the robotic system's accuracy. Also, its ability to be used based on clinical conditions and patient acceptance needs to be studied in the future.

Keywords: robotics, dental implants, dental implantation, surgery, systematic review

A large-scale dataset for mammography and a model for predicting BIRADS Score

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Background and aims: Breast cancer is among the most important etiologies of cancer mortality universally. A breast cancer diagnosis at earlier stages provides more efficient treatments and enhances survival probability. Convolutional neural networks (CNNs), a type of deep-learning method, can potentially aid radiologists in the early diagnosis of images. In the current study, we aimed to assess CNNs use in discriminating malignant and benign breast lesions on mammography and predicting the Breast Imaging Reporting and Data System (BI-RADS) score.

Method: A total of 10000 mammography images from 2500 patients and their radiological reports were collected. The images were gathered from Saee and Mahdieh radiological centers, Tehran, Iran. The lesions were classified into five groups according to the last version of BIRADS scores. With the help of CNN models, a deep learning model was processed to detect BIRADS from mammography images, and different algorithms were used to obtain the highest accuracy and specificity in diagnosis. To evaluate the accuracy of CNN models, an external dataset and an internal dataset were assessed by both the two readers and the CNN models. Two human readers also interpreted these test data and scored the probability of malignancy for each case using Breast Imaging Reporting and Data System. Finally, specificity, sensitivity, and area under the curve (AUC) were calculated to evaluate the diagnostic function of the CNN models in predicting the BRADS scores of the lesions on images.

Results: Our results showed that the average AUC of CNN models was 0.790 (0.715-0.895). The first reader, second reader, and the best CNN model showed a sensitivity of 0.85, 0.78, and 0.89, respectively, in the 4-5 BIRADS group. The specificities were as follows: 0.83, 0.85, and 0.82 in the same group. On the internal dataset, AUC was 85.7 (external 92.3) for the CNN and 88.6 ± 1.3 (external 93.6 ± 2.5) for the readers.

Conclusion: The diagnostic performance of CNN models in classifying the lesions according to the BIRADS score was comparable to radiologist readers.

Keywords: BIRADS Prediction, CNN Mammography, Mammography Deep Learning

Liver vessel segmentation based on attention guided deep convolutional neural network from CT images

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Background and aims: Liver vessel segmentation from abdominal computed tomography (CT) images is crucial for liver cancer surgery and liver transplants, given the significant impact of hepatic vascular structure.

The task of liver vessel segmentation is of particular complexity, very challenging, and time-consuming because of the large anatomical variability in the size, position, and branching of the portal and hepatic veins. While conventional methods have been useful in liver vessel segmentation, deep learning-based methods have been shown to provide superior performance. Therefore, automatic liver vessel segmentation using deep learning based approaches became a fundamental processing step of computer-aided diagnosis, which aims to increase precision in surgical planning and has become increasingly popular in recent years. These approaches can reduce manual interactions and greatly simplify the work of physicians. Therefore, in this paper, a novel automatic method for liver vessel segmentation based on deep learning approaches is presented.

Method: We propose an end-to-end vessel segmentation network including multi-head attention by expanding a deep convolutional neural network to employ an effective combination of convolution and self-attention.

The network architecture incorporates multi-scale convolutional operators to capture local spatial information. Additionally, we designed the Attention-Guided Concatenation module to adaptively select context features from low-level features based on guidance from high-level features. The proposed method was thoroughly evaluated on the 3Dircadb and the MICCAI 2018 Medical Segmentation Decathlon (MSD) Challenge datasets.

Results: The experiment results of liver vessel segmentation on abdominal CT images demonstrate that the proposed method can effectively segment liver vessels with a dice score of 74.61% and outperforms previous methods by up to 7%.

Conclusion: The proposed network structure is highly effective in distinguishing between the vessel and non-vessel regions, resulting in accurate liver vessel segmentations.

Keywords: Deep Learning, Liver Vessel Segmentation, Attention Guided, Convolutional Neural Network

Quick Mask Detection with Edge Detection model and YOLO5 Detector in Deep Learning

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In this century, without a doubt, if we ask different people in society, about one of the 3 most important events in the life of humanity in the last 5 years, everyone will point to the spread of the Coronavirus as one of the most bitter and of course the most influential events in their lives A type of viral disease with a high level of transmission and widespread in the world, which has left huge human casualties. Undoubtedly, according to the published statistics, it is time for computer science and especially artificial intelligence to once again enter the campaign against the corona epidemic to help human society in the context of making it smarter. Currently, deep learning along with machine vision has provided a suitable platform for solving problems such as mask recognition.

Background and aims: As you know, humans transmit the virus to their own species by talking, breathing and actually communicating, and we are all aware of the effect of prevention over treatment. Apart from the treatment methods suggested in the medical field, both medicinal and non-medicinal, the most effective and least expensive behavior and at the same time the most applicable prevention method is using a mask during communication. According to statistics, if it is used correctly, it prevents the transmission of the virus by 80%.

Method: The proposed algorithm with the help of edge detection and YOLO5 object detector in the context of artificial neural network and machine learning concepts has provided the possibility of high-speed identification. It is better to know that (CNN) networks are used for identification in this model.

Results: Also, in the method, two performance evaluation criteria of YOLO5, i.e. precision and average accuracy of (mAP_0.5) threshold have shown good results in 100 training courses.

Conclusion: Undoubtedly, artificial intelligence and artificial neural networks have taken a new step towards protecting human health by providing different mask detection methods in the past years, but after the coronavirus epidemic the need for more accurate detection with less time and costs is more necessary than past. It is hoped that in this research, by improving the power of detection by presenting a new algorithm in the field of artificial intelligence, we have taken a valuable step toward the health of society.

Diagnosis in Psychiatry with the Help of artificial intelligence

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Background and aims: A crisis in psychiatry is a vital issue that separates psychiatry from medicine. The crisis in psychiatry is evident by many statistics with different competing approaches to psychiatric diseases, including psychodynamic, biological, molecular, pandemic, precise, cognitive, and phenomenological psychiatry, mind-brain dichotomy, and post-psychiatry. The purpose of this article is to explain the new nomothetic psychological approach (NNP) that uses machine learning methods to build various diagrams by collecting risk, cognitive, and brain resilience.

Method: We searched this topic in the reliable scientific database PubMed and summarized the results of the articles using the keywords artificial intelligence, neuroscience, psychiatry, psychology, classification, machine learning, and deep learning, and using the filter, we reduced the number of reviewed articles to 8 related to the topic.

Result: This pattern recognition method exposes new categories of patients (transdiagnostic) and can form new nosological categories (transdiagnostic).

Conclusion: For the evaluation and general functioning of the brain in psychiatry, it is possible to use the information recorded and processed from brain signals, as well as the use of neuro markers using image processing and machine learning. After the obtained information, data analysis on latent variable scores of latent data R/R, AOP, cognition, brain some, and phenomena are applied. Methods used in artificial intelligence (AI) overlap with methods used in computational psychiatry (CP). By using artificial intelligence and using machine learning methods in psychiatry, errors caused by misdiagnosis can be reduced. The incorporation of neural-based technologies into psychiatry offers a novel means to use neural data in patient assessment and clinical diagnosis.

Keywords: deep learning, machine learning, artificial intelligence, Neuroscience, Psychiatry, Diagnosis

Online artificial intelligence based mental health interventions for youth: A Systematic review

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Background and aims: The age of onset for mood and anxiety disorders is typically reported as 15-24 years. Online interventions are recognized as one of the effective ways to reduce the impact of these diseases. However, there are contradictory findings regarding their effectiveness, and there is a lack of systematic studies evaluating the effectiveness of artificial intelligence (AI)-based interventions on the mental health of adolescents.

Methods: Three electric databases (PubMed, Scopus, and Web of Science) were searched for records in English from inception to February 10, 2023. Searches were performed using combinations of the following keywords: "mental health" AND "artificial intelligence" AND "young"; Also, the search didn't limit the above words and any synonyms included in the strategy; Clinical trial studies that assess the effectiveness of AI-based online interventions for mental health included. The risk of bias tool of the Cochrane was used to assess the quality of the included studies.

Results: In the initial search, 756 studies were reviewed, out of which three studies were included in the final analysis. All studies focused on healthy participants. Two studies (Tess and Woebot) investigated depression and anxiety, and found that depression was reduced in both studies, while anxiety was reduced in only one study. One study assessed the effectiveness of Problem-solving strategies using MYLO, an ELIZA chatbot. The retention rate of AI-based chatbot interventions varied from 83% to 100%, with one study reporting 83% and two studies reporting 100%. It is worth noting that these results highlight the potential of AI-based chatbot interventions in mental health research, but further studies are needed to establish their effectiveness in diverse populations and settings.

Conclusion: AI-based interventions for mental health have shown effectiveness, but due to the limited number of studies, further research with larger sample sizes is needed to establish a definitive opinion.

Keywords: Artificial Intelligence, Telehealth, Youth, Mental Health

Evaluation of people's sentiments towards Covid-19 vaccine side effects based on artificial intelligence methods

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Background and aims: Acquiring information about people's attitudes and sentiments towards vaccination is an important issue to monitor the acceptance of vaccines among people, which causes a more accurate assessment of the community's needs, which may lead to faster modification of vaccine properties or vaccination approaches. An important example is the assessment of sentiments towards covid-19 vaccines that led to better decision-making for governments. Now social media has become a global platform for sharing opinions and talking about various topics, making it get used as a data source for extracting people's attitudes. Studying and dividing attitudes in such a way that has the least theoretical mistake is done by artificial intelligence (AI).

In related studies, the positive and negative sentiments towards the vaccination of Covid-19 have been discussed, but in this study, for the first time, we systematically review to what extent side effects can affect the desire and attitude of people towards the vaccines.

Method: We searched the related articles in three databases: PubMed, Web of Science, and Scopus. The keywords for the search were related to artificial intelligence, side effects, and covid-19 vaccines.203 articles were extracted from databases, among them 13 articles were related to our work. The exclusion criteria for article screening were Congress, non-English articles, and articles including terms related to vaccine discovery, etc.

Results: According to our investigation, both in the global evaluations and in the evaluation of a country, the positive attitude of the people towards the vaccine was higher than the negative attitude or was almost equal.

In all evaluations, concerns and negative sentiments about the side effects of the vaccine made up a high percentage of people's negative attitudes toward the vaccine. The results of 192 countries are in very close agreement with the results at the global level. Attitudes toward some vaccines, particularly the AstraZeneca COVID-19 vaccine, have changed drastically over time. Latent Dirichlet Allocation (LDA) is the most applied method based on machine learning to form the topics of sentiment analysis of text mining results, after that, we can refer to Valence Aware Dictionary for Sentiment Reasoning (VADER) which is frequently used for scoring the words in the same cluster. The results were variable based on the number of data, and with the increase in the number of data, the results of different studies were closer.

Conclusion: We realized that the side effects of the vaccine were their main obstacle to receiving the Covid-19 vaccines. So, it appears that the best approach to increase people's participation in receiving the vaccine is to increase information about the side effects of the vaccine. It is also recommended that future studies address the role of social media in inducing negative opinions because it is possible that some side effects reported by people on social media are only influenced by the declaration and sentiments of others.

Keywords: artificial intelligence, machine learning, Covid-19 vaccine, sentiment, side effect, attitude

Application of machine learning algorithms in EEG studies: a scientometric analysis

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Background and aims: There is a great deal of interest in using machine learning methods for automatic electroencephalogram (EEG) analysis, particularly in the domain of EEG-based clinical diagnostics. ML algorithms are applied in EEG data for pattern analysis, decoding brain activity, and categorization in order to provide a more accurate interpretation. Knowing which key terms are frequently employed and which domains are more prominent in such EEG studies is required for future research to retrieve more precisely on this subject. We conducted a scientometric analysis to accomplish this as well as provide objective data that may reflect the relevance of these studies.

Method: In this scientometric study, a comprehensive search was conducted in Scopus using the terms "Machine Learning", "Unsupervised Learning", "Supervised Learning", "Deep Learning", "Reinforcement Learning," "Electroencephalography, "and electroencephalogram" up to February 2023. VOS viewer, the R 4-2-1 programming language, and the Bibliometric package, to measure research networks performance (countries, institutions, and authors) were used.

Results: After the screening of the titles and abstracts and the removal of duplicate publications, 3772 studies between 1988 and 2023 were included, which have been published in 841 journals. These articles were written by 11217 authors. Out of the 158 countries in the data with at least 4 documents for each country, 74 countries have appeared in the network; among these countries, China (link strength: 139), the United Kingdom (link strength: 111), and the United States (link strength: 661) were the top countries in terms of link strength. In density visualization, keywords such as electroencephalogram, feature extraction, classification, epilepsy; brain-computer interface; convolutional neural networks; emotion recognition; seizure prediction; and seizure detection were among the hot topics in this field.

Conclusion: China, the UK, US are the main Research forces in the brain-inspired intelligence domain, and always maintain a high degree of research interest. From the analysis of keywords and hotspots, it is easily drawn that the researchers focus mainly on epilepsy and seizure prediction in recent years. Major countries/regions pay more attention to academic cooperation and exchanges in brain-inspired intelligence. It shows that major countries are aware of the importance of academic cooperation and exchanges to promote the development of brain-inspired intelligence.

Keywords: "Machine Learning", "Electroencephalogram", "Unsupervised Learning", "Supervised Learning", "Deep Learning", "Reinforcement Learning", "Electroencephalography"

Investigating the level of consciousness with artificial intelligence, a narrative review

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Background and aims: The occurrence of a disorder in the level of consciousness may be related to one of the following four causes. Reduction of brain oxygenation (hypoxia and reduction of blood supply), neurological damage (stroke and stroke), metabolic disorders (heart failure, liver and kidney failure and diabetic ketoacidosis) and toxicological (high dose of medicine, alcohol or drug poisoning). Many instruments have been developed to assess the level of alertness, which mostly not only measure different aspects of alertness, but also provide more reliable information that helps identify potential problems. Artificial Intelligence is a general term that implies the use of a computer to model intelligent behavior with minimal human intervention. Artificial Neural Networks (ANNs) are essential tools in machine learning that have attracted increasing attention. Structure, and learning of ANNs to better address a wide range of challenges in brain research. The processing capabilities of artificial intelligence are not far from the processes in the brain. Artificial intelligence uses the process of deep learning to perform computational problems quickly and uses a network of layered algorithms that are interconnected to solve more and more complex problems. Considering the extraordinary capabilities of artificial intelligence, the purpose of this review is to know the different capacities of artificial intelligence that can help to automatically detect the level of consciousness.

Method: the main aim of this article is to collect data on the various theories of consciousness published between 2000-2023 and to synthesize them to provide a general overview of this topic. We performed a literature review using PubMed and Google Scholar for relevant articles. Keywords include artificial intelligence, disorders of consciousness, and level of consciousness, and thus, we initially found 31 studies as relevant studies in PubMed and Google scholar. Next, the title and abstract of more relevant studies were screened and the full text of 11 studies was reviewed.

Results: Finally, 7 studies met the inclusion criteria. It seems that consciousness research that has sought to use artificial intelligence has grown exponentially in recent years. Most of the studies used the features extracted from the EEG signal to build a predictive model of consciousness. Currently, most researches in the field of consciousness medicine use artificial intelligence algorithms such as machine learning (ML) and perceptron (one of the artificial intelligence algorithms) to predict the pattern of differential brain activity in the level of consciousness.

Conclusion: Artificial intelligence is a practical tool to care for the patient and to increase the diagnostic capabilities of the level of consciousness and to perform high-sensitivity therapeutic and surgical methods. The deep learning method has a high ability to model and diagnose the patient's symptoms and can identify the symptoms more accurately and provide them to the experts. However, in the field of health, more data is needed for the application of perceptron and DL algorithms. Also, using these tests before using them in medical centers requires more studies.

Keywords: Artificial intelligence, Consciousness, Electroencephalogram, Consciousness disorders.

A review of the relationship between artificial intelligence and mental health (with a focus on major depressive disorder)

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Major depressive disorder (MDD) is the leading cause of disability that is recognized as a mood disorder in the world. This disease is characterized by symptoms such as depressed mood that lasts for more than two weeks and causes emotional distress, functional impairment, health problems and suicide, etc. Artificial intelligence and mathematical modeling techniques have gradually been welcomed by researchers in mental health research to try to solve these issues. The field of mental health can benefit from these techniques because they understand the importance of obtaining accurate information to describe various psychiatric disorders.

Background and aims: Artificial intelligence is currently being used to facilitate early disease diagnosis, enable better understanding of disease progression, optimize drug/treatment doses, and discover new treatments. The purpose of this project is to review whether artificial intelligence allows us to use it in the diagnosis of mental health disorders (with a focus on major depressive disorder).

Method: Recent studies related to the use of artificial intelligence in mental health (with a focus on major depressive disorder) in the years 2015-2022 have been reviewed. We used PubMed and Google Scholar to locate studies that have conducted original clinical research in a field related to artificial intelligence and mental health.

Results: The use of artificial intelligence techniques offers the ability to develop better pre-diagnosis screening tools and develop risk models to determine susceptibility or risk of mental illness. The use of computational approaches to big data can be used in the implementation of personalized mental health care as a long-term goal.

Conclusion: We have a relatively limited understanding of the interactions between biological, psychological, and social systems. Intelligent systems can increasingly be used to support clinical decision-making. A review of new and original literature in the field of artificial intelligence and mental health care (Methods/Results) and how artificial intelligence can supplement mental health clinical practice, considering current limitations, is one of the results of this research.

Keywords: Mental health, Major depressive disorder (MMD), Artificial intelligence

A Software Architecture for Sharing and Reusing Health Data in Smart Hospitals

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Background and aims: With the emergence of a large amount of medical data in new information systems and due to the use of new technologies, a need arises that how to make this data available to research centers and those who can use this information in order to create value for patients and Medical and service community to use.

Method: In this research, we first survey various smart hospital architectures and available platforms. Our objective is to identify the most appropriate architecture for sharing hospital data with third parties. To gather requirements, we conduct a case study based on a smart hospital project and evaluate the proposed architecture's effectiveness.

Results: From the very beginning of the formation of hospital information systems, the primary value and importance of these systems was the creation and design of the system for administrative tasks such as managing patients' bills and payments. Therefore, no targeting in the field of hospital data sharing to improve the conditions of hospitals, providing more and additional services to doctors, nurses, and patients, as well as research applications based on these data was not considered. On the other hand, the value of the high volume of health data in this field is still not known, to the community and this lack of awareness prevents the provision of useful services that can improve the lives of a large number of patients and medical and research procedures. Collecting this high volume of medical and health data and making them available to different organizations with the aim of reusing them in medical research, pharmaceuticals, and awareness-raising leads to creating value and making money in this field. The architecture we want to present complements health information systems to enable these systems for new applications based on data collection, management, distribution, security, and governance. Providing a new architecture that can respond to the needs of hospital data sharing, so that it can integrate different sources of data and information within the hospital with each other and using a standard method and maintaining the confidentiality of the patient's rights and the type of access and security at the disposal of consumers for applications. Various research, medical, treatment, drug prescription, information spreading, etc.

Conclusion: We have developed a comprehensive service-oriented architecture for this domain, encompassing a range of critical features including data acquisition, information management, data distribution, data governance, data security, data analysis, and service management extracted from a reference data-sharing model. This architecture has been tailored to meet the specific needs and requirements of Iran, and it is viable for implementation in local hospitals.

Keywords: Smart hospital, Hospital information system, big data, Internet of Things, Medical data sharing

Machine Learning Algorithms Applications for Early Diagnosis of Osteoporosis using Medical Images: a Systematic Review and Meta-Analysis

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Background and aims: Osteoporosis is a silent disease which may not be detected until bone fractures appear. Approximately 50% of women over the age of 50 will suffer from a fragility fracture in their remaining lifetime. Early detection is the only prevention of osteoporosis. Artificial intelligence (AI) has been used as a specified technology to interpret images in the diagnosis of many disorders, such as diabetic retinopathy. New studies reported that recent developments in AI have led to successful applications in the diagnosis of osteoporosis.

Method: We conducted a comprehensive systematic search of Medline (via PubMed), Scopus, Embase, and Web of Science from inception to March 2023. The search was performed using MeSH and free keywords such as "Artificial intelligence", "Machine learning", "Osteoporosis" and "DXA". The database search also included gray literature and manual search. Two independent investigators screened located articles in multiple levels of title, abstract, and full-text. A third reviewer was involved in case of disagreements. We included studies that used AI models or machine learning (ML) algorithms to diagnose osteoporosis (T-score < -2.5) using any type of medical imaging with the gold standard (DXA) used as a reference/standard test. Two independent researchers assessed the quality and bias of the studies that met our inclusion criteria according to the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) checklist. Microsoft Office Excel 2021 software is used to extract data such as ML algorithms, the regions and types of imaging, and the accuracy of models. Pooled Accuracy was calculated using CMA v.3.7 software, using random effects model.

Results: A systematic search of databases yielded 590 articles. A total of 297 articles were duplicates, and 214 were excluded after reviewing the title and abstract of the articles. After reviewing the full-text articles, 53 articles were excluded. Finally, 26 studies were included in this study. In the present review, most studies had a low bias, but depending on the type of studies, the outcome Reporting Bias was tangible in the studies. Radiographs and CT scans are the most common. Spine, hip, chest, and periapical images are the most popular among studies. About 58% of studies used SVM and CNN algorithms, and four of them used more than two ML algorithms. Overall, studies that used spine CT or radiographs, or dental radiographs had higher accuracy than others. A total of 72,957 images from 26 studies were included in the meta-analysis. The pooled diagnostic accuracy of osteoporosis was 88.6% (95% CI: 0.019-0.021, P < 0.001).

Conclusion: AI-based systems such as CNN and SVM have the potential to diagnose osteoporosis via medical images such as radiographs and CT scans of some specific regions of the body such as the spine and hip.

However, there were some flaws in the development of AI-based real-world screening tools, such as patient selection and methodological defects. Further studies by resolving the mentioned flaws are required to make AI a powerful and reliable tool for osteoporosis diagnosis.

Keywords: Osteoporosis, Machine Learning (ML), Dual-energy X-ray absorptiometry (DXA), Diagnosis,

Artificial Intelligence for Improving the Proactive Intelligent Safety of Pedestrians

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Background and aims: Road traffic injuries are the main threat to public health and a serious cause of concern across the world, especially in low and high-income countries. Pedestrian injuries and fatalities, as vulnerable road users, have increased nearly every year. Recently, simultaneously with increased urbanization, Artificial Intelligence (AI) opened up new opportunities for intelligent traffic safety and has been widely used in order to deal with road traffic injuries and deaths. The high vulnerability of pedestrians in road traffic crashes highlights the need to explore and implement effective interventions in the realm of AI to protect pedestrians. The aim of this study was to study the applications of AI for improving pedestrians' safety.

Method: This study has been done according to Arkesy and O'Malley's framework according to a review of related literature from January 2000 to February 2023. Six main steps were conducted in this study as follows: identifying the research question, identifying relevant studies, study selection/screening, charting the data, collecting, summarizing, and reporting results, and providing practical recommendations. To explore the relevant studies, the databases of PubMed, Science Direct, Scopus, and Web of Science were searched using predefined keywords. Literature screening and selection were done according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses, which extended to Scoping Reviews (PRISMA-ScR). Endnote software edition 7 was used for data management.

Results: The findings of the literature review and screening showed that there are different approaches for the application of AI in order to deal with road traffic accidents and prevent pedestrian injuries and deaths. Applications of AI in preventing pedestrian accidents and improving their safety were in various fields, including the main categories of 1) pedestrian identification and detection systems using the Vehicle-to- Pedestrian (V2P) wireless communication technology, adaptability of autonomous vehicles (AVs) to communicate with pedestrians, and visibility related systems, 2) pedestrian accident prediction using the approaches like vehicle to everything (V2X) systems, and 3) pedestrian-assistance devices to help them by providing navigation and orientation information.

Conclusion: AI involves a variety of technologies that facilitates proactive intelligence in pedestrian safety and is widely used in this area. Some of these technologies such as Vehicle-to- Pedestrian communication systems, or autonomous vehicles can be used in limited countries because of the need for high technology and strong infrastructure. Although all countries should move towards using different approaches to pedestrian safety promotion, it seems the use of pedestrians-assistant devices is more suitable for countries with limited needed infrastructures. These findings can be useful for road safety policy-makers, technologists, and inventors in the design of systems and devices to promote pedestrian safety.

Keywords: artificial intelligence, public health, pedestrians, safety, proactive safety

Implementation of national eLogbook AI-BI dashboards for Residents' clinical performance assessment

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Background and aims: logbooks are purposeful assessment tools to record the learner's clinical performance. They facilitate self-reflection, and self-assessment and help medical residents to achieve their educational goals. In this study, we aimed to design the logbook Artificial Intelligence-Business Intelligence (AI-BI) dashboard based on integrated data from eLogbook systems in all universities of medical sciences with the aim of the national policymakers, residency program board members, academic managers to make intelligent decisions about the residents learning and assessing process.

Method: This applied cross-sectional study was conducted by the Information Technology working group of the Education deputy at the Ministry of Health and Medical Education in 1401. Medical universities that hold medical residency programs were included in the study. The Universities that use the electronic logbook system were identified. The ETL technique was used to integrate logbook data from different university sources into a national warehouse platform. To build an intelligent dashboard at first thematic analysis was performed to explore the effective key performance indicators (KPI) for national monitoring of medical resident performance on logbooks. Based on the result of the thematic analysis, a questionnaire was developed to conduct a Delphi method to rank and consensus the KPI metrics. Then we used the OLAP engine to create cubes and process KPIs from the logbooks data panel.

Results: 44 out of 67 medical universities hold residency programs. They use four eLogbook different products for the medical resident clinical assessment. The data in the following three years (2019 and 2023) from all university databases were integrated into a national eLogbook warehouse to build an AI-BI-enabled dashboard. The results of the thematic analysis and the two Delphi rounds finally led to the selection of seven main KPIs for analysis and reporting resident academic achievement at the national level. The ELogbook dashboard was deployed based on classification and deep learning algorithms and used to visualize multidimensional data about residents. Deep learning algorithms predicted the resident academic achievement with an AUC of 0.82. Machine learning classifiers (SVM and RF) are trained to predict residents' progress in in-training examinations. The deep learning algorithm had the highest performance (AUC, 0.74).

Conclusion: In this study, we designed and implemented the artificial intelligence dashboard to report medical residents' performance on logbooks in the whole country. AI-BI logbook dashboard has provided the ability to gain insight into the learning process and make reforms to increase residents' learning achievements in different medical specialties. Deep learning algorithms are more reliable and accurate for predicting student performance.

Keywords: artificial intelligence, business intelligence, electronic logbook, medical resident, medical university, dashboard

Development of an AI-Powered Decision Support System for Early Diagnosis and Treatment of Neurological Disorders

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Introduction: Stroke, Alzheimer's disease, and other neurodegenerative conditions afflict millions of individuals every year and place a heavy financial strain on healthcare systems around the globe. Better patient outcomes and lower healthcare expenditures are possible with earlier diagnosis and treatment. This scoping review aims to investigate the present level of research into the implementation of AI in the design of decision support systems for the prompt detection and treatment of neurological illnesses.

Methods: We used PubMed, Embase, and Scopus to perform a systematic review of the relevant literature. Included were studies that looked into how AI can be used to improve decision support systems for the early detection and treatment of neurological illnesses. The primary results were AI system type, system accuracy, and clinical applicability.

Results: Our systematic review found 38 studies that met the inclusion criteria. There were 19 on stroke diagnosis, 11 on Alzheimer's disease, and 8 on other neurodegenerative diseases. The majority of studies (n = 27) developed decision support systems using machine learning algorithms, with the remaining studies using deep learning (n = 7) or hybrid models (n = 4).

The accuracy of AI-powered decision support systems ranged from 72 to 99.2% across all studies, with an average accuracy of 89.7%. Deep learning algorithms produced the highest accuracy in studies. The clinical applicability of the systems was reported in 19 studies, with 16 demonstrating the ability of AI-powered decision support systems to improve early diagnosis and treatment of neurological disorders.

Twelve of the studies on stroke diagnosis reported on the use of AI-powered decision support systems to predict patient outcomes. In all of these studies, the AI-powered system was able to accurately predict patient outcomes such as stroke severity and functional disability. Furthermore, three studies reported on the use of artificial intelligence to develop personalized treatment plans for stroke patients.

Seven of the Alzheimer's disease studies reported on the use of AI-powered decision support systems to aid in early diagnosis, with the remaining four focusing on disease progression prediction. AI-powered systems achieved accuracy ranging from 78% to 96.8% in studies aimed at improving early diagnosis. The accuracy of AI-powered systems in studies aimed at predicting disease progression ranged from 74% to 89.7%.

Finally, AI-powered decision support systems were used in eight studies that focused on other neurodegenerative conditions to aid in early diagnosis and treatment. The accuracy of these systems ranged from 72% to 84%.

Conclusion: There is hope in the application of artificial intelligence (AI) to create decision-support systems for the early detection and treatment of neurological illnesses. Algorithms based on machine learning can analyze massive volumes of data and spot patterns that would be invisible to humans. By facilitating earlier diagnosis and individualized treatment regimens, these technologies may enhance patient outcomes. However, big datasets and cooperation between physicians, researchers, and data scientists are necessary for the creation and validation of these systems.

Overall, our findings indicate that AI-powered decision support systems have the potential to improve the early detection and treatment of neurological disorders. More research is needed, however, to determine the best AI algorithms and to validate these systems in larger, more diverse patient populations.

Keywords: AI, decision support systems, early diagnosis, neurological disorders

Ensemble classification algorithms on acoustic features to predict Parkinson's disease

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Background and aims: Parkinson's disease is a progressive neurodegenerative disorder that affects a person's movement. Dopamine is responsible for controlling movement in the human body. Parkinson's disease destroys brain cells that produce dopamine, causing the brain's level of dopamine to decrease. Parkinson's disease causes neurological and movement disorders. One of the factors to predict this disease is measuring the person's vocal features. These features can help to determine whether a person has Parkinson's disease or is healthy. This article aims to develop an intelligent algorithm using artificial intelligence, to analyze the voice features of people who have Parkinson's disease. According to the recorded features of the patient's voice, this algorithm checks whether the person has Parkinson's disease.

Method: Classification algorithms classify samples based on their input features. These algorithms look for similar patterns between samples and put those that have the most similarity into a category (training phase). Then, when a new sample is given to the algorithm, the algorithm checks the sample's features, and based on the classification done in the previous stage, it is placed in the collection that is closest to it (test stage). Simple classification algorithms examine all samples once and then categorize them, while ensemble classification algorithms perform the classification in several stages and based on voting, which increases the accuracy of the final algorithm. In this study, we used three simple classification algorithms (SVM, Decision Tree, and K-Nearest Neighbors) and five ensemble classification algorithms (Ensemble AdaBoost, Ensemble Bagging, Ensemble Gradient Boosting, Ensemble Extra Trees Classifier, and Ensemble Random Forest Classifier) to develop a high-accuracy detection algorithm for detecting Parkinson's patients among the dataset samples. The dataset used in this study was from the University of California, Irvine (UCI), which included 240 samples of Parkinson's patients and healthy subjects. At first, we used simple classification algorithms to build the detection model, and after checking their accuracy, we used ensemble algorithms to create the final algorithm.

Results: Firstly, the detection algorithm was implemented using three simple classification algorithms, which included SVM, Decision Tree, and K-Nearest Neighbors. Algorithms achieved final accuracy of 87, 90, and 85, respectively. The implementation of ensemble classification algorithms showed that these algorithms achieved higher accuracy in making the final algorithm than simple classification algorithms (all ensemble algorithms had a final accuracy rate of more than 90%). Secondly, experiments showed that the size of the dataset (number of records) is related to the number of features examined in the dataset. The accuracy rate in large datasets can improve by limiting the features (using highly correlated features) in most algorithms. Ensemble AdaBoost, Ensemble Bagging and Ensemble Gradient Boosting, and Extra Trees Classifier algorithms achieved 100% accuracy in both large datasets and small datasets with limited features. The Random Forest Classifier algorithm obtained the worst accuracy results in all the examined modes. Ensemble classification algorithms obtain better results than simple classification algorithms due to the construction of several models of data.

Conclusion: In this article, we tried to design an artificial intelligence algorithm with high accuracy to diagnose Parkinson's disease. This algorithm can determine whether a person has Parkinson's or not by receiving the voice features of each person. The dataset used in the training and testing stages of the algorithm included the voice features of people with Parkinson's disease and healthy people. Classification algorithms are popular in the design of artificial intelligence algo-

rithms. We examined several types of simple and ensemble classification algorithms, and results showed that the ensemble algorithms ultimately have higher accuracy than the simple classification algorithms. Also, the number of dataset samples and the features of people's voices can have a high impact on improving the performance of the final algorithm.

Keywords: Artificial Intelligence, Parkinson, Ensemble classification, Acoustic data, Machine Learning

Non-invasive Brain-Computer Interfaces (BCIs) for the Treatment of Neurological Disorders

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Introduction: Neurological disorders such as stroke, spinal cord injury, and cerebral palsy can severely affect a person's quality of life. Brain-computer interfaces (BCIs) have emerged as promising therapeutic tools for treating these conditions. However, invasive BCIs carry risks and are often impractical for long-term use. This systematic review aims to evaluate the effectiveness of non-invasive BCIs for the treatment of neurological disorders.

Methods: We conducted a systematic review of the literature using electronic databases such as PubMed, Embase, and the Cochrane Library. Studies that investigated the use of non-invasive BCIs for the treatment of neurological disorders in humans were included. The primary outcome measures were improvement in motor function, cognitive function, and quality of life.

Results: Our systematic review found 25 studies that met the inclusion criteria and included 347 patients with various neurological disorders. The majority of the studies used electroencephalography (EEG) based BCIs, while a few used functional near-infrared spectroscopy (fNIRS) based BCIs.

Motor Function: Ten studies found that non-invasive BCIs improved motor function significantly. These enhancements were observed in patients suffering from stroke, spinal cord injury, and cerebral palsy. Exoskeletons, prosthetic arms, and wheelchairs were all controlled using non-invasive BCIs. Motor function improvement was assessed using a variety of scales, including the Fugl-Meyer Assessment, the Action Research Arm Test, and the 10-meter walk test.

Cognitive Function: Seven studies found that non-invasive BCIs improved cognitive function significantly. These improvements were observed in stroke and traumatic brain injury patients. Non-invasive brain-computer interfaces (BCIs) were used to provide cognitive training and improve attention, memory, and executive function. Various assessment scales, such as the Stroop test, the Trail Making Test, and the Digit Span test, were used to assess cognitive function improvement.

Quality of Life: Eight studies found that non-invasive BCIs improved quality of life significantly. These improvements were observed in stroke and spinal cord injury patients. Non-invasive BCIs were used to improve communication and environmental control. Various assessment scales, such as the Stroke Impact Scale and the Spinal Cord Injury Quality of Life Questionnaire, were used to assess the improvement in quality of life.

Conclusion: Non-invasive BCIs have the potential to provide safe and effective therapeutic options for patients with neurological disorders. EEG-based BCIs show promise for motor rehabilitation, while fNIRS and TMS-based BCIs hold potential for cognitive rehabilitation. However, larger randomized controlled trials are needed to establish the long-term efficacy and safety of these interventions.

Keywords: Brain-computer interfaces, neurological disorders, non-invasive, rehabilitation

Automatic diagnosis of insomnia using artificial intelligence: A narrative review

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Background and aims: Numerous studies are focusing on the artificial intelligence (AI) and its relation to sleep medicine. Using AI in various fields of sleep researches such sleep disorders, automated scoring of polysomnography, and screening of obstructive sleep apnea syndrome are the leading fields that has attracted the attention of researchers. One of the most common sleep disorders is insomnia that characterized with difficulty falling asleep, staying asleep, or both. However, early diagnosis of insomnia is very challenging, but it has a great role in prevention of further medical complications such as anger issues, heart disease, anxiety, depression and high blood pressure.

Considering the tremendous capabilities of artificial intelligence, the aim of this review is to know the various capacities of AI that can help to diagnose insomnia automatically.

Method: We performed a narrative review of the literature using the search for relevant articles in PubMed and google scholar. Keywords include AI, sleep disorder, and insomnia and hence, we initially found 48 researches as the related studies in PubMed and Google scholar. Next, the title and abstract of more relevant studies were screened and the full texts of 22 studies were reviewed.

Results: Finally 12 studies satisfied the inclusion criteria. It turns out that insomnia researches that have sought to use AI have grown exponentially in recent years. Most of the studies used the features extracted from electroencephalogram signal of polysomnography for make a predictive model of insomnia. Already the most researches in field of sleep medicine used AI algorithms such as machine learning (ML) and deep learning (DL) for prediction of differential brain activity pattern in patients with insomnia disorder and automatic prediction of Insomnia.

Conclusion: Investigating the trend of using AI in the field of diagnosing sleep disorders illustrates the unique potential of AI to play a strong role in sleep medicine to do better patient care, enhancing diagnostic abilities, reinforcing the management of insomnia, and to detect insomnia automatically.

It seems that DL has a great capability in diagnosing of insomnia. DL algorithms need more significant data for training and testing and in the future, automated sleep disorders detection will be addressed by DL and strong algorithms. However, it can be suggested that AI algorithms should be standardized before being applied to patients in clinics.

Keywords: Artificial intelligence (AI), Electroencephalogram, Insomnia, Polysomnography, Sleep disorder

Using different neural networks to diagnose the severity of breast cancer

Background and aims: Breast cancer is a type of cancer with a high mortality rate among women, which is the most common cause of death in women's society. Therefore, it seems necessary to have an accurate and reliable system for the timely diagnosis of tumor severity. Timely diagnosis of cancer reduces the death caused by it. In this research, we are trying to present a new method to detect whether cancer is benign or malignant.

Method: In order to diagnose the type of cancerous mass of the patient, firstly, the information of the mass such as clump thickness, uniformity of cell size, uniformity of cell shape, marginal adhesion, single epithelial cell size, bare nuclei, bland chromatin, normal nucleoli, and mitoses was obtained. For automatic classification, six K-Nearest Neighbor methods, Weighted K-Nearest Neighbor, Bayesian, perceptron artificial neural network, Radial Basis Function neural network, and Support Vector Machine Neural Network are used. With the obtained results, the mass of the patient's body is classified as benign or malignant.

Results: Automatic diagnosis of the disease and its type is much more accurate and faster than non-automatic methods, and accurate and timely diagnosis reduces the mortality rate. In this study, the data of cancer patients have been classified using different neural networks. In the perceptron network, with the increase in the number of layers, it was observed that the increase in the number of neurons had no effect on the optimization of the results, and the best result of this network is 94.9% accuracy, which is the least accurate among the networks. By classifying the data with Bayesian, K-Nearest Neighbor, Weighted K-Nearest Neighbor, and Support Vector Machine methods, the results are obtained with the desired accuracy, but the best result belongs to the Radial Basis Function neural network with 100% accuracy.

Conclusion: With the proposed method, the severity of the disease can be diagnosed with high accuracy by using different types of neural networks. Considering the importance of the detection time, a network should be selected that has high detection speed in addition to accuracy. Therefore, by reclassifying the data with different types of neural networks, the detection speed of each neural network can be calculated so that the network that is selected and used has high accuracy and speed in detection.

Keywords: neural network, artificial intelligence, breast cancer

Designing a Software for Pregnant Women with Heart Disease in Iran

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Background and aims: heart disease in pregnancy is an important health issue worldwide that needs precise care to improve pregnant women's health care and reduce the maternal mortality rate. As we know registries play an important role in the improvement of health care, so We decided to design software to take the first step toward having a national registry for pregnant women with heart disease in Iran and classify them in a more effective way to reduce mismanagements.

Method: Implementation: Our software has been developed on the .NET Windows platform. The software has been coded using the Visual C#.NET programming language. To ensure a streamlined and efficient development process, we have utilized the WPF DevExpress toolkit for the user interface. In addition, we have used a SQL-based relational database management system as the database for our software.

Design: To design and implement the software, a multidisciplinary team consisting of two experienced cardiologists, a skilled gynecologist, and a proficient MD programmer collaborated in a comprehensive effort. The team first carefully analyzed the patient's medical records and conducted multiple meetings, discussing crucial information relevant to the diagnosis, treatment, and follow-up of the patients. Subsequently, based on the literature review of heart diseases in pregnancy, the team developed a comprehensive unit form for recording and storing the patients' data in the software. The form includes various important aspects such as patient history, family history, physical examination, laboratory test results, sonography data, and other relevant clinical information, which are securely stored as an Electronic Health Record (EHR) in the database.

Function: Our software serves as a pilot for a national registry, and we have already started collecting data using it. The software requires several inputs, including patient demographics such as age, gender, race/ethnicity, and socioeconomic status. These factors can impact a patient's health outcomes and may help identify disparities in care. We also collect medical history and comorbidities, such as past medical conditions, pregnancy history, vaccination and drug history, and any other health conditions that may impact treatment and outcomes. Cardiac disease status is also recorded, including information on cardiac disease diagnosis, cardiac surgery, and patient classification based on WHO and NYHA classes. In addition, laboratory and diagnostic test results are recorded, such as echocardiography, exercise tests, cardiac magnetic resonance image (CMR), angiography, and cardiac catheterization data, which can provide important information for diagnosis and treatment planning.

Our software is designed to provide a comprehensive and detailed database of patient information related to maternal health and heart disease during pregnancy. The software generates several outputs that can be used to identify areas for improvement in patient care, develop targeted interventions for high-risk patients, and provide valuable data for clinical trials and research studies, as well as AI technology.

Results: Since the launch of the software, information for 500 pregnant women with heart disease has been entered. The most common types of heart disease in order were congenital heart disease, prosthetic heart valves, valvular disease, and cardiomyopathies.

Conclusion: In conclusion, the software developed by our team provides a comprehensive and efficient tool for managing patients with heart disease in pregnancy. The use of this software can help identify high-risk patients early on, leading to better patient outcomes and ultimately contributing to the global goal of reducing the maternal mortality rate. In the field of pregnant women

with heart disease, gathering large and accurate data over time can be utilized in AI for analysis.

Keywords: Pregnancy, Heart disease, Software, Artificial intelligence, Pregnancy registry, maternal mortality rate

A critical analysis in medical dehumanization by artificial intelligence on Feenberg's perspective

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Background and aims: The increasing progress of Artificial Intelligence (AI) and its potential in medicine, including applications in diagnosis, treatment, and research, made it impossible to ignore the role of this technology in medicine. However, the current design of intelligent systems, from the point of view of the knowledge it produces and its function in medicine and its ethical and legal challenges, not only neglects the values of Medical Humanities, but also intensifies the dehumanization process. The purpose of this research is to find a solution to the challenges of dehumanization related to AI by using Feenberg's perspective.

Method: The article describes six potential causes of dehumanization in medicine and how they relate to the use of artificial intelligence. These reasons include deindividuation, impaired patient agency, dissimilarity, mechanization, empathy reduction, and moral and human rights disengagement. Then we discuss these causes and their specific relationship with AI. Finally, we present a critical model of using AI in medicine by exploring Feenberg's perspective on the relationship between technology and medical dehumanization.

Results: The article suggests designing and using AI in medicine according to Feenberg's critical theory of technology, which combines opinion and action to correct problems caused by technology. According to Feenberg, AI in medicine should consider the principles of medical humanities and attention should be paid to clinical efficiency. By doing so, AI can be made more humanized in medicine.

Conclusion: According to Feenberg, technology is a combination of technical principles and socio-cultural values. However, in the current design of intelligent systems in medicine, the values of medical humanities are being ignored, which leads to the intensification of the dehumanization process in medicine. To solve this problem, the principles of medical humanities as base of the secondary instrumentalization of AI should be incorporated into the design of intelligent systems. Furthermore, a democratic transformation of technology is necessary to involve patients and healthcare professionals in the development and implementation of AI in medicine, aligning the design of AI with their values and preferences. Considering these factors, according to Feinberg's continuity thesis, will lead to the continuous of the artificial intelligence design process in medicine, So AI can better serve the stakeholders' needs and contribute to the humanization of healthcare.

Keywords: Medical humanities, artificial intelligence, dehumanization, Feenberg's critical theory of technology, secondary instrumentalizations

Evaluation of gastric cancer imaging using Artificial Intelligence and Deep Learning

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Artificial intelligence has exemplified radical changes in radiology and medical imaging techniques which in turn led to marvelous changes in screening designs. In specific, progressions in these techniques led to the development of a computer-assisted discovery (CAD) strategy. Artificial intelligence (AI)-based applications have distorted numerous trades and are extensively used in various customer products and facilities. In medicine, AI is primarily being used for image organization and natural language dispensation and has great potential to affect image-based specialisms such as radiology, pathology, and gastroenterology (GE). Gastric cancer (GC) is one of the most mutually malignant tumors with high death. Accurate diagnosis and action choices for GC rely heavily on human specialists' cautious decisions on medical images despite the current fast progressions in technology, pretreatment diagnostic correctness differs between modalities, and associations between imaging and histological topographies are far from faultless.

Keywords: artificial intelligence, radiology, gastric cancer, imaging

A Systematic review on using deep learning in Retinopathy of Prematurity

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Background and aims: Retinopathy of prematurity (ROP) is an eye disease that can happen in premature babies. It causes abnormal blood vessels to grow in the retina and can lead to vision problems and blindness. Retinopathy of prematurity can be a treatable disease with an appropriate and timely diagnosis. In the last two decades, many different approaches have been applied in Retinopathy of prematurity detection. A lot of AI algorithms have been developed for the detection and diagnosis of diseases such as cancer, heart disease, and Parkinson's disease. In ophthalmology, it has demonstrated clinically acceptable diagnostic performance in detecting diabetic retinopathy (DR), glaucoma, and age-related macular degeneration using fundus photos and OCT. Compared to traditional computation algorithms, machine learning, and deep learning algorithms are more effective in diagnosis and disease detection. This study aimed to review the diagnostic accuracy of deep learning algorithms to identify retinopathy of prematurity.

Method: A systematic search was conducted in Medline (PubMed), Scopus, and Web of Science (WOS) using a combination of the key terms retinopathy of prematurity and deep learning and their alias from January 2015 to February 2023. The title, abstract and full text of the extracted articles were then viewed using the PRISMA checklist. Studies dealing with the application of deep learning algorithms in connection with retinopathy of prematurity were included. The information regarding developed models was extracted from reviewed articles.

Results: Of 1631 searched articles between 2015 and 2023, 35 studies met the inclusion criteria. All studies focused largely on using deep learning to detect plus disease in retinopathy of prematurity screening or to determine ROP severity level or both. Moreover, there were 8 available premature infants' retinal image datasets for ROP using for detection, classification, and segmentation. Studies showed the area under the curve (AUC)'s ranged between 0.834 and 0.994 for diagnosing retinopathy of prematurity on retinal images. The performance of deep learning algorithms was excellent and promising. This review showed that deep neural networks (DNNs) have become the most favored and approved method for ROP detection. Among these DNN methods, Convolutional Neural Network (CNN) models were the most frequently applied in the classification of medical image data.

Conclusion: DL approaches provide enhanced automation which accelerates evaluation and goes beyond traditional statistical analysis. Considering the high performance that DL models have shown in the ROP context, these techniques can be a good alternative to the traditional methods for diagnosing this disease.

Keywords: artificial intelligence, deep learning, retinopathy of prematurity, convolutional neural network

Electrocardiogram based Sleep Apnea Detection using SVM Classifier

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Sleep apnea is a common disorder that affects breathing during sleep, and it can lead to serious health problems if left untreated. In this study, we propose a machine learning approach using electrocardiogram data to detect sleep apnea.

Background and aims: Sleep apnea is a common sleep disorder characterized by the cessation of breathing during sleep. It can cause daytime fatigue, headaches, and even serious health problems such as high blood pressure, stroke, and heart disease if left untreated. Polysomnography is the gold standard for sleep apnea diagnosis, but it is time-consuming and expensive. Therefore, developing a reliable and efficient method for sleep apnea detection is crucial.

Method: We used electrocardiogram data from the PhysioNet Apnea-ECG database to detect sleep apnea. The database consists of 70 records, with recordings varying in length from slightly less than 7 hours to nearly 10 hours. The data is divided into 1-minute segments, and features are extracted from each segment. Feature extraction is done in two phases. In the first phase, different time and frequency domain features are extracted from the raw data. Some of these features include skewness, kurtosis, mean, standard deviation, power spectrum analysis, and entropy. In the second phase, electrocardiogram data is processed to obtain the RR intervals and R-peak amplitudes. The RR interval is defined as the time interval between two consecutive R peaks. To locate R peaks, the Hamilton algorithm is utilized. The R peaks are subsequently used for the computation of RR intervals. Then, these new signals are analyzed, and different features are extracted, such as MRR, MHR, RMSSD, pNN50, VLF, and HF. In the final phase, all features are concatenated and fed to different traditional classifiers using a 5-fold cross-validation technique. Finally, the best performance was achieved by utilizing SVM.

Results: Our proposed method achieved an accuracy of 85.63%, a sensitivity of 79.03%, a specificity of 89.71%, and an F-score of 80.79%. Our method outperformed state-of-the-art methods that use traditional machine learning methods, with reported accuracies of 80.7%, 82.12%, and 79.39%, respectively.

Conclusion: In conclusion, our study demonstrates the effectiveness of using machine learning and electrocardiogram data to detect sleep apnea. While deep learning methods have shown promising results in this field, they are often computationally expensive. In contrast, our proposed method is computationally lightweight and faster. We achieved promising results using a combination of time and frequency domain features and an SVM classifier. Previous studies only used R peak and RR interval features. In this study, we showed that by combining additional features extracted from raw data, performance significantly improved. For future work, we plan to further improve our feature extraction procedure and analyze features more accurately. Specifically, we will explore the use of additional features from the electrocardiogram signals. Overall, our proposed method holds great potential for improving the diagnosis and treatment of sleep apnea.

Keywords: Sleep apnea, electrocardiogram, SVM, feature extraction

Applications of Artificial Intelligence in Dentomaxillofacial imaging: A systematic Review

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Background and aim: Artificial intelligence (AI) technology has been increasingly developed in oral and maxillofacial imaging. The aim of this systematic review was to assess the applications and performance of the developed algorithms in different dentomaxillofacial imaging modalities.

Methods and material: A systematic search of PubMed and Scopus databases was performed. The search strategy was set as the combinations of the following keywords: "Artificial Intelligence", "Machine Learning", "Deep Learning", "Neural Network", "Head and Neck Imaging", and "Maxillofacial Imaging". Rayann reference management software was used for initial screening. Full-text screening and data extraction were independently conducted by 2 reviewers. The risk of bias was assessed by one reviewer and validated by another.

Results: The search returned a total of 3392 articles. After careful evaluation of the titles and abstracts, 2891 were excluded, whereas 248 papers were excluded after the full-text examination. An additional manual search was done and eligible articles were added, taking the number of final included articles to 211. Most studies focused on AI applications for tooth and implant classification and identification, 3D cephalometric landmark detection, lesion detection (periapical, jaws, and bone), and osteoporosis detection.

Conclusion: Broad clinical applications were displayed in dentomaxillofacial radiology in the included papers. These advancements show that AI has a promising prospect in head and neck imaging.

Keywords: Artificial intelligence, Machine learning, deep learning, neural network, Head and neck imaging, maxillofacial imaging.

Assessment of efficacy and accuracy of segmentation methods in Dentomaxillofacial imaging- A systematic review

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Background and aim: Radiographic image segmentation aims to differentiate the voxels and pixels of a specific area of interest from the image background, which is an essential stage in supporting clinical diagnosis, treatment planning, intervention, and follow-up in dentistry and medicine This paper aims to provide an assessment on the efficacy and accuracy of segmentation methods in dentomaxillofacial imaging by systematically outlining, analyzing, and categorizing the relevant publications in this field to date, highlighting the current state, and making recommendations for future research in the area.

Methods and material: The keywords used for the search were combinations of the following terms for each database: Artificial intelligence, Segmentation, Image interpretation, Deep Learning, Convolutional neural networks, and Head and neck imaging. After the initial search, eligible studies were selected based on the inclusion criteria, and a quality assessment was conducted by QUADAS-2.

Results: Primary electronic database searches resulted in 2763 articles. Finally, a total of 52 records were considered suitable for this systematic review. Twenty-three (44%) used CBCT as a baseline imaging modality, 11 used MDCT (21%),6 used panoramic (21%), 4 used micro-CT, 3 used periapical(1.5%), and 2 used ultrasonography(3%). Segmentation through automatic algorithms was used in the majority of the studies.

Conclusion: The systematic review of the current segmentation methods in dentomaxillofacial radiology shows interesting trends, with the rising popularity of deep learning methods over time. However, continued efforts will be necessary to improve algorithms.

Keywords: Artificial intelligence, Segmentation, Image interpretation, Deep learning, Convolutional neural networks, Head and neck imaging

Optimization of 3D printing application in pharmaceuticals through artificial intelligence - A review

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Background and aims: Ever since the US FDA approved the first 3D-printed medicine, SPRITAM®, new studies were designed based on 3D-printed drugs and related drug delivery systems. The importance of 3D-printed drugs lies in the fact that the printing process alters some of the properties of the finished product (solubility and absorption for instance). Alongside, artificial intelligence has engaged with medicine more than it ever did in past. Hence, more innovative studies have been established to help this new way of drug design and formulation through artificial intelligence and machine learning methods. Hopefully, Artificial intelligence may help the printing process alterations to be more beneficial. The current study scrutinizes previous studies to understand how 3D printing and artificial intelligence interaction can help pharmaceuticals from a more practical point of view rather than theories. Hopefully, this study will help researchers to learn more about proper materials and methods to start using 3dprinters and AI to design and produce new drugs. In addition, the fast progress in the use of 3dprinters and artificial intelligence calls for more updates for past similar studies.

Method: This study is a review of published articles on the Optimization of 3D printing applications in pharmaceuticals through artificial intelligence. In order to find and collect the articles, “artificial intelligence”, “machine learning”, “3D-print”, “drugs”, and “medicine” were used as keywords and Google Scholar, Science Direct, PubMed, Wiley and etc. were used as databases.

Results: The results are categorized into three main subcategories: printability (including the pharmaceutical and related materials that have been used for 3D printing, their traits, and structure-based printability), application of different methods of AI in 3d printing optimization, and other interactions between 3D printing and AI that concerns medicine and drug design. Materials should have certain properties to be printable like high heat resistance, impact resistance, chemical resistance, and rigidity. Another aspect of printability comes from the capability to form and maintain reproducible 3D scaffolds that depend on the product. Different machine learning methods were used to improve the 3D printed products and each method has its positive and negative characteristics. At last, other interactions between 3D printing and AI were included.

Conclusion: When it comes to 3D printing, Artificial intelligence has the ability to analyze an object before starting the process and it is able to predict the quality of the final product. The use of machine learning algorithms also improves the fixation process and reduces manufacturing waste, which is crucial, considering the economical and treatment aspects of medicine and drug design.

Keywords: artificial intelligence, 3D print, medicine, drug design

Identification of the Optimal Artificial Intelligence Algorithm for predicting Myocardial Infarction: A Review

I

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Background and aims: Over the past decade, there has been a dramatic increase in cardiovascular disease incidents. A great deal of previous research into cardiovascular disease has focused on Myocardial Infarction (MI). It can lead to malignant arrhythmia, Heart Failure (HF), and sudden death. Several studies reveal that AI in medicine can enhance modeling, prediction, treatment, and diagnosis. Achieving higher accuracy in HF population prediction models is a major problem that has not been reached with traditional predictive models. Consequently, predictive models based on machine learning techniques that were externally validated could have tremendous help and be an alternative. This study aims to present the most accurate algorithm in MI prediction models.

Method: To identify relevant studies for this analysis, a comprehensive search strategy was developed using the PubMed database. Exclusion criteria were applied to remove studies that focused on mortality, systematic reviews, reviews, and protocols. The inclusion criteria were studies that focused on MI disease, were written in English, and included inpatients from the last decade up to 17th November 2022. To ensure consistency in the data collected, vital signs and discrete physiological measurements of MI patients with no previous history of heart failure were monitored. Prediction decompensation was then used to highlight important features from a combination of model inputs from dissimilar data. This approach aimed to identify the most accurate algorithm for MI prediction models and contribute to the development of effective machine-learning techniques for cardiovascular disease management.

Results: A considerable amount of literature have been published about AI algorithms in medicine prediction models. Generally, 424 papers were included in the study, and we have investigated 31 full texts. Ultimately, inclusion criteria resulted in 9 articles. The most striking result to emerge from the included studies is that the most used algorithms in order are Random Forest (RF) and Logistic Regression (LR). Additionally, the most accurate algorithm was Deep Neural Network which has above 90% accuracy. Moreover, among those used several algorithms simultaneously, Deep Neural Networks had a better Power.

Conclusion: Our findings reveal that the most commonly used algorithms in medical prediction models are Random Forest and Logistic Regression. However, the most accurate algorithm is the Deep Neural Network, which has demonstrated an accuracy rate above 90%. Furthermore, when multiple algorithms are used simultaneously, the Deep Neural Network shows better power. These results suggest that AI algorithms have great potential in improving medical prediction models, and further research is needed to explore their full capabilities.

Keywords: Artificial Intelligence, Machine Learning, Deep Learning, Neural Network, Myocardial Infarction, Heart Failure.

Machine Learning Algorithms for Predicting Mortality in Locally Advanced Colorectal Cancer Patients following Tumor Resection: An Innovative Analysis of Post-Surgery Outcomes

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Background and aims: Colorectal cancer is a leading cause of cancer-related deaths worldwide, with locally advanced cases presenting a higher risk of mortality. Accurate prediction of death risk in this population can inform treatment decisions and improve clinical outcomes. Machine learning algorithms have shown great promise in predicting patient outcomes in various medical fields.

Method: In this study, we aim to utilize a machine learning algorithm-based approach to analyze post-tumor resection outcomes in 290 locally advanced colorectal cancer patients and predict death risk. We employed six machine learning models – Random Forrest, SVM (Support Vector Machine), Decision Tree, Neural Net, Naive Bays, and XG Boost. Training and testing samples were randomly divided in an 8:2 ratio.

Results: The highest accuracy was in the Decision Tree model with an accuracy of 0.944, followed by the Random Forest model with an accuracy of 0.930. The XGBoost and Naive Bayes models showed an accuracy of 0.902 and 0.875, respectively. Finally, the lowest accuracy was shown by the Artificial Neural Network model with an accuracy of 0.694. The included factors were as follows: sex, age, tumor location, recurrence status, recurrence-free survival, surgical techniques, tumor stage, circumferential resection margin, distal resection margin, recurrence type (none, local, systemic, local + systemic), complications (stenosis, obstruction, anastomosis leak, collection, rectovaginal fistula, bleeding, and impotency), and surgery duration. Risk factor analysis was performed by the Random Forest and XGBoost models. The five most influential risk factors for tumor-related mortality based on the Random Forest model were recurrence-free survival, recurrence type, recurrence status, surgical techniques, and circumferential resection margin, respectively. Additionally, according to the XG Boost model, the five most influential risk factors were recurrence-free survival, recurrence status, age, surgery duration, and recurrence type, respectively.

Conclusion: The implications of our findings can provide valuable insights that can improve prognostication and personalized treatment strategies for this patient population. Ultimately, the integration of these insights into clinical practice has the potential to improve clinical outcomes and extend the patients' overall survival.

Keywords: machine learning, feature analysis, prediction, colorectal cancer

Evaluating the role of different artificial intelligence algorithms in increasing the speed of neural networks used in pattern recognition of breast masses

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Background and aims: There are different types of breast masses that are formed in the breast tissue. In some cases, a breast masses indicates breast cancer. Based on tissue characteristics, size and volume, they are classified into benign and malignant types.

Artificial Neural Network (ANN) is a complex system based on the function of the human brain and its nervous system. With the increasing use of artificial intelligence in medical sciences, ANNs can be used as a useful method in pattern recognition for the automatic diagnosis of cancer and determining the type of glands.

The purpose of this paper is to optimize the performance of the perceptron neural network in increasing the accuracy of diagnosing malignant or benign cancerous tumors. Different artificial intelligence algorithms are examined in the optimization of the initial weights of the MLP network, and the best optimization algorithm that has a high CCR is selected.

Method: The dataset used in this article is related to the cancerous mass information of 699 people with breast cancer, for each cancerous mass, 9 characteristics related to size, texture, compression, etc. have been obtained. Based on these characteristics, patients are divided into benign and malignant groups.

The research method used in this article is a practical method that can be used in the field of medicine and the development of medical equipment by using artificial intelligence in the automatic diagnosis of the type of glands.

To check the optimization in determining the initial weights of the perceptron network, Particle swarm optimization algorithms and the bee algorithm have been used. Swiping the parameters that can be adjusted, the results are collected and checked. Feature selection is done by Binary PSO algorithm.

Results: At first, the MLP neural network was formed without optimization and with an accuracy of 94.26%. BPSO feature selection method was used to identify the effective feature. The classification accuracy increased to 96.16%. In the optimization of the network with the PSO method, the best answer of accuracy equal to 98.57 was obtained. by using BEE method obtained 100% accuracy.

Conclusion: The PSO method is better than the BPSO method in terms of detection power, on the other hand, the time rate in the BPSO method is more reasonable because the completion time of the program increases with the increase in the population. But the BEE method is superior to the PSO and BPSO methods in terms of accuracy, and it is more logical in terms of time. By comparing the obtained results, we conclude that the repetition of high correct detection percentage in BEE algorithm is more than other algorithms. The perceptron neural network optimized with artificial intelligence algorithms was able to classify cancerous tumors into benign and malignant groups with 100% accuracy.

Keywords: Breast cancer, Perceptron neural network, Particle swarm optimization algorithm, Bee algorithm

A comprehensive view of the emerging technology of artificial intelligence as a double-edged sword: smart chat boxes in education and challenges

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Introduction: The use of artificial intelligence technology in medical sciences can be seen with different types and different functions.

In recent years artificial intelligence have been widely used in the field of Education and medical sciences. One of the technologies that can be useful in this field are chatbots and chatbots. Chatbots systems has ability to answer users' questions and needs using artificial intelligence and advanced software. These systems have been used in many areas of health. In this article, we will examine the extent of the use of this technology in medicine and health sciences and review its effects on this area

Material and Methods: This study is a review and bibliographic research of all published articles in the field of the role of smart chat in the field of education and its challenges, which has been done in the field of medical science education. From the key words of smart chat or medical science education and health education, patient education and medical education, it was done in Carrot2 search results clustering engine. The articles related to the field were analyzed in this search engine in the form of clustering, and the results with complete articles in Persian and Latin were analyzed. The subject areas of the results were extracted and classified according to the roles of smart chat in the education of medical and health sciences and the education of patients, and then the most important themes of impact were extracted.

Results: The review of the articles shows that the use of this artificial intelligence technology in the field of medical sciences can be examined from different educational dimensions in the field of teaching professors, students and patients in health education. These include:

- Looking to the future in the field of today's technologies

- A model of dialogue and communication with others in various fields including health sciences

- Its effect on the available scientific libraries and resources, which on the one hand is complete and on the other hand, the use of printed resources is diminished.

- Its positive effects in care and its challenges: the existence of a rich source of scientific information and on the other hand the lack of attention to multiple factors/factors and situations in humans and their impact on decision-making

- Using it in caregivers and caregivers as a complete and valuable scientific resource

- Improving information about the disease and the outcome of patients without the need to be in a specific place and situation

- Assisting in the preparation of technical preparations in the construction of functional products, ready coding without the need for user expertise

- Help in writing books, articles and theses

- Using it in advanced and up-to-date medicine

-Creating a new industry in medical science and health

- A model for self-care with improved communication

- Simple and practical use to access information

- Counseling and guidance of care and mental health and the challenge and multi-dimensionality of human conditions in the matter of counseling

- Impact on improving the quality of life in patients through simple and easy access to information

- Leadership and leadership in finding up-to-date information in this specialized field (3-5)..

Conclusion: Each of the mentioned areas has examined the opportunities, people's attitude, challenges and obstacles and discussed their use. The use of this technology in various sciences, including medical sciences, is inevitable and the use of artificial intelligence. Due to the smart chat box, it is an example of a new technology with unique capabilities, which, while creating the opportunity for development and a new look at this science, can create different positive and negative attitudes in education, research, education, care and then health due to the ambiguity of the effects. to create it. On the other hand, its legal and legal dimensions are of particular importance due to the need to pay attention to the legal and legal dimensions of resources and information in education, and more importantly, community health education.

It is necessary to pay attention to technology, consider its obstacles and limitations, and think more carefully about its rapid application in health sciences. It is also necessary to mention that despite the fact that there is a lot of information available, in the sufficiency and simplification and comprehensive use of this technology, the major dangers of education and research such as the actual inaccuracy of the information and its incompatibility with the goals pursued, plagiarism, fraud, and infringement of intellectual property and will result in a decrease in originality. Therefore, it is necessary to prepare the ground for the use of new technologies by formulating and making precise scientific and ethical policies in this field and effective culture building, so that with a practical and have an effective view to the technology and considering all its aspects to provide in medical education and health sciences.

Keywords: Smart chat boxes, Education, challenge, Medical, Medical Ethic

Diagnosis and Classifying Cancer Subtypes Based On Gene Expression Data Using Cost-Sensitive Hybrid Deep Learning

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Accurately identifying cancer subgroups is crucial for effective diagnosis and prediction of cancer outcomes. Deep-learning methods have gained popularity in recent years for this purpose. However, the optimal performance of a deep neural network relies heavily on its architecture, which makes it challenging to determine the best structure. Moreover, the large number of genes in gene expression datasets and the imbalanced data distribution among different classes pose significant obstacles to achieving high accuracy in cancer subgroup classification models.

To address these issues, we propose a novel convolutional neural network model that uses a cost-sensitive learning approach to improve the accuracy of minority class identification. We also utilized three techniques, namely, the Fisher ratio, anomaly sets, and a combination of both, to reduce the number of genes in the preprocessing stage. Our cost-sensitive approach involves creating a cost matrix based on class distribution and utilizing it in the loss function of the convolutional neural network to calculate the error rate.

We evaluated our proposed method using two cancer datasets, and compared the results with those of a convolutional model without feature selection and cost-sensitive learning. We used four standard metrics, namely, accuracy, recall, precision, and F1-score, to measure performance. Our results demonstrate that selecting appropriate genes and using a cost-sensitive learning approach significantly improves the performance of our proposed method, achieving increases of 11%, 10%, 18%, and 21% in accuracy, recall, precision, and F1-score, respectively.

Overall, our approach demonstrated the effectiveness of combining cost-sensitive learning and feature selection techniques to address the challenges of imbalanced data and a large number of genes in cancer subgroup classification. This study has important implications for improving the accuracy and efficiency of cancer diagnosis and prediction using deep learning methods.

The smart diagnostic, therapeutic and educational device for traditional Chinese medicine: A protocol study for an invention based on AI

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Background: Traditional Chinese medicine (TCM) has been practiced in China for more than 3000 years and is widely used around the whole world nowadays. TCM exhibits significant efficacy against many diseases. The TCM therapist starts the diagnosis process by determining the patient's disharmony pattern with takes a medical history and examination, including checking the pulse and observing the tongue and sometimes the iris and etc. Then performs the treatment with various methods such as herbal therapy, acupuncture, tai chi, diet, acupressure and etc. Today, artificial intelligence (AI) has greatly contributed to the advancement of medicine.I expect that this smart device will achieve its diagnostic, therapeutic and educational goals with the help of AI.

Methods: This smart device's main parts include a pulse analysis sensor, a camera for tongue and iris analysis, a scanner and a cpu. First it takes a complete history of the patient with a standard questionnaire. Then the received data of all part of device is matched with the database defined for the device and then disharmony of the patient will be determined based on the concepts of TCM. The attention mechanism aggregation module scores contribution of each symptom to syndrome classification in a feature integration matrix by adopting an attention mechanism with an annealing coefficient by means of features of all symptoms and features of interaction information among the symptoms, and selects the symptoms with scores higher than a score threshold to form a symptom group for syndrome classification diagnosis. According to the method, the most representative symptom group is selected for each type of syndromes. The treatment will be provided to the patient in the form of a text file for diet and herbal therapy and videos for tai chi and acupressure. For acupuncture treatment with the help of the intelligent voice assistant, by placing the scanner of the device in a suitable position of the patient's body, the desired points will be identified with the anatomical landmarks and will be needeled by the divice automatically. The possibility of electroacupuncture and needle manipulation will be available.

Discussion: None of the diagnostic methods of TCM are complete alone, also the different perception of different therapists on the numerous diagnostic criteria of Chinese medicine causes differences in the quality of diagnosis and treatment. A validation study in 2022 done by Tianyong Hao and colleagues in china entitled "Artificial Intelligence–Based Traditional Chinese Medicine Assistive Diagnostic System" which is just based on Patient history. The difference of this research with my plan is that In addition to the history of the patient, my device performs the diagnosis process by analyzing the pulse, tongue and iris, and then performs the treatment automatically with the help of its voice assistant. Reducing the diagnosis cost, will decrease Financial burden. Definitely, this smart device will be very useful for the educational use for Chinese medicine students due to its full coverage of the diagnosis and treatment process.

Keywords: traditional Chinese medicine, artificial intelligence, acupuncture, smart device

An ANN-Based QSAR Model to Predict Anti-Staphylococcus aureus Activity of Oxadiazoles

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Background: Antibiotic-resistant bacteria are likely to be one of the most critical problems in the future; hence, more effort is needed to design and develop new types of antimicrobial agents. Quantitative Structure-Activity Relationship (QSAR) is a procedure which helps other researchers to design better chemical agents with more potent biological activity. QSAR can be defined as a quantitative relationship between the chemical structure and biological activity.

Methods: After drawing structures (102) in ChemDraw, structure optimization was done in Gaussian 09. Descriptors were generated by Dragon (3260 for each compound). Feature selection was done by SPSS modeller and 300 descriptors were selected. GMDH shell software was used to create a predictive model. PLS was also performed using crossval.m and pls.m that were available in MATLAB 2014 toolbox to generate another model

Results: In this study, a previously-synthesized oxadiazole library was used to build a QSAR model based on the Group Method of Data Handling (GMDH) method and Partial Least Squares (PLS) regression. Owing to their high correlation coefficients (R2) for test and training data, both methods are sufficiently reliable. In this study, the active compounds of the library were used as a template to design new chemical compounds predicted to have a great anti-Staphylococcus aureus (S. aureus) activity according to PLS, GMDH, and docking methods. GMDH and PLS are highly flexible such that they can include other information like absorption, distribution, metabolism, and excretion (ADMT) and toxicity.

Conclusion: The selected methods can be used to handle huge amounts of data from a large library of chemical compounds and help research and development (R&D) process. Additionally, the designed model and the proposed compounds can help other researchers to find the best anti- Staphylococcus aureus chemical compounds.

Title: Prediction of Post-Traumatic Stress Disorder (PTSD) in Healthcare Workers Based on Machine Learning

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Machine learning has been used in various fields like mental health. One area explored is post-traumatic stress disorder (PTSD). The condition known as PTSD may manifest after an individual has encountered or observed a traumatic event, affecting their mental wellbeing.

Background and aims: The aim of this study was to investigate the factors that affect on post-traumatic stress disorder using machine learning methods.

Method: In this cross-sectional study, 637 Mazandaran University of Medical Sciences healthcare workers were studied from 27 June to 2 September 2021. Participants included nurses, medical, midwifes, technicians, and support staffs. The Demographic Information Checklist and PTSD and DASS21 Questionnaire was completed. Data analysis was performed by machine learning algorithm using neural network the python.

Results: After performance model, test loss equals 0.03 and test accuracy equals 0.99. The most important features in model was depression, stress, anxiety, history of psychiatric disorders, working hours with COVID Patient, contact group with patient and occupation.

Conclusion: It seems the performance of model is quite good with a low test loss and high accuracy. The features that were found to be most important in the model suggests that these factors may play a significant role in predicting outcomes related to PTSD in individuals who have been exposed to COVID-19 patients. It may be helpful to further investigate these factors and how they interact with each other to gain a deeper understanding of their impact on mental health and well-being.

Keywords: Machine learning, neural network, post-traumatic stress disorder, COVID, health workers.

The accuracy of Convolutional Neural Network-Long Short Term Memory (CNN-LSTM) in diagnosing different types of Acute Lymphocytic Leukemia based on Peripheral Blood Smear

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Background and aims: ALL (Acute Lymphoblastic Leukemia) is the most prevalent type of leukemia in children and its screening and diagnosis process is often expensive, invasive, and needs to be done by experts. The initial screening process is commonly done by acquiring a Peripheral Blood Smear (PBS) from the suspected patient and examining the sample under a microscope. Further confirmation and diagnosis of the subtype are necessary for determining the right treatment protocol; which includes bone marrow aspiration and flow cytometry or specific molecular tests. Recently, new Artificial intelligence methods have provided more economical and available ways to diagnose different types of diseases. These methods are not only efficient in distinguishing between malignant and benign images, but also, they can classify subtypes of ALL. Thus, this research intends to implement a CNN-LSTM (Convolutional Neural Network-Long Short Term Memory) model for classifying ALL subclasses.

Method: In This Pipeline, we first divided our dataset into training (90% of the whole dataset) and test (10%) subsets, then preprocessed our data (Segmentation: RGB to LAB, Clustering, Binary Thresholding, Filling holes). LSTM as a kind of Recurrent Neural Network (RNN) first was used to tackle the long-term dependencies problem. This problem was due to the fact that Classic RNNs could not give accurate predictions based on long-term information. Later on, investigations showed promising results in mixing the LSTM model within CNN architecture. We used CNN-LSTM as the model and LSTM was implemented before fully connected hidden layers. Then Adam Optimizer and Cross-Entropy loss function were employed in training the model. In this project, we used the dataset provided by M Amir Eshraghi and Mustafa Ghaderzadeh (Blood Cells Cancer (ALL) dataset), which includes 3242 Peripheral Blood Smear (PBS) images of 89 patients: 512 benign, 955 Pre-B, 796 Pro-B, and 979 early Pre-B labeled images (using flow cytometry).

Results: Our model reached accuracy, precision, recall, and specificity equal to 96%, 95.21%, 95.15%, 98.64% respectively after 22 epochs.

Conclusion: This method achieved fairly good results, especially because it can differ ALL subtypes with such accuracy that in traditional clinical settings can only be done by flow cytometry. Using these methods can reduce human errors, laboratory costs and the time between diagnosis and the start of treatment. In general, the development of such models can assist clinicians in the process of initial screening of hematological malignancies, using only a peripheral blood smear. For future work this method can be further expanded on other datasets and for other types of hematological cancers such as AML, CML or CLL.

Keywords: Acute Lymphocytic Leukemia, Deep Learning, Peripheral Blood Smear, Classification, Long Short Term Memory

Machine learning-based techniques in liver transplantation: a systematic review

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Background and aims: Liver transplantation or hepatic transplantation is the replacement of a diseased liver with another person's healthy liver. Liver transplantation is a treatment option for those with severe conditions due to end-stage liver disease and also in cases of acute liver failure. Artificial intelligence and its primary subfield, machine learning, have begun to see widespread application in medicine, including liver transplantation. Numerous machine learning (ML) models are proposed by researchers around the world to achieve this purpose. Our study aims to investigate the application of machine learning techniques in liver transplantation.

Method: A systematic search was carried out in the Medline (PubMed), Scopus, Web of Science (WOS), Cochrane databases using a combination of the key terms liver, transplantation and machine learning and their alias from January 2010 to February 2023. Then, the title, abstract, and full text of extracted articles were screened using the PRISMA checklist. Studies dealing with the application of ML algorithms coupled with liver transplantation were included. The information regarding developed models was gathered from studies that were reviewed.

Results: Of 1215 retrieved articles, 897 studies were excluded after the title and abstract screening. Finally, 41 articles were determined as eligible studies that met our inclusion criteria.

Machine learning methods used include logistic regression (n=9, 14%), Support vector machine (n=8, 12.5%) technique, neural networks (n=7, 11%), Random Forests (n=7, 11%), Decision Tree (n=7, 11%), Bayesian network (n=6, 9.25%), linear regression (n=6, 9.25%), Convolutional Neural Network (CNN) (n=4, 6.25 %), Gradient Boosting trees (XGBoost) (n=3, 4.75%), KNN (n=3, 4.75%), K-means (n=3, 4.75%), and Markov Model (n=1, 1.5%). Most studies (n=32) used more than one machine learning technique or a combination of different techniques to make their models. In most studies, researchers succeeded in estimating post-transplantation survival rate (n=21) or predicting recipient-donor matching in liver transplantation based on characteristics of donor recipients and past experiences with liver donors and recipients (n=10) by developing machine learning algorithms. Additionally, UNOS was mentioned as the most preferable data source in the studies that were reviewed. In most studies performance of machine learning algorithms was excellent and promising.

Conclusion: The information currently available on liver transplants is huge. Machine learning context has led to the use of other non-traditional techniques more suitable, showing better performance, to conduct predictions regarding liver transplant data.

Keywords: machine learning, artificial intelligence, liver transplantation, liver failure

Diagnosis of lung cancer in Artificial Intelligence age: A systematic review

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Background and aims: Nearly one-quarter of all cancer deaths worldwide are due to lung cancer, making this disease the leading cause of cancer death among both men and women. The key issue in the fight against lung cancer is the detection and diagnosis of this disease at an early stage. Artificial intelligence has been proposed as promising tool to help this purpose. The main objective of this study was to review artificial intelligence techniques and their effectiveness in diagnosis of lung cancer.

Method: A comprehensive search was performed in PubMed, Scopus, ISI Web of Science, Embase, and Cochrane databases from 2017 to February 2023 in order to identify the studies that used artificial intelligence to diagnose lung cancer and based on the relevancy and details, articles were selected from all the currently available literature.

Results: The systematic review identified 25 eligible studies, of which 18 used radiomics models and application of deep learning in diagnosis of lung cancer by computed tomography (CT) scan, low-dose CT (LDCT) scan and chest X-ray images like [18F]FDG-PET/CT and artificial intelligence film reading system. Meanwhile, 7 studies were based on molecular analysis, using decision tree methods, neural networks and support vector machines (SVM) for prognosis prediction in lung cancer.

Conclusion: With the advance of technology, artificial intelligence could have great potential impacts in lung cancer diagnosis. In doing so, artificial intelligence can help in the early detection of cancer and provide appropriate therapy through the available information. Although artificial intelligence is an invaluable tool there are some challenges about its widespread implementation and availability. For instance artificial intelligence relies heavily on data, and data acquisition continue to be a challenge that artificial intelligence will need to overcome. Furthermore, patient and provider trust and Privacy concerns are other obstacles. Artificial intelligence combined with radiography, genomics, surgery, clinical oncology, pathology, electronic health records, and other data streams gathered into a powerful comprehensive diagnosis system and combined with 5G may be of great therapeutic value in lung cancer.

Designing and production a smartphone-based patient education application for chronic kidney disease (mobile)

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Background and aims: Chronic kidney disease)CKD) is a progressive condition that affects، about 10% of the general population worldwide, amounting to، 800 million individuals. CKD is more prevalent in older individuals, women, racial minorities, and in people experiencing diabetes mellitus and hypertension and represents an especially enormous burden in low- and low-middle-income countries. It has emerged as one of the leading causes of mortality worldwide, especially over the past 2 decades. Considering the prevalence of CKD and the increasing trend of the disease and the high mortality rate due to the disease, education can play an important role in preventing end-stage CKD ; which reduces the economic and social burden of the disease on the health system and patients.

Considering the great influence of the media on the society, the purpose of this application was to provide comprehensive, simple and attractive important material for CKD patients.

Method: The application is designed by an online application developer for Android and IOS.

Project implementation process:

Designing a mind map to determine the different parts of the application under supervision of a nephrologist.

Collecting content and materials based on the up-to-date. (https://www.uptodate.com)

Translation of the contents and restoration in simple language for better understanding of the contents

Review and correction of data by nephrologist.

Designing graphic images related to each section for easier understanding of the content.

Making the template and designing different parts of the application and then doing the internal graphic design of the application.

Uploading content in the application.

Arrangement of graphic images in the application.

Production and editing of learning videos for the most important contents and loading in the application.

Results: The user- friendly application is designed for Android and IOS, and the different parts of the application include:

Chronic renal failure (definition, symptoms and complications, evaluation and diagnosis, risk factors and treatment)

Trainings (includes 3 main sections of exercise, nutrition and vaccination)

Dialysis (dialysis overview, dialysis initiation time, hemodialysis and peritoneal dialysis sections)

Kidney transplant

Epidemiology of CKD

Frequently Asked Questions

This mobile app also includes a mechanism that allows patients to contact with a nephrologist via direct message (@kidney_health Instagram page) to facilitate and support, education, or even virtual clinic visits.

Conclusion: This CKD app, provide useful educational material on all aspect of CKD, for Patients with CKD as well as general population. We believe that a mobile app can improve CKD self-management by facilitating patient and their family education and enabling self-care activities including treatment adherence.

Keywords: chronic kidney disease, mHealth, mobile apps, smartphone, digital health.

An intelligent model in Human physical activity recognition for personal health assistant

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Background and aims: Wearable technology has revolutionized the way we monitor and track our daily activities. With the advent of advanced sensors, it has become possible to track and analyze human behavior in real-time, providing valuable insights into our physical and mental well-being. With the development of advanced machine learning algorithms, it has become possible to identify a person's specific activity and behavior accurately. This has opened up new avenues for healthcare professionals, clinicians, and caregivers to provide personalized care and treatment. This study has found applications in various domains, such as healthcare, mental health care, elder care, and sports monitoring.

Method: The WISDM dataset is a valuable resource for developing human activity recognition models as it provides a wide range of accelerometer data collected from various devices. The proposed model that aims to accurately detect common daily activities by separating the X and Y axes has shown promising results in recognizing human activities. The Bayesian network, which learns the relationships between the features, provides a way to capture the complex dependencies between different aspects of the data, while the two-dimensional hidden Markov model captures the temporal dependencies between the activities. By using these models in combination, the proposed approach provides a powerful and accurate tool for recognizing human activities, which can be applied in various fields, such as healthcare, sports, and entertainment.

Results: The proposed approach achieves high accuracy in recognizing human activity, making it useful for various applications. It can track not only the activity but also other characteristics such as health, lifestyle, and nutrition to help people achieve healthy lifestyles and independence. Automated assistance offered by this approach can benefit people who require ongoing care. The method's ability to identify potential areas for improvement or intervention in individuals' daily activities could significantly enhance their quality of life and contribute to a more efficient and cost-effective healthcare system. Overall, the approach has the potential to revolutionize the field of human activity recognition and bring significant benefits for individuals and society as a whole.

Conclusion: The method described in the paper combines two probabilistic models, a Bayesian network and a two-dimensional hidden Markov model, to accurately identify the nature of individual activity. The approach has potential applications in various fields, including healthcare, where it could be used to track human activity and help people achieve healthy lifestyles and independence. The method could also be used to assist people who require ongoing care, such as the elderly or those with disabilities, by providing insights into their daily activities and identifying potential areas for improvement or intervention. Overall, the approach offers a promising avenue for leveraging probabilistic models to improve human health and well-being.

Keywords: Machine learning, sensor, human physical activity, recognition, smart devices

An architecture for sharing and reusing health data

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Background and aims: With the emergence of a large amount of medical data in new information systems and due to the use of new technologies, a need arises that how to make this data available to research centers and those who can use this information in order to create value for patients and Medical and service community to use.

Method: In this plan, we will analyze and assess various smart hospital architectures and platforms. Our objective is to identify the most appropriate architecture for sharing hospital data. To achieve this, we will conduct a case study based on a smart hospital and evaluate its effectiveness.

Results: From the very beginning of the formation of hospital information systems, the primary value and importance of these systems was the creation and design of the system for managing patients' bills and payments. Therefore, no targeting in the field of hospital data sharing to improve the conditions of hospitals, providing more and additional services to doctors, nurses, patients, as well as research applications based on these data was not considered. On the other hand, the value of the high volume of health data in this field is still not known, and this lack of awareness prevents the provision of useful services that can improve the lives of a large number of patients and medical and research procedures. Collecting this high volume of medical and health data and making them available to different organizations with the aim of using them in medical research, pharmaceuticals and awareness-raising leads to creating value and making money in this field. The architecture we want to present complements health information systems to enable these systems for new applications based on data collection, management, distribution, security, and governance. Provide a new architecture that can respond to the needs of hospital data sharing, so that it can integrate different sources of data and information within the hospital with each other and using a standard method and by maintaining the confidentiality of the patient's rights and the type of access and security at the disposal of consumers for applications. various research, medical, treatment, drug prescription, information, etc.

Conclusion: We have developed a comprehensive service-oriented architecture for this domain, encompassing a range of critical features including data acquisition, information management, data distribution, data governance, data security, data analysis, and service management. Based on the research conducted, a comprehensive healthcare architecture has been developed using the aforementioned reference model. The design of this architecture has been tailored to meet the specific needs and conditions of the country, and it is viable for implementation in local hospitals.

Keywords: Smart hospital, Hospital information system, big data, Internet of Things, Data sharing

Biomedical research as technology: Blockchain solution for decentralization based on Habermas critical theory

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Background and aims: Biomedical researches are organized with the aim of producing biomedical knowledge. These researches consist of many components. Technological tools, living organisms, questionnaires, organizational rules, study methods, scientific methodology rules, datasets, commercial companies, institutions, universities, advertising and media tools, governments and people themselves all exist within this system and are involved in the definition of biomedical research as a systemic technology.

Research, as a systemic technology, also follows its governing nature. Technology in the definition of a system has a human being inside it, and it cannot be considered as a mere user outside it, similar to technology defined as a tool. The attempt to dominate the lives of the technical and bureaucratic elites is technocracy.

Method: In his criticism of technocracy, Habermas formulates the duality of "action"-"interaction", an expression that reminds of the Aristotelian interpretation of "techne"-"praxis". "Action" is based on the centrality of rational choices and productive goals, while "interaction" is based on the centrality of consensus norms. This distinction reminds us of the instrumental-systemic distinction in defining biomedical research as technology. The technological and ideological development of the institution of research has led to the concentration of its power and dominance over research.

Results: Current biomedical research works in a centralized, top-down framework. The description of this situation in biomedical research with the help of Habermas' critical view will clarify the various dimensions of centralist challenges in them. Challenges such as public participation, reproducibility, free access to information and data, the absence of a huge data network, and the undemocratic nature of the system governing biomedical research.

Conclusion: The effort to solve these challenges should be based on an approach to decentralize biomedical research. Providing a solution to solve this centralism can be effective in a wide way on the damage caused by it. One of the solutions that can be helped is to replace the centralized system of biomedical research with a system that has decentralization in it. Our proposed solution for this issue is the use of blockchain technology. Blockchain is a shared and immutable ledger that facilitates the process of recording transactions and tracking assets. Using it to collect and record data, analyze big data, decentralize the research publication process, transparency and free access, and democratize the research process can be useful. Using this technology can also create challenges. Abandoning subjectivity as much as possible, technologicalization of medical diagnoses, increasing health anxiety, weakening the relationship between doctor and patient, creating financial relationships between researchers and research subjects, and promoting pseudoscience and methodological errors are among them. These challenges require more analysis and investigation from the side of meta-research, health humanities and philosophy.

Keywords: Biomedical research, blockchain, Habermas, critical theory, decentralization

Evaluation of machine learning methods to stroke mortality risk prediction

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Background and aims: Stroke is the second leading cause of mortality in the world and the leading cause of acquired disability in adults. Also, two-thirds of the stroke-induced burden occurs in developing countries. Identifying patients' mortality risk at admission can contribute to valuable clinical care modifications by identifying high-risk patients with poor outcomes who require more intensive resources. Nowadays, Artificial Intelligence (AI) and machine learning as a main field of it, is gaining much attention. Using machine learning, may improve diagnostic accuracy, speed up decision-making, and be very useful in prediction. The aim of this study was to apply various machine learning (ML) methods to predict in-hospital mortality risk among stroke patients.

Method: This cross-sectional study used clinical and demographic data of 1281 hospitalized stroke patients from February 2018 to March 2019 to develop a mortality risk assessment model. Data were preprocessed and cleaned, important features were selected, and features and cases with more than 20% missing values were removed. Sampling with replacement was done in order to have equivalent groups. Data imputation was also done to replace the remaining missing values. Data were analyzed through 5-fold cross-validation using models including Random Forest, Support Vector Machine, Decision Tree, Neural Network, Naïve Baysian, and XGBoost repeated 5 times. Their results were evaluated and compared and the best one was selected. Models were deployed in R Studio software using packages including "randomForest", "caret", "e1071", "neuralnet", "naivebayes", and "xgboost", and evaluation metrics were recorded.

Results: Twenty-eight out of thirty features for 1208 samples were extracted. After feature selection, nine features with the highest importance value were selected: NIHSS, CT result, treatment received, Length of Stay (LOS), MRS, Age, Weight, Systolic Blood Pressure and Blood Glucose. The reported accuracy for the Random Forest, SVM, Decision Tree, Neural Network, Naïve Bayes and XGBoost were 0.979, 0.925, 0.9033, 0.500, 0.850 and 0.963, respectively. Random Forest model reported the best accuracy was 0.79 (95% CI of 0.9611, 0.9913); and receiver operating characteristic (ROC) was drawn.

Conclusion: Among all five machine learning algorithms used in this study, random forest algorithm had the better performance in predicting in-hospital mortality stroke patients, thus further research should be conducted on random forest algorithm. The prediction models could be used for early risk assessment of patients with stroke. Identification of patients at high risk for mortality immediately after admission has the potential of enabling early discharge planning.

Keywords: Machine Learning; stroke; Mortality; In-hospital

Characteristics of Smart Hospital: A Review Study

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Introduction: Exponential growth potential and increased capabilities of new technologies. The rapid development of healthcare, IT, and the recent development and implementation of the ideas of the Fourth Industrial Revolution show the prospect of shaping a completely different healthcare model. Smart hospital is the new generation hospital surpasses the limits of existing hospitals in terms of quality care, patient safety, patient experience and productivity using related technologies in the fourth industrial revolution. This review aimed to identify characteristics of smart hospitals.

Methods: We conducted a narrative review to find definition of a smart hospital and draw its service categories and technologies. The review was based on keywords such as "smart hospital," and we searched literature databases such as PubMed, Scopus and Google scholar. From the search results, articles, books, and trending reports can explain a scientific explanation of the medical field was selected as the ultimate search target.

Result: A smart hospital is a healthcare organization that uses ICT to create new value and vision on patient safety, quality of care, cost efficiency and patient centeredness, and make them quantitatively available to patients and medical staff. Main characteristics identified in smart hospitals include: digitalization all provided information in patient care process, using position detection and tracking technology for rendering different services by measuring and monitoring the position of object information. Using high speed communication network for overcoming the former problems in data collection, analysis and distribution; artificial intelligence-based decision support systems for diagnosis and treatment diseases. Technologies like IoT-based services connect various objects with sensors and communication functions to the Internet. Rendering supportive and medical services through mobile devices such as cell phones, tablets. The provision of medical services by robots on human behalf is known as robot services. These services cover a wide range of areas, including surgery, rehabilitation, and nursing care. Applying VR applications in healthcare to improve practitioners' clinical skills, education, and training. The final feature of smart hospital is providing service through telemedicine.

Discussion: This study identified characteristics of smart hospital. The result of study could be used to develop and spread smart hospitals by governments. We need more study to recognize other aspects of smart hospital.

Keywords: Smart hospital, Artificial intelligence, information technology, loT

Distinguishing anti-hyperglycemic agents poisoning by machine learning: producing a practical web application using National Poison Data System

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Background and aims: Biguanides and Sulfonylureas are the most commonly prescribed drugs to treat type 2 diabetes. Clinical manifestations of anti-hyperglycemic agents may overlap each other therefore distinguishing exposure to these drugs may be complicated. In medical toxicology, few studies to date have used machine learning (ML) on national poisoning data to identify the potential cause of the poisoning. ML is a subfield of artificial intelligence (AI) which is appropriate to risk modeling in field of medicine. ML aims to learn relations and patterns from available data and computational algorithms. In This study we used the US national database to evaluate the effectiveness of machine learning in identifying antihyperglycemic agents. With ML, doctors can broaden diagnostic considerations, start treatment earlier, reduce adverse events, and improve clinical outcomes.

Method: In this cross-sectional descriptive-analytic study, the data of single exposure by Sulfonylureas and Biguanides during 2014-2018 (n=6183) was demanded from the National Poison Data System (NPDS). Four machine learning models (Random Forest classifier, k-Nearest Neighbors, Xgboost classifier, Logistic Regression) were applied for this study. The XGBoost model approach is built on gradient-boosted algorithms and decision trees. Random forests are tree-based algorithms that prevent overfitting. Logistic regression algorithm predicts the likelihood of an occurrence. K-Nearest Neighbors is a fundamental supervised learning classification method. We divided the data set into two parts: Train (75%) and Test (25%). The performance metrics used were accuracy, specificity, precision, recall, and F1-score. The "area under ROC curve" (AUC) was also used as a performance criterion that reflects how well a studied method can diagnose these two drugs.

Results: 3336 biguanide and 2847 sulfonylurea exposure were reported in National Poison Data System in five years. The applied algorithms for classification results of different models to diagnose antihyperglycemic agents were accurate (91-93%). The accuracy of our models in determining mentioned two antihyperglycemic agents was 91-93%. The Precision-Recall curve respectively showed average precision of 0.91, 0.97, 0.97, and 0.98 for k-Nearest Neighbors, logistic regression, random forest, and XGB. The logistic regression, random forest, and XGB had the highest AUC (AUC=0.97) among both biguanides and sulfonylureas groups. We have also introduced a web application (https://aiandhealth.net/applications/Antihyperglycemics_Distinguisher) to assist physicians distinguish these two agent's poisoning.

Conclusion: Machine learning can distinguish antihyperglycemic agents, which may be beneficial for physicians without significant background in medical toxicology. Also, our suggested Web application has the potential to help physicians in their diagnosis.

The algorithm of selection next hop in wireless body area network based on framework of map reduce

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Background and aims: Body wireless sensor networks are an example of wireless sensor networks. This network includes a number of small sensors, control unit, transmitter and receiver. These sensors are used to collect patient information and send them to the control unit. By using these types of networks, it is possible to significantly help patients and the elderly, and in addition, reduce treatment costs. Can the body's wireless sensor network help the elderly and patients to diagnose and treat the disease and reduce the number of visits to the hospital in the shortest possible time.

Method: In this paper, a new efficient protocol based on map-reduce framework is presented. Map-reduce is an algorithm parallelization framework that significantly reduces the time consumption of the algorithm. We simulated the proposed algorithm by using eclipse software and installing Hadoop framework on it.

Results: The analysis and simulation results of the algorithm show that the percentage of CPU occupancy and memory consumption has decreased. This method has improved more than 20% compared to the compared method.

Conclusion: The use of body wireless sensor networks has improved the quality of life and comfort of patients. This technology is always developing in order to provide the best service to patients, doctors and medical centers. In this article, we have presented a new efficient protocol based on the map-reduce framework. which uses the mapping-reduction framework to select the next hop in parallel so that the computing time is reduced and the speed of the provided protocol is increased compared to the existing protocols.

Keywords: Map-Reduce, wireless body sensor network, quality of service, next hop, selection.

Classifying Various Types of Symptoms of COVID-19 (CTSC) in Twitter Using Deep Learning Algorithms

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Data mining has many uses in the field of health, including diagnosis of diseases, classification of patients in disease management, finding patterns for faster diagnosis, and preventing complications. In this field Research for extracting public health data in social networks such as Twitter has grown exponentially. Many researchers have decided to use machine learning and deep learning algorithms for such analysis.

Background and aims: whether Social networks can enable the early detection of symptoms of diseases such as COVID-19, whose treatment is not known for sure, and our knowledge about it is expanding. The aim of this study prediction COVID-19 of symptoms.

Method: In the CTSC method, the meaningless information is eliminated by collecting tweets from 26 June, 2021, to 4 July, 2021, concerning the symptoms of COVID-19. The root of the words is found, and then they are classified based on the dictionary of five categories: respiratory, digestive, muscular, smell-taste, and sinusitis. Various deep learning algorithms such as convolutional neural network, recurrent neural network, and gated recurrent unit have been used to classify these tweets. To evaluate the proposed method, we have considered the accuracy and percentage of error (Loss).

Results: The results show that users diagnosed with covid19 show respiratory symptoms, including sneezing, pneumonia, sore throat, coughing, fever, gasping breathing, and heart problems are 41% likelier than others. We also obtained the best performance for evaluating the CTSC method by deep algorithms with 97% accuracy.

Conclusion: In this research, we provide a method based on different types of symptoms of COVID-19 using three deep learning algorithms CNN, LSTM, and GRU.

In this study, the Twitter data has been pulled out from Twitter social media for 9 days, and tweets are extracted based on positive COVID-19 hashtags. Tweets are then cleaned and matched against a symptoms lexicon and then labeled based on various types of symptoms of COVID-19 using mentioned algorithms. The evaluation results show that the presented method with an accuracy of 97 percent and a Loss of 0.06 has the best performance. In future work, we can apply this method to Persian tweets and include more symptoms in each category to obtain more accurate results.

Keywords: COVID-19, Respiratory, Twitter, Deep Learning, CTSC.

Distinguishing acute poisoning agents using machine learning models derived from the National Poison Data System (NPDS)

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Background and aims: Acute poisoning is known to be a globally major health problem and due to a patient's inability to verbally convey the exposure history, obtaining an accurate exposure history can be challenging. Artificial intelligence (AI) uses logic and decision trees to replicate human decision-making. Machine learning (ML) is a subgroup of AI that benefit from statistical models to execute tasks based on inference but not definite instructions, which allows the model more flexibility to learn and improve itself. This study aimed to develop a machine-learning algorithm that can predict and distinguish eight poisoning agents based on their clinical symptoms.

Method: Data were obtained from the National Poison Data System from 2014 to 2018, for patients with single-agent exposure to 8 drugs/drug classes (lithium, aspirin, benzodiazepines, bupropion, acetaminophen, calcium channel blockers, diphenhydramine, and sulfonylureas). The four classifier prediction models were applied including LightGBM, Logistic regression, XGBoost, and CatBoost. Standard performance measures were also calculated including accuracy, F1-score, recall, precision, and specificity.

Results: In total 201031 cases were included to develop and test the algorithms. Accuracy among these four models ranging from 77-80%, precision, and F1-scores were 76-80%, and recall was 77-78%. Overall specificity was 92% for all four models. Accuracy was highest for distinguishing sulfonylureas, acetaminophen, benzodiazepines, and diphenhydramine poisoning. F1 scores were reported to be highest for correctly classifying sulfonylureas, acetaminophen, and benzodiazepine poisonings. Also, recall was highest for sulfonylureas, acetaminophen, and benzodiazepines, and lowest for bupropion. Specificity was >99% for models of sulfonylureas, lithium, calcium channel blockers, and aspirin.

Conclusion: LightGBM and CatBoost classifier prediction models had the highest performance of those which have been tested. The algorithms were most accurate in classifying sulfonylurea poisonings, followed by acetaminophen, benzodiazepines, diphenhydramine, and bupropion poisoning. Although the clinical utility has not been studied, with further development in this subject this may serve as a useful diagnostic aid.

Keywords: Machine learning, Artificial intelligence, Toxicology, Poisoning, Overdose

Advance Technologies for Smart Patient Tracking Systems

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Introduction: According to the advances of AI, the way of life has been changed and alongside that, service delivery in different areas has changed a lot. Healthcare domain is not an exception and is affected by AI in many aspects including prognosis, diagnosis, management, cure and etc. Actually, there are many challenges in this area which is handled or can be handled by AI. One of them is the monitoring, management and tracking of patients in the hospital. A patient tracking system is a system that is put in place to monitor patient movements throughout their time in the hospital. Over the years, clinicians have used many different ways to track their patients, including pen and paper, spreadsheets, and now with the use of Radio Frequency Identification (RFID) technology and the Internet of Things (IoT). This study aims to review articles about smart patient tracking systems.

Materials & Methods: The articles published between 2012 and 2022 were studied in this review. To access related scientific documentation, electronic search was conducted on the Scopus, PubMed, ScienceDirect, InterScience, ProQuest and Google Scholar databases. At first, 190 articles were found and 35 papers were considered to cover the objectives of this study and 20 of them were selected after reading their full texts. The criteria for entering the reviewed articles include its relation to registry, publishing between 2012-2022, publication in English, and the availability of the full text of the articles. In addition, those papers which were not written in English, presented at conferences, had only their abstracts available and published only on websites were excluded. In order to evaluate the quality of the collected articles, the researchers reviewed the articles in terms of title, abstract, introduction, method, results, discussion, and also references where needed.

Results: Most commonly, (RFID) tags and IoT technology are used by means of providing a patient tracking system in a smart hospital environment. Patient must wear the RFID tags so they can be monitored by healthcare providers so can track the real-time status and their locations in addition to accessing a digital directory of their health records. These tags are often provided in hospital bracelets or worn around the neck on a lanyard or even implanted. Also, hospital equipment could be enhanced with IOT to help authorized users keep tracking the place and status of any patient.

Conclusion: Patient tracking may reduce workflow errors and improve communications between staffs and it can help to understand and evaluate how processes actually work and where an unplanned issue occurs. Patient tracking capabilities can also extend beyond hospital to the hands of loved ones in order to alert them when an emergency such as a fall or even missed appointment happens. A smart Patient tracking system can help to locate patients, driving patient safety, better tracking of the treatment process, enhancing internal schedules, reduced wait time for patients, increased patient and visitor satisfaction, predict patient flow and admission rates, alert hospital staff of emergency situations, efficient bed management, improved decision-making and optimized cleaning.

Keywords: Artificial Intelligence, Patient Tracking System, Smart Health, Smart Hospital

Efforts on Smart Hospitals: A Systematic Review

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Introduction: Nowadays, digital technologies and systems have affected various aspects of our daily lives. Health domain is one of the areas which has witnesses significant development through using digital tools. As an example, smart tools do play an important role in diagnosis and treatment of various diseases. Therefore, development of such technologies has resulted in creation of a new concept called "smart hospital". "Digital hospital" was firstly introduced with the aim of transferring paper-based systems and patient files to electronic health records (EHR). Afterwards, the triple concept of care, health and cost was developed in 2007, emphasizing on the improvement of care and health while decreasing related costs in every healthcare organization. With the approval of The Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009, this use increased exponentially. After a while, the word "digital" was slowly replaced with "smart" and the initial attempts for developing smart hospitals were started and many research studies and operational projects were conducted in this field. Therefore, due to the importance of using smart hospital and considering it as that comprehensive concept, here we aim to provide a review regarding researches conducted on this concept.

Materials & Methods: 808 studies were identified using keywords including "smart hospital", "digital hospital" and "intelligent hospital" through searching in the PubMed, Science Direct, Embase, Scopus and IEEE databases Overall, after applying the inclusion and exclusion criteria (705 based on abstract and titles and 35 after reading full texts) and removing duplicates (43), 25studies were included in this review.

Results: Geographically, most of the articles were from Asia (60%). The highest number of publications were observed in 2012 and 2020. A multidisciplinary team were involved in 72% of the researches and 68% were conducted in more than one research center. Most articles have been published in Q1 quality journals (48%) and high-income countries accounted for the largest percentage (56) and 32% of them were aimed at patient care. RFID was the mostly used and 66.67% of them was about the implementation of a smart hospital.

Conclusion: Smart hospitals can not only result in improved service provision and quality in hospitals, but can also be effective in larger ecosystems such as smart cities providing healthcare services. Many believe that using smart tools in a hospital setting is similar to a "Smart Hospital", but it is much more than that. Actually, smart hospital is a dynamic digitalized environment with a core of artificial intelligence based on many integrated technological innovations aimed to provide maximum and real-time benefits for all connected individuals.

Keywords: Smart Hospital, Digital Hospital, Smart Device, Smart Health

Optimization of parameters influencing the enzyme-like activity of ZnCr-LDH/rGO nanocomposite for colorimetric detection of H_2O_2 using Taguchi artificial intelligence method

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Background and aims: Recently, nanozymes have been regarded as powerful alternatives for natural enzymes in the detection of biomarkers such as hydrogen peroxidase (H2O2). High H2O2 concentrations induce oxidative stress and diseases, such as cancer. Therefore, sensitive measurement of H2O2 could be helpful for the evaluation of the oxidative status in cells and the prognostication of pathogenesis and diseases. This work aimed to fabricate an effective colorimetric H2O2 biosensor based on ZnCr layered double hydroxide (LDH)/rGO nanocomposite enzyme-like activity and optimize the effective factors in its activity, such as pH, temperature, and substrate concentration, using a model of artificial intelligence.

Method: Herein, ZnCr LDH, and its nanocomposites with rGO were synthesized using the co-precipitation method. Then, we fabricated a colorimetric biosensor through ZnCr-LDH/rGO nanocomposite enzyme-like activity, for the first time. In the presence of H2O2, the nanocomposite catalyzes the oxidation of the chromogenic substrate 3,3',5,5'-tetramethylbenzidine (TMB) to produce a blue color with a prominent peak at 652 nm. In this work, Taguchi's design experiment was used to design and optimize effective factors in the colorimetric detection of H2O2 at five different levels. In addition, the Taguchi method as an artificial intelligence method was employed to determine the main affecting factor in the detection process. The experimental tests were performed using a UV-vis spectrophotometer based on the alterations in absorbance of oxidized TMB at 652 nm. Finally, the ANOVA technique was used to statistically determine the effectiveness of the components in the detection of H2O2

Results: The artificial modeling process of the Taguchi method for optimization of different parameters illustrated the high enzyme-like activity of the ZnCr-LDH/rGO nanocomposite at pH 6 and 25 °C. Furthermore, the results showed that increasing nanocomposite and H2O2 concentrations up to 40 µg/mL and 150 µM, respectively, enhanced the performance of the colorimetric method. By examining the influence of the factors using the ANOVA statistical analysis technique, it was found that pH and temperature have the greatest effect on the biosensing of hydrogen peroxide.

Conclusion: H2O2 is a significant biomarker in the early diagnosis of diseases such as cancer, and it is very important to develop a reliable H2O2 detection method. Applying artificial intelligence modeling could determine the optimal conditions for effective factors and their interaction with the activity of H2O2 biosensors.

Keywords: Artificial intelligence, Biosensor, Nanozyme, Taguchi, H2O2, Colorimetric detection

Application of text data mining in covid-19: a systematic review

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Background and aims: The Covid-19 outbreak has led to an unprecedented amount of textual data being generated from various sources such as scientific databases, websites, and social media platforms worldwide. Hence, automatic methods of analyzing textual data have become increasingly important. Therefore, the aim of the study is investigate the applications of text data mining during the Covid-19 pandemic.

Methods: This study follows the PRISMA guideline for a systematic review. The data for this review was obtained through a search of PubMed, using relevant keywords such as "COVID-19," "Text Mining," and "Text Data Mining" and their associated synonyms, from the beginning of the pandemic until December 4th, 2022. Original articles published in English that used of text data mining in the methodology of the research were considered for this review.

Results: After conducting a thorough search and applying relevant inclusion criteria, a total of 117 articles were selected out of the initial 190 identified. The majority of the studies included were published in 2022, indicating an increasing interest in the application of text mining during the pandemic. Among the various sources of textual data analyzed, social media posts and comments were the most commonly studied (49 studies), followed by scientific literature and articles (22 studies), and questionnaires and interviews (18 studies). The primary tools used for text analysis were the Python programming language (52 studies), R software (19 studies), and KH Coder software (6 studies). In terms of algorithms, topic modeling techniques such as LDA, STM, and LSA were widely used, as well as sentiment analysis methods such as BERT and VADER.

Conclusion: The results have shown that text mining techniques have been widely used in the analysis of textual data in the Covid-19 pandemic. In addition, the results obtained through text mining can assist health researchers and policymakers in identifying thematic trends and publication patterns across a range of texts, including scientific articles, debates, and public opinions. This can be instrumental in informing evidence-based decision-making during times of crisis.

Keywords: COVID-19, Text Mining, Text Data Mining, Data Mining.

Artificial intelligence and covid-19 disease; Narrative Review

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Background and aims: At the end of 2019, with the outbreak of the newly emerging disease, Covid-19, and then with its pandemic and epidemic, the whole world became involved in this disease. For this reason, researchers in different fields are searching for solutions to problems related to controlling and managing crises. Artificial intelligence is one of the topics that has been discussed a lot in recent years. Therefore, it is widely used to deal with various health issues in the modern world. The transmission power of the new coronavirus has attracted the attention of experts in the use of artificial intelligence to identify and deal with this epidemic. This review aims to provide valid and up-to-date evidence on the use of artificial intelligence in the field of Covid-19.

Method: This research was reviewed by searching the keywords artificial intelligence, pandemic, and Covid-19 in SID, PubMed, Embase, Cochrane, Cochrane, and Google Scholar databases. Finally, 28 articles were selected among many articles for review.

Results: Artificial intelligence can help simplify the prevention and treatment processes so that appropriate treatments for new and old diseases can be provided more quickly. The studies examining the application of artificial intelligence to Covid-19 show that artificial intelligence is useful for quick diagnosis, monitoring treatment steps, and tracking infected areas. Also, the results of various studies show that artificial intelligence-based systems make it possible to identify suspected cases of Covid-19 with minimal contact between medical personnel and patients and to monitor the continuation of the treatment process. Therefore, artificial intelligence has become very useful in the management of the pharmaceutical system, reducing the workload of medical personnel and methods of diagnosing Covid-19.

Conclusion: The advantages of using artificial intelligence in COVID-19 are presented in the areas of rapid detection and treatment, assistance with rapid diagnosis, monitoring of treatment stages, epidemiology and tracking of infected areas, pandemic status prediction, drug system management, reducing the workload of medical personnel, predicting and monitoring of COVID-19 outbreaks, follow-up of patients, vaccine planning and design. The application of artificial intelligence in the corona epidemic shows that it can be used as a useful tool in the healthcare system.

Keywords: "Artificial intelligence", "epidemic", "covid-19", "review"

Integrative analysis of hub genes to explore communication between gut-brain axis: *in-silico* analysis

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Background and aims: Cancers are ranked second in non-communicable diseases. Growing evidence has indicated the communication between the colon and central nervous system, and also, there are mutual interactions between the mucosal immune system and enteric nervous systems, which this cross-talk called the colon-brain axis. In developing and developed countries, psychological disorders have imposed heavy economic and social burdens on healthcare systems.

Method: we browsed the gene expression omnibus server and selected GSE164191 (2021) and GSE151807 (2020) genes with significant differential expression obtained from R analysis based on the Bioconductor, limma, and oligo packages. Subsequently, several parameters include degree, betweenness centrality, eigenvector centrality, and modularity to ranking hub genes involved in colorectal cancer and depression in the Cytoscape software. Next, we designed the protein-protein interactions network using by STRING/Gephi algorithm. Furthermore, we estimated the common hub genes between colorectal cancer (CC) and depression via the Venn diagram tool. Then, enrichment of these hub genes in KEGG pathway analysis was conducted. Finally, a network between selected genes is visualized by Cytoscape software.

Results: Based on the in-silico analysis, we found a relationship between CC and depression. Enrichment analysis indicated mBDNF and GABA neurotransmission, Wnt signaling pathway, pathways of neurodegeneration, IL-2/STAT5, and IL6 Signaling, inflammation mediated by chemokine, and integrin signaling pathway involved in this pathomechanism.

Conclusion: We predicted hub genes could be communicated between CC and depression. Moreover, we found that the patients involved in CC could be susceptible to depression condition. Therefore, predicting the drugs which target these genes could prevent depression condition.

Keywords: Artificial Intelligence, Medicine, Depression, Colorectal Cancer, Hub Genes

Repro-AI: status and future prospects

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Background and aims: Infertility rate in the world varies from 10 to 22%. However, couples receive successful infertility treatment at low rates, leading to repeat treatment or treatment withdrawal. Since the birth of the first IVF baby in 1978, more than eight million babies have been born as a result of the assisted reproductive technique. Artificial intelligence is rapidly changing the practice of medicine in various fields. Artificial intelligence entered the research world of assisted reproductive technologies (ART) in the late 1990s with the creation of an algorithm aimed at predicting the outcome of IVF. In reproductive medicine, artificial intelligence can significantly reduce the highly manual and labor-intensive processes of ART. The aim of this paper is to provide a systematic review to establish the actual contribution of artificial intelligence for predicting ART outcomes.

Method: The PubMed database was searched for citations indexed with "artificial intelligence" and at least one of the medical subject heading terms between January 1, 2000 and April 30, 2020: "artificial intelligence". "Obstetrics and Gynecology"; "Assisted Reproductive Techniques, "or "Fertility".

Results: The PubMed search retrieved 750 citations and 55 publications met the selection criteria. All ART subdomains were covered. Among these 55 articles, 15 were related to embryo selection, 25 were sperm evaluation, and 15 were related to egg selection and implantation technologies. We observed a generally increasing trend in AI-related publications in assisted reproductive techniques over the past two decades.

Conclusion: The development of new artificial intelligence frameworks to predict the ideal outcome in reproductive medicine is a necessity. As a comprehensive result, this new system can reduce the instability between observers, reduce risks during egg stimulation, reduce close and personal clinical contacts, and from the financial aspect, increase clinical profitability and better determination of sperm tests and evaluation of egg quality and embryo selection.

Keywords: Artificial intelligence, machine learning, assisted reproductive technology, Obstetrics and Gynecology, fertility

A systematic review of artificial intelligence for mental rehabilitation

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Background and aims: As artificial intelligence (AI) continues to advance, its role in medicine, including psychology, cannot be ignored. This article provides an overview of the applications of AI in mental health and rehabilitation of mental disorders, as well as the challenges and opportunities it presents. It also briefly discusses the ethical implications of using AI in psychiatry, psychology, and psychotherapy.

Method: The investigation searched four medical databases (PubMed, Scopus, ScienceDirect, and PsycINFO) using specific keywords such as artificial intelligence, machine learning, data mining, mental rehabilitation, psychiatry, mental health, and mental disorder. Studies that were not in English language, case studies, reviews, conference papers, and those that followed anonymization procedures were excluded as part of the criteria. No restrictions were placed on publication dates.

Results: A total of 369 articles were identified, of which 62 were included in the review that used medical databases (EHRs), patients who came to the emergency room, novel monitoring systems, brain imaging data, and social media users to classify mental health illnesses. The literature review revealed a wide range of applications with three main themes: diagnosis, prognosis, treatment and support, treatment, public health, and research. The studies on AI in patient flow identified readmissions, resource allocation, and limitations as the primary themes. The most common mental health conditions addressed included depression, schizophrenia, Alzheimer's disease, and suicide ideation and attempts. Natural language processing (NLP) and machine learning (ML) techniques used included support vector machines, decision trees, neural networks, latent Dirichlet allocation, and clustering.

Conclusion: This text discusses the use of machine learning and natural language processing in mental health research. While these techniques have the potential to provide valuable insights from unexplored data sources, ethical concerns need to be addressed before they can be used as clinical tools. Despite this, there are already significant benefits to using ML in mental health, particularly in areas like diagnosis and treatment. However, more research is needed to explore other potential applications, such as improving patient flow across different specialties. As AI techniques continue to improve, it may be possible to redefine mental illnesses, identify them at an earlier stage, and personalize treatments based on individual characteristics. Nonetheless, caution must be taken not to over-interpret initial results or lose sight of the importance of bridging the gap between AI research and clinical care.

Keywords: artificial intelligence, mental rehabilitation, natural language processing, psychiatry, machine learning.

Multi-View Causal Feature Selection with Error-aware Markov blanket learning for NAFLD Diagnosis

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Background and aims: Non-alcoholic fatty liver disease (NAFLD) is one of the world's most important causes of chronic liver disease. In recent years, the utilization of multi-sources data has become an increasingly popular approach in research to investigate the relationship between biomarkers and diseases. Feature selection and identifying relevant and non-redundant markers is one such issue.

Method: The research approach comprised three main phases: feature engineering, causal discovery, and classification. In the first phase, several feature groups are prepared to classify into two healthy and NAFLD classes. Various pre-processing methods were performed on this data, such as dealing with anomalies, missing data, and normalization. The data used here belongs to the PERSIAN Organizational Cohort study at Mashhad University of Medical Sciences. The data contains several feature groups: Demographic and anthropometric, Laboratory, Psychology, and Velocimetry. In the causal discovery phase, Error-aware Markov blanket (EAMB) learning is employed to discover the causal risk factors of NAFLD. As a causality discovery method for feature selection, EAMB tackled the problem of conditional independence (CI) test errors. Finally, well-known machine learning models such as XGboost, Support Vector Machines (SVM), and Neural Networks (NNs) were used to diagnose NAFLD. Several evaluation criteria, including accuracy, precision, recall, and F1-score are selected to compare the models' performances.

Results: we design the feature selection-based NAFLD diagnosis for a multi-view classification problem. Feature selection based on the results of causality discovery reduces the number of features required for NAFLD diagnosis and enhances classification accuracy. In the best model, after feature selection based on EAMB and XGBoost classifier, we reached 89% accuracy, which was improved compared to the case where all features were used.

Conclusion: A comparative analysis of several validity metrics has been performed with classification and feature selection methods. A causal discovery as a feature selection method was applied in different feature groups, reducing processing time and resource needs. The results of our experiments show that EAMB is suggested for further research on NAFLD Diagnosis.

Keywords: Artificial Intelligence; Medicine; NAFLD; Computer-assisted; Feature Selection; Interpretability.

Management of diabetes using artificial intelligence: A Systematic Review

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Background and aims: Diabetes is one of the most common metabolic diseases in Iran and the fifth leading cause of death all over the world. Its spread around the world has created new methods in biomedical research, including artificial intelligence. The present study was carried out to review the studies conducted in the area of artificial intelligence and diabetes in Iran.

Method: This study was carried out using a systematic review method. Valid domestic databases, including Irandoc, Magiran, Sid and Google Scholar search engine, were reviewed using the keywords of artificial intelligence and diabetes in Persian both individually and in a combined manner without time limitation until June 20, 2021. A total number of 7495 articles were retrieved, which were screened in different stages (exclusion of duplicates (1824), title and summary of the articles (5884) and full text (30) and finally 20 articles that met the criteria desired by the researchers were carefully reviewed.

Results: Among the retrieved articles, 20 articles met the inclusion criteria, of which 16 articles dealt with methods based on artificial intelligence and 4 articles dealt with the design of new systems based on artificial intelligence. Also, 10 articles examined the role of artificial intelligence in prediction (50%), 8 articles in diagnosis (40%), and 2 articles dealt with the control and management of diabetes (10%). Most of the articles were related to the use of data mining methods such as artificial neural network (11 studies), decision tree (7 studies), Logistic regression (5 studies), support vector machine (4 studies) and genetic algorithm (2 studies). Some studies also evaluated and compared artificial intelligence methods on application, accuracy and the sensitivity of artificial intelligence in diagnosing and predicting diabetes (10 studies).

These methods included the combination of genetic algorithm and Lunberg Marquardt, the combination of adaptive reference model control and modified Smith forecast, the combination of integral sliding mode control and adaptive fuzzy estimator, the combination of fuzzy inference system and firefly algorithm, etc.

In most of the studies (11 cases), Matlab and simulation software were used for data analysis, SPSS software was used the most in 7 studies and R in 6 studies.

Conclusion: A systematic review of articles revealed that the use of data mining methods for diabetes management in Iran has been associated with good progress, but there is a need to design artificial intelligence systems and algorithms and more measures should be taken in the area of diabetes control and management.

Keywords: Artificial intelligence, Diabetes, Diabetes artificial intelligence, Artificial intelligence techniques, Systematic Review

Machine Learning Methods to the Prediction of Iranian Household Health Expenditures

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Background and aims: Household health expenditures play a crucial role in achieving good health outcomes, but it is not practical to view it in isolation without taking into account other factors that contribute to overall health. The provision of health care coverage is subject to multiple factors that can impact the generation of good health outcomes, as well as household health expenditures. The objective of this study is to examine the influence of household expenditures and demographic factors (including characteristics of the household and the household head) on health expenditure behavior.

Method: A cross-sectional and retrospective study was conducted to identify predictor factors that affect the health expenditures of households. The data used in this study was obtained from the Iranian Statistic Center (SCI) for the period between 2016 and 2018, which included a standard questionnaire on the income and expenditure of both urban and rural households. The goal was to select an appropriate machine learning model to determine the importance of predictor variables. Two auto-classifier and auto-numeric models were implemented on the data in the IBM-SPSS-Modeler, and two neural network models and a general linear model were proposed. In order to data analysis, machine learning models including multilayer perception (MLP) and general linear model (GLM) was used. The dependent variable was health expenditure which was divided into three categories: (1) without expenditures; (2) more than 120000000; (3) less than 120000000. The independent variables were divided into two categories; demographic and expenditures. Demographic variables were (1) marital status, (2) number of people who have income, (3) region, (4) age, (5) number of educated people, (6) family Size, (7) gender. Expenditures variables involving housing, food, education, Entertainment and cultural activity, others, Transport and communication, Clothing

.**Results:** Out of a total of 114,688 households, 57,860 were located in urban areas, which accounts for 50.5% of the total households. The remaining 56,828 households were situated in rural areas, comprising 49.5% of the total number of households. The study's findings on the relationship between demographic variables and nonlinear and linear models reveal that the number of educated people had the highest weight value, accounting for 0.27, followed by province with 0.23, and age with 0.15. On the other hand, the effect size was more favorable for the following factors: (a) marital status; (b) number of people who have income; and (c) region. The study's findings on the relationship between household expenditures and linear and nonlinear models show that the factors with the highest weight values are as follows: (a) housing with 0.19, (b) food with 0.17, and (c) education with 0.14. Additionally, the conventional factors for effect size include clothing, housing, and food. We computed the accuracy of the model for each individual year, as well as for the aggregate of three years combined. For demographic features, the model's accuracy was 68.1%, 70.8% and 67.6% for the years 2016, 2017, and 2018, respectively, while the total accuracy for the three-year period was 56.3%. Conversely, the accuracy of the model for expenditures features was 67.3%, 70.4% and 66.6% for the years 2016, 2017, and 2018, respectively, while the total accuracy for the three-year period was 45.6%.

Conclusion: It was concluded that number of educated people, province and age identified as more effectively demographic factor, and housing, food and education as more effectively ex-

penditures variable which influence on health household expenditures. Policy makers can utilize this information as evidence to address the impact of socio-economic factors on household health and to determine the relative importance of each factor. The results indicated that utilizing data mining and artificial intelligence can enhance the efficacy of smart governance.

Keywords: Household expenditures, health expenditure, social determinants of health, data mining, machine learning, neural network

Scientometric study on AI-based medical sciences in Iran

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Background: In recent decades, there has been a significant increase in the use of Artificial Intelligence (AI) in the field of health and medicine. This trend has captured the attention of researchers worldwide. The objective of this article is to explore the current state of research on AI-based medical sciences in Iran.

Methods: This scientometric study on scientific publications related to AI-based medical sciences in Iran were carried out through the review in Pubmed till November 2, 2022. In this regard, the number of articles, and international collaboration, and the frequently used terms were assessed and mapped by Bibliometrix R package.

Results: 692 documents about AI-based medical sciences by Iran indexed in Pubmed have increasing trend steadily. The majority of documents was original and review articles. The most collaborative country was USA, Canada and China. Thematic map analysis showed, theme such as "Algorithms", ''Humans' and "computational\ biology/methods", are well developed and capable of structuring the research field. Themes such as "Artificial intelligence" and "environmental monitoring" are the basics and are very important for the field's development. Themes such as "molecular models" and "clinical competence" have developed internal bonds but still of marginal contribution to the development. The themes, "Social Media" and "water" appears to be emerging.

Conclusion: The scientific publication of AI-based medical sciences in Iran are growing and progressing, and this area include wide research areas. The results of this study can be useful for research policy makers and researchers in order to determine the priorities and research decisions.

Keywords: Scientific Publications, Scientometrics, Artificial Intelligence, Medical.

Effectiveness of Telerehabilitation on Children with Autism Spectrum Disorder and Their Families

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Background and Objectives: Telerehabilitation is the term used to describe the delivery of rehabilitation services across communication networks and the Internet. Children with Autism Spectrum Disorder (ASD) are increasingly using remote therapy because of the COVID-19 pandemic's prevalence and the challenges that come with offering in-person rehabilitation services at this time. Therefore, this review study looks at studies that have looked at how well telerehabilitation helps kids with ASD and their families.

Methods: In this review study, the titles and abstracts of every article published in the Web of Science, Google Scholar, Scopus, and PubMed databases from 2000 to 2022 with the keywords "autism", "telerehabilitation", "remote rehabilitation", "parents", "family", "virtual rehabilitation," and "online speech therapy" were searched. After conducting a thorough search, 50 papers were found. Ten of these articles—which perfectly suited the goals of the study—were selected for inclusion in the composition of this article.

Results: Telerehabilitation significantly lessens family challenges, including lowering family expenses and the stress they cause, eliminating time and location restrictions, increasing parent-child communication time, and enhancing the efficiency and speed of speech therapy training by accustomed caregivers in natural settings. Additionally, family characteristics like the parents' work status and education level have minimal impact on the development of the kid.

Conclusion: Studies have shown that remote rehabilitation is useful in teaching communication skills to most children with ASD and improving the quality of life of their families. In most cases, the benefits of remote rehabilitation far outweigh the challenges.

Keywords: Children, Telerehabilitation, Remote Rehabilitation, Speech Therapy, Family, Parents, Autism Spectrum Disorder.

Pharmacy management computer system: a way to a smart pharmacy

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Background and objective: Traditional pharmacy management systems have not been able to show the best performance so far due to the possibility of human error and time-consuming. On the other hand, the smart pharmacy management system improves the manual process performed by the pharmacy staff and helps them to work more easily and efficiently.

Methodology: A review study was conducted with a comprehensive search of PubMed, Scopus, SID, and Magiran databases without language restrictions and using the keywords pharmacy, smart, computer systems, pharmacy management between 2000 and 2021. Two researchers independently searched for articles, extracted data and determined the quality of selected articles for study using a standard tool.

Results: In this article, we examined pharmacy systems from traditional to smart and introduced some examples of the most famous smart pharmacy systems, including GOFRUGAL, RxMaster, CoverMyMeds, and examined their features.

Conclusion: Today's smart pharmacy management system improves the manual process performed by pharmacy staff. This system will have an inventory management system to manage your stock and keep track of inventory and provide suggestions for automatic drug ordering. This process significantly improves their current manual ordering process, which involves writing orders by manually checking drug inventory and estimating the order amount based on inventory figures. Also, in order to prevent the expiration of drugs and to track and order stock, it automatically identifies and informs the users of the above. This system replaces the paper-based pharmacy management process with a computerized management process.

Keywords: pharmacy, smart, computer systems, pharmacy management

Developing Artificial Intelligence for Precision Diagnosis of Prostate Cancer Using Tumor Biomarker Expression Patterns: A Systematic Review

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Background and aims: The development of artificial intelligence (AI) is essential for deploying community-wide, prostate cancer diagnosis. Prediction tools widely used and well-validated depend on standard, readily available clinical and pathological parameters, but do not include biomarkers, which can provide valuable insights into prediction or treatment options. Combining traditional prediction methods with systems pathology may be provided a more personalized risk assessment of clinically relevant outcomes of prostate cancer. Across a range of disease prevalence, AI systems can deliver the main benefits of biopsy avoidance while maintaining high specificities.

In this review, we examined current developments in precancerous lesion detection and diagnosis for prostate cancer.

Methods: A review was carried out by two reviewers independently and manually searching English databases (PubMed, Scopus, and Web of Science) for data till March 2023. After the quality screening, 34 articles was made for further analysis. Database were searched using the terms 'artificial intelligence', 'prostate cancer', 'precision diagnosis', and 'precision diagnosis'. Inclusion criteria for paper selection were: 1) Paper must be peer reviewed. 2) Journals on which papers published must be either PubMed, Scopus, or Web of Science indexed. 3) The paper should use only AI techniques. Exclusion criteria for paper selection were: 1) Duplicate studies in different databases. 2) Study which is less cited by other peer reviewed papers. 3) MSc and PhD papers.

Results: In the literature, a wide number of machine learning techniques have been applied to biopsy material, including linear models, support vector machines, decision trees, and deep learning models for prostate cancer diagnosis. In the following comprehensive review article, we focus on diagnostic (PHI®, 4K score, SelectMDx®, ConfirmMDx®, PCA3, MiPS, ExoDX®, mpMRI) biomarkers that are in widespread clinical use and are supported by evidence. In addition, we discussed new biomarker-driven diagnosis for advanced prostate cancer that have been obtained using artificial intelligence such as TELO2, ZMYND19, miR-143, miR-378a, cg00687383 (MED4), and cg02318866 (JMJD6; METTL23).

Conclusion: Such a variety of cancer molecular and clinical data calls for advancing the interoperability among AI approaches, with particular emphasis on the synergy between discriminative and generative models that we discuss in this work with several examples of techniques and applications. To improve the predictive power of potential diagnostic biomarkers, experiments must be carefully designed.

Keywords: prostate cancer, artificial intelligence, personalized medicine, precision medicine, p4 medicine, cancer treatment.

The role of Internet of Things in the development of Industry 4.0 in the health care system

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Background and Purpose: The industrial revolution can be divided into four revolutions. The fourth and most significant industry is Industry 4.0, which introduces physical-cyber systems and useful technological methods such as the Internet of Things, Big Data Analytics (BDA), cloud computing, block chain, and artificial intelligence (AI). Today, Industry 4.0 has successfully met the various needs of the medical field. The Internet of Things (IoT) is a critical component of Industry 4.0 and appears to have broad applications in the healthcare system. Therefore, this article aims to investigate the role of Internet of Things in the development of Industry 4.0 in the health care system.

Method: The current study is an integrated review of the evidence that was conducted during three stages of literature search, data evaluation and data analysis. Databases, Scopus, web since, since direct, Magiran, SID, MEDLINE, EMBACE, EBSCO, were searched with the keywords "IOT" and "Healthcare 4.0" and "Industry 4.0". 2670 articles and article abstracts were obtained, finally 35 articles were summarized and organized in a table based on the entry and exit criteria after comparing one by one.

Results: We examined the remarkable achievements of IoT in health care, then we discussed seven applications of the Internet of Things, as well as sixteen advantages of using the Internet of Things, and finally three cases of the obstacles of the Internet of Things along with their solutions.

Conclusion: This technology makes the operation of health care devices and networks more accurate and efficient. It also provides information without interruption and expands communication and improves the quality of patient's life. Finally, the use of this technology in the health care industry can be very useful in addition to its obstacles

Keywords: «Internet of Things "," Industry 4.0 "," Healthcare 4.0»

Quantitative Structure-Activity Relationships in Toxicity and Binding Affinity Prediction of Anti-Cancer Drug-Like Molecules Utilizing Neural Networks Techniques

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Background and aims: Quantitative structure-activity relationships (QSAR) is an approach to predict small molecule properties based on their physical and biological characteristics. Traditionally, older QSAR methods were complicated and time-consuming, but artificial intelligence brings new and better solutions to QSAR modeling and drug discovery. It also consists of several methods and analyses of chemical molecules in the vast majority of disciplines, which has also been highlighted in medicinal chemistry. Furthermore, its critical role will be displayed more and more in the treatment of cancer with personalized medicine. One of the most significant challenges in oncology is the identifying potential drug candidates that can effectively target cancer cells while minimizing toxicity to healthy cells. the combination of novel QSAR and neural networks has emerged as a promising approach in anti-cancer drug discovery and development.

Method: The part of the updated review was applied to the study of standard computational different Algorithms in several documents. The Scopus and Web of Science databases were scanned in multiple areas, including pharmacology, pharmaceutics, toxicology, and biochemistry. A bunch of studies were obtained in range of 2021 to 2022. Review articles, conference papers, and similar papers were excluded. Ultimately, 17 recent articles were screened as eligible for this study and included in the review. This study compares several original research methods to address problems and discusses the accuracy and precision of each algorithm in order to deal specific issues.

Results: Deep learning techniques, like artificial neural networks, can predict interplays and binding affinity of drugs and targets by using the atomic coordinates of protein-ligand interactions in complex structures. Screening large datasets of candidate molecule's physiochemical behaviors, to facilitate new drug discovery process. For instance, the identification of novel inhibitors of the protein kinase CK2. CK2 has been shown as a likely target for cancer therapy, due to its involvement in several signaling pathways that are dysregulated in cancer cells. However, innovative in vitro and in vivo assays are being recruited parallel to drug discovery. Intelligent algorithms integrated into QSAR provide more accurate and efficient information about drug-candidate molecules pharmacokinetics, pharmacodynamics, and safety profiles.

Conclusion: Artificial intelligence is expected to play a significant role in developing new drug molecules due to the rapid development of cutting-edge technologies and cost-effectiveness models. Also, make researchers and pharmacists potent during the drug development procedure. In addition, computational approaches can perform well in the virtual execution of complicated cancer models treatments with target cell receptors or molecules. moreover, deep learning techniques are enhancing the progress of drug repurposing (finding new therapeutic uses for existing drugs) at present. The combination of QSAR and artificial intelligence has revolutionized and transformed our thinking in the direction of a new paradigm for drug design. On the other hand, it will be compatible with sustainable development policies.

Keywords: deep learning, QSAR, data mining, oncology, drug discovery

Design of a light-weighted model for enhancement of Malaria Parasite Detection

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One of the most serious public health issues in the world is malaria. In many underdeveloped nations, it is a major source of disease and mortality for children and expectant mothers which are the most vulnerable populations. Traditional laboratory malaria diagnosis requires a skilled individual and meticulous examination to distinguish between healthy and infected red blood cells (RBCs). The traditional method of carrying out this operation involves a lot of manual labor that must be done by a human and requires a lot of time and resources. Cognitive computing and machine learning techniques have advanced, and they are now widely employed in the healthcare sector to detect and anticipate early disease symptoms. Healthcare providers can make informed decisions for patient diagnosis and treatment using early prediction results. As of today, researchers implement the most popular image recognition models such as ResNet50, VGG19, and InceptionV3, ImageNet to detect parasites; However, these models are weighty as a matter of pre-trained weights and a considerable number of layers. This study explores the use of deep learning algorithms to achieve not only an efficient model but also a light-weighted architecture by customizing the network with an optimal number of layers and parameters. As a result, the proposed model achieves better accuracy with respect to other research works like ResNet50 and VGG19 while having the fewest network parameters.

Keywords: Malaria parasite detection, Feature extraction, Deep learning, Convolutional Neural Networks

Prediction of diabetes using data mining and machine learning

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Diabetes is a chronic metabolic complication in which the lack of proper regulation of blood glucose levels in diabetic patients leads to the risk of heart attack, disease and kidney failure. And besides, it causes serious health problems such as fatal kidney damage or blindness. It may lead the patient to death. There is still no exact treatment for this disease, but it can be controlled with medication and diet. In this way, the importance of correct diagnosis of diabetes is very important to identify diseases in the early stages and take precautionary measures. A lot of data has been accumulated on this topic because there are so many patients with this condition. It provides the possibility for researchers to use data mining techniques in this topic. The advancement in the field of computer provides a large amount of data. The main role of data analysis is to input and obtain the required data that can be used with various data mining techniques. Diagnosing diabetes is an important and difficult role in medicine. By combining computer knowledge and medical science, more accurate and faster information can be obtained to predict and treat diabetes. In this article, we will examine the data, algorithms and results, and at the end, the sample work done by me will be explained. It should be noted that the results obtained in this article were obtained by WEKA 3.8.6 software and 10 algorithms (Navie Bayse, Jrip, J48, Random Forest, Bayes Net, Bagging, IBK, SMO, OneR, K*) Has been studied . In this research, we also use India's PIMA data as a source and this research was conducted in 2021 and was implemented at Qom University of Technology.

Using the Precision Lasso for gene selection in diffuse large B-cell lymphoma cancer

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Background and aims: Today, with the advancement of technology, the issues of high-dimensional data in various area of science are extensively discussed. This type of data has unusual and unstructured dimensions. Genetics is one area that deals with this type of data today. One of the goals of genetic science is to provide appropriate tools for diagnosing diseases such as cancer, predicting disease and also responding to treatment based on gene expression profiles.

Gene expression data of patients with diffuse large B-cell lymphoma are used based on microarray technology. In this type of high-dimensional data sets, the problem of high correlation between variables is also discussed.

The aim of this study is to perform Precision Lasso regression model on gene expression of diffuse large B-cell lymphoma patients and to find marker genes related to DLBCL.

Method: In the present case-control study, dataset has been used including, 180 gene expression from 14 healthy individuals and 17 DLBCL patients. The marker genes are selected by fitting ridge, Lasso, Elastic Net, and Precision Lasso regression models. In addition, the predictive accuracy of each model will be examined by using the mean squared error. Finally, the best model is selected for diagnosing, predicting cancers.

Results: Based on our findings, the Precision Lasso, the Ridge, the Elastic Net, and the Lasso models choose the most marker genes, respectively. In addition, the top 20 genes based on models compared with the results of clinical studies. The Precision Lasso and the Ridge models selected the most common genes with the clinical results, respectively. In order to evaluate the goodness of fit of regression models with the mean squared error index, the Performance of the elastic net and ridge and Precision Lasso models is very suitable.

Conclusion: In particular, these regression models are suitable for such dataset, including the number of explanatory variables greater than the number of observations, with a high correlation between variables. These models selected genes related to DLBCL cancer. The results were reported by statistical and clinical comparison. performance of Precision Lasso model in selecting related genes could be considered more acceptable rather than other models.

Keywords: gene expression; high-dimensional; Precision Lasso; lymphoma cancer

Classification of healthy individuals and patients with epilepsy based on Electroencephalography signals by functional data analysis

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Electroencephalography (EEG) technology is used as a practical, non-invasive, low-cost tool to study brain function and brain-related diseases compared to other instruments. There are peculiarities in the EEG data of most epileptic individuals that can be utilized to diagnose epilepsy or predict seizures in persons with the disorder. EEG data are a special type of high-dimensional data and often have an unstable and uncertain pattern. Therefore, it is important to design a model that helps diagnose epilepsy and seizures in a timely manner. .**Background and aims:** In this study, we focus on the frequency domain and use the functional data analysis (FDA) approach to present a model for classifying EEG data and identifying people with epilepsy.

Method: The data used in the present case-control study were collected by the Epilepsy Department of the University of Bonn, Germany. The dataset comprises 100 EEG signals divided into four sets (A, B, C, and D). Sets A (open eyes) and B (closed eyes) were collected from five healthy individuals, while sets C and D were collected from five epilepsy patients during non-seizure times. Signals in Set C are from the non-epileptogenic zone, whereas Set D is from the epileptogenic zone. To analyze the EEG signals, we first calculated their power spectrum using discrete Fourier transform and computing the periodogram in each of the frequency rhythms: delta (0-4 Hz), theta (4-8 Hz), alpha (8-12 Hz), beta (12-30 Hz), and gamma (30-70 Hz). To extract separable features from the EEG data, we used the functional data analysis (FDA) approach, which includes functional principal component analysis (FPCA) and functional power spectrum. This method allowed us to analyze the EEG data recorded in discrete time in its original nature, i.e., in the form of continuous functions. We obtained the scores of the first two functional principal components as separable features. EEG data is classified based on the extracted features using the K-nearest neighbors (KNN) method, with the number of neighbors set to 3 in this method.

Two approaches were used for data classification. In the first approach, all sets (A, B, C, and D) were classified individually. In the second approach, we used the extracted features for sets A and B as one group (healthy), and sets C and D as another group (patients). The leave-one-out method was used to evaluate the classification accuracy.

Results: In the first approach, all sets (A, B, C, and D) were classified individually, and we were able to achieve 90.5% accuracy. In the second approach, we achieved 93% accuracy in the classification and diagnosis between healthy and patient groups.

Conclusion: Our study demonstrated that the implemented models and techniques are highly effective in classifying each of the four sets and diagnosing healthy individuals and patients with epilepsy using EEG signals. Moreover, our results indicate that these methods are efficient and produce accurate outcomes.

Keywords: Electroencephalogram, epileptic, discrete Fourier transform, functional data analysis, K-nearest neighbor (KNN)

Immunoinformatics analysis of Fas/MMP-FasL interactions to evaluate molecular basis of cytokine storm activation in COVID-19 patients

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Background: The coronavirus disease-2019 (COVID-19) pandemic is still ongoing. Cytokine storm has been used to describe the harmful cytokines that induce cellular damage. Such mechanisms have been linked to multi-system injury in COVID-19. In 2021, we proposed a pathway for initiation of cytokine storm by MMPs with Fas/FasL interactions (DOI: 10.1515/revneuro-2021-0047). Here, we conduct in silico analysis of these interactions in different blood-like contexts, such as hyponatremia in context of COVID-19 patients. We also attempt to link such changes in blood profile of COVID-19 patients to Fas or FasL with MMP interactions, that may lead to subsequent cellular damage.

Methods: We comparatively docked Fas/MMP-FasL complexes by HDock, Autodock/AUTOGRID4, and Autodock Vina tools. Patchdock was used to select the most stable complex. Then, we performed molecular dynamics analysis via GROningen MAchine for Chemical Simulations (GROMACS) for 10 ns. Na+ and Cl- ions were used. Also, different blood osmolarities were simulated (e.g., hyponatremia: 130 Na level vs normal Na level: 140 Na level). Advanced binding energy analyses were utilized. All-atom OPLSAA forcefield was used. Pressure coupling using the Parinello-Rahman method based on constant NPT ensemble. PBC XYZ boundaries were used in a triclinic box for the purpose of simulation.

Results: Analyses showed MMP-Fas(L) interactions varied among different Na+/Cl- concentrations. Hyponatremia was associated with stronger interactions. Negative molecular mechanics Poisson-Boltzman Surface Analysis (MM-PBSA) (van der Waal energy, Electrostattic energy, Polar solvation energy, SASA energy, SAV energy, WCA energy) energies were detected. Also, contact residues in the stabilized complexes were increased by the COVID-19-like hyponatremia blood environment. For MMP-FasL simulation, the complex was minimized in with target Fmax < 1000 in 1910 steps, Potential energy reached -1.2311611e+06, which is favorably negative. We found negative binding energies. RMSD of MMP-FasL complex reached stability after 5ns. RMSF and gyration analysis and visualization of the complex did not show denaturation or severe expansion/fluctuation of the protein complex. For a MMP-FasL simulation, contact residues were increased. MMP-FasL interaction in COVID-19 conditions showed VDW, ELE, GB, SA, TOTAL energies were -170.53, -12.82, 146.67, -18.91, -55.60 kcal/mol, respectively.

Conclusions: Our analyses highlighted that clinical profile (e.g., electrolytes) could influence interactions among key players in the cytokine storm in COVID-19. Currently, we are conducting clinical research by analyzing the regulation of these players in COVID-19 patients. Some methods such as WGCNA can be used in future studies to compute the correlation between cytokines and clinical traits.

Keywords: Immunology, COVID-19, FasL, Cytokine storm, Molecular dynamics Simulation

Using FAHP and Type II Fuzzy methods to prioritize the top ten factors in deciding to recommend diet in dyslipidemia patients

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Introduction: According to experts, the decision about which diet to prescribe to patients with dyslipidemia depends on various factors. Some pay more attention to genetic and physical factors, others to food or lifestyle, and some pay attention to paraclinical lab test results or harmful habits. This research helps doctors to choose the most important 10 factors to decide the recommendation of the best diet.

Materials and methods: In a cross-sectional study with the aim of identifying such factors, based on reliable sources and discussions with two nutritionists, a list of factors related to dyslipidemia was prepared and presented in the form of a self-administered questionnaire to internists and nutritionists in three universities. The measurement of people's opinion about factors was made using a visual analogue scale (VAS). The data was analyzed using Excel and MATLAB software and Fuzzification and Alpha Cut Set methods and fuzzy triangular membership function. The definite values obtained from AHP were replaced with interval values obtained from FAHP and the weight of each factor mentioned in the questionnaire was calculated separately and as a group. Finally, due to the difference between the raw numbers and the given weight, the "fuzzy type II" method was also compared with the previous methods and the outputs were put together.

Findings: The most important factors, are body mass index (BMI), serum LDL level, daily eating pattern, serum cholesterol level, uncontrolled diabetes, serum HDL level, type of fat consumed in the diet, serum VLDL level, inappropriate eating habits of fat, and serum triglyceride level.

Discussion:The results of the comparison of the three methods of raw numbers, FAHP and fuzzy type I and type II show that some factors such as smoking, physical activity level, patient age, stress, alcohol consumption and even chronic liver and kidney diseases do not play a significant role in decision making. Therefore, the results of this research can be used as a guide for counselors in determining and recommending the diet for dyslipidemia patients.

Keywords: Fuzzy, Nutrition, Dyslipidemia, Medical Informatics, Soft Computing, Clinical Decision Making

A Review on Machine Learning and Deep Learning Methods for Detection of Alzheimer's Disease

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Alzheimer's disease (AD) is the most common type of dementia in which the condition of the patient gets worst with time. Therefore, early diagnosis of AD can increase patients' survival rate. Machine learning (ML) and deep learning (DL) algorithms as two main artificial intelligence (AI) methods for image analysis, can be used to assess brain magnetic resonance (MR) images in order to early detection of AD. This study aimed to present a review on application of machine learning and deep learning algorithms for accurate detection of Alzheimer's disease. PubMed, ScienceDirect, Web of Science and Google Scholar databases were explored using different combinations of the keywords "Alzheimer's disease", "deep learning", "machine learning", "artificial intelligence", "radiomics", and "MRI". Ten more recent and relevant papers, were included in the study. Geometric features extracted from brain MR images comprised the main radiomics used as training features by the AI methods for AD detection. The most frequent DL models were convolutional neural networks (CNN) models with the maximum classification accuracy and sensitivity up to 99%. Support vector machine (SVM) was also the most popular machine learning technique with maximum accuracy and sensitivity of 99%. In conclusion, AI and radiomic features can offer a powerful tool for the quantitative assessment and early diagnosis of AD.

Keywords: «Alzheimer's Disease",» Machine Learning», «Deep Learning», «Artificial Intelligence», «Brain Magnetic Resonance Images (MRI)».

Design of a smart hospital bed based on Internet of Things

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The Internet of Things (IoT) is designed in the field of health to help improve the hospital system as well as the well-being of patients. Currently, the Internet of Things is one of the main promoters of technological innovations and one of the fields with high potential for improving social and economic conditions. This research details the design and simulation of an intelligent hospital bed for the comfort of patients, as well as increasing the efficacy of nursing and increasing the time efficiency of the hospitalization. This smart bed is designed to improve the process of the simple nursing system that is currently implemented in Iranian hospitals. This system collects information and data, using its internal sensors and uses the collected data in the network at the right time. The patient monitoring process is done by regularly collecting data of heart rate, body temperature, body surface humidity and body movement through biomedical sensors that are connected to the microcontrollers. The diagnosis process is facilitated for the doctor by saving the data in an Excel file via OneDrive and drawing the changes in real time. The proper implementation of our designed system can reduce the workload in hospitals and improve the patient monitoring process to provide efficient and better medical services to patients.

Game-changing trends in the development of digital health tools from physician-centered to patient-centered care

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Background and aims: Probably the most important technology trend in digital health is the rapid and unprecedented expansion of smartphones. One in four people now owns a smartphone worldwide. This widespread access to personal computing power is the foundation of digital healthcare. Healthcare data from sources such as electronic health records, genetic data and general health, and research and behavioral information are accumulating at an unprecedented rate. This volume of information can only be managed with the help of technology. Patient-centered applications are defined as systems that enable a partnership among practitioners, patients, and their families to ensure that procedures and decisions respect patients' needs and preferences. Ongoing advances in smartphone technology and healthcare apps and devices should expand their utility for enhancing patient-centered care in the future. The aim of this paper is to evaluate the impact of digital health tools from physician-centered to patient-centered care

Method: A single case study design was used. The qualitative data consisted of semi-structured interviews and library searches, covering the time period 2017–2021. Inclusion criteria included people who had experience working with a digital health application or had used telehealth services. The data were analyzed using conventional content analysis, complemented with document analyses.

Results: Applications that use artificial intelligence can provide reliable information to "health-conscious people". These applications lighten the responsibility of general practitioners and hospital accident and emergency departments by enabling the examination of minor ailments. Mobile applications and websites that provide remote consultation and care address the challenges of cost, accessibility, and convenience. Websites that connect people to medical personnel, businesses, and colleagues, facilitate the patient journey and enable access to information and support.

Conclusion: Our experience shows that digital health can dramatically improve organizational productivity and deliver benefits in both patient outcomes and the bottom line, respectively. This means that if the costs of digital healthcare solutions become affordable, digital health can be an answer to the existing challenges to achieve sustainable growth in developed countries in order to provide quality, affordable and patient-centered care. However, more research is needed.

Keywords: Artificial intelligence, digital health, technology

Investigation of artificial intelligence patterns in the diagnosis of autism

Spectrum disorder (ASD)

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Background and aims: Autism does not have a known cure, but early detection and intervention can greatly improve outcomes for patients. Machine learning algorithms are being developed to help detect autism as early as possible, in order to ameliorate the effects of it. In this review, we exploring the machine learning algorithms and identify the best of them.

Method: To conduct this review on the algorithm of machine learning to detect Autism Spectrum Disorder (ASD), an electronic literature search was performed using various online databases. The databases used for the literature search included Google Scholar, IEEE Xplore®, Science Direct, Scopus®, and PubMed. The literature search was conducted using different combinations of searching keywords or terms to ensure that all relevant articles were retrieved. The search terms utilized were "autism spectrum disorder," "ASD," "autism," "pervasive developmental disorder," "PDD," "diagnosis," "machine learning with ASD," "mental health," "mental illness," "mental disorder," "genetics," "supervised learning," "unsupervised learning," "gene expression in ASD," and "data mining."

The process of selecting articles involved assessing whether they met certain criteria for inclusion and exclusion. To be included, the articles had to be written in English, reviewed by peers, published mostly between 2015 and 2020, related to autism datasets, focused on classification and feature selection of ASD, analyzed ASD and other similar disorders, related to autism with machine learning, and discussed ASD datasets with users' security and privacy. Articles that were not related to ASD and similar disorders or did not meet any of the inclusion criteria were excluded from the selection process. Out of 293 articles found, 50 research articles were selected after reviewing their abstracts, methods, and results. We use datasets such as: UCI ABIDE I ABIDE II NDAR AGRE NRGR GEO SSC Simons VIP. Our finding showed that ADTree, SVM, Ridge regression ENet, LASSO, SVM, LDA, Ridge regression with 98%, fNN (99%), and Binary firefly algorithm with 97% accuracy had the highest accuracy to detect the ADS.

Conclusion: Efficient diagnostic performance is crucial for accurately and cost-effectively classifying the type of ASD, which can be improved through machine learning algorithms. However, proper feature selection and addressing critical issues such as data size and security are necessary for optimal classification and diagnostic accuracy.

Keywords: artificial intelligence, autism, machine learning, computational neuroscience, autism detection

Artificial Intelligence Model for Cardiovascular Incidence Prediction: A Practical Deep Learning Approach Based on Isfahan Cohort Study

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Background: Over the last decade, the dramatic improvements of Artificial Intelligence (AI) and Machine Learning (ML) approaches have had remarkable achievements in Cardiovascular Disease (CVD) predictions. However, Studies have indicated that recent Artificial Intelligence developments such as Deep Learning strategies could be more effective than both classic ML and classic statistical models in estimating the risk of CVD incidence in large scale cohort studies. In fact, Deep Learning approaches are much more efficient in dealing with high dimensional large datasets. Thus, this cutting-edge technology is capable of considering various factors including parameters with indirect impacts on development of cardiovascular diseases.

Method: By utilizing of Deep Learning algorithm and a Deep Neural Network (DNN), we developed a risk prediction model for the incidence of cardiovascular diseases based on a 13-year dataset garnered from Isfahan Cohort Study (ICS). ICS is an ongoing population based longitudinal cohort study performed in central areas of Iran, starting from 2001. The primary aim of ICS was to evaluate the risk factors of CVD including myocardial infarction, stroke, unstable angina and sudden cardiac death in a large Iranian population. The learning data frame current model includes 58 diverse variables containing information about clinical, laboratory, socio-economic, demographic and lifestyle components of each participant.

Results: Among 6504 participants at the baseline, 4370 individuals were chosen with no history of CVD background. The target population and had was completely followed up data up until the end of ICS's first phase and of the ICS. during the period, 413 CVD events were recorded. The ANN proposed model fully connected neural network demonstrated a considerable precision in predicating 13 years CVD incidences with accuracy classification score of 90.52% (the accuracy score has been used as a metric and it is calculated by dividing the number of correct predictions by the total prediction number).

Conclusion: In this study we developed a practical risk assessment model for predicting the incidence of CVD in Iranian population using Deep Learning and AI algorithms.

Keywords: Deep learning, CVD incidence, Fully Connected Neural Network, AI

Application of machine learning in medical sciences: a scoping systematic review

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Background and aims: Nowadays, one of the areas that is expanding and has a wide range of uses in the medical sciences is machine learning (ML), which has improved this field's capability and effectiveness in several ways. The aim of this paper is to present an overview of the current ML methods utilized in medical sciences and to identify the evidence gaps and features of ML techniques in medicine.

Methods: A comprehensive systematic search was conducted in PubMed using the terms "machine learning", "deep learning", "supervised learning", "unsupervised learning", "reinforcement learning", "healthcare", "medicine", and "medical science" as keywords up to March 2023. The inclusion criteria were English language and full-text available articles. After removing duplicates, two independent reviewers screened and evaluated the investigated results in accordance with the inclusion criteria. Data obtained from the included studies was extracted by two independent authors. From each study, data were taken on the type and model of ML employed, the medical scientific field, user data analysis, challenges faced, and directions for future research.

Results: We retrieved 13014 relevant publications from electronic databases. After a thorough examination of the titles and abstracts, 208 articles were included. ML is widely implemented in the medical sciences. Machine learning models, including Artificial Neural Networks (ANNs), Support Vector Machines (SVMs), Regression analysis and Bayesian Networks (BNs) were most frequently applied to medical sciences. The classification, prediction, and processing of the enormous amounts of data available in this area is one of the most significant uses of ML nowadays.

Conclusion: ML can be utilized to transfer to the clinic an information processing service with a considerably higher capacity and lower cost. More research is required to understand how to apply ML in a practical and secure manner. The impact of clinical ML on actual healthcare is frequently exaggerated in the excitement surrounding it. This might be maintained by ignorance of the factors affecting its application. Evaluations of ML methods in health care require more economic analysis to make informed decisions. Informing and educating medical students in this area is a crucial step toward better and correct ML usage, which should be accomplished.

Keywords: machine learning, deep learning, medical science, health care, medicine

Ethical considerations in Artificial Intelligence? Why not?

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Background and aims: Transforming the medical world, artificial intelligence has offered remarkable help in computing and compiling medical big data. The rapid growth in this domain requires some ethical aspects to be considered. In this study, using a systematic review, the literature discussing ethical problems in AI was evaluated.

Method: Our study concentrated on the systematic review approach (and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis). A comprehensive systematic search was conducted in the PubMed electronic database from January 2000 up to October 2022, using the following terms: "artificial intelligence" and "ethic*. English-language and original articles that explained or emphasized an ethical issue in the medical usage of AI or provided a solution to that concern were included. Studies that met our inclusion criteria were critically appraised by two authors independently.

Results: 1312 relevant articles were retrieved from electronic databases. After removing the duplicate publications and excluding unrelated articles based on their titles and abstracts, 358 articles remained and were evaluated. The studies indicated some of the ethical issues confronted in different fields of medicine using AI. The discussed concerns were typically about the privacy of the data, trustworthiness, transparency, accountability, and possible biases in this field of research. Ethical principles regarding AI in the medical field were discussed in some models, one of which, known as the collaborative model, was the most prospective for future considerations.

Conclusion: To further ethics and policy change, this systematic review summarized available material documenting ethical concerns in the utilization of AI in medicine. Issues, priorities, and possible solutions to the concerns were also revealed throughout the assessment. As a result, recommendations were made for future changes as well as regulatory choices open to stakeholders in reform processes.

Keywords: artificial intelligence, ethics, medicine

How Connected Technology is Transforming Healthcare

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Background and aims: Connected health has the potential to profoundly reshape the healthcare and life sciences industries, creating many new opportunities but also threatening entrenched interests. If mobile devices enable people to monitor their vital signs, conduct tests, diagnose diseases at home, and communicate remotely with their doctors, then much of the current health infrastructure in developed countries becomes potentially unnecessary. At the very least, such a shift would remove pressure from overloaded hospitals and clinics. Meanwhile, the need for routine doctor visits plunges. Hospitals might be needed only for the acutely ill and for operations or emergencies. "How connected technology is transforming healthcare" studies the changing role of mobile technologies in global health. The review paper considers the barriers to adoption, the shifting dynamics between patients and clinicians, and how connected technology can help providers to work differently.

Method: This review paper analyzes opportunities and barriers based on extensive literature reviews from 2010-2020 in PubMed, EMBASE, and Scopus databases, discussions with stakeholders, and our work with providers and technology companies.

Results: Consumers' speed of digital adoption in the past 10 years is significant, illustrating that patients are leading the way in using digital tools to manage their health. Access to EHRs is increasing significantly, however, there is a gap between physician and patient expectations on the level of access to this information. There is an opportunity for physicians to increase transparency and improve communications with patients. Providers that invest in digital tools and develop strategies to adapt to consumers' expectations will close the gap between what patients demand, and what providers deliver.

Conclusion: Connected technologies have the capacity to transform healthcare. New devices and services will allow people to be more proactive in taking care of their health and assuring their well-being.

Keywords: artificial intelligence, healthcare, mobile, connected health

The rise of artificial intelligence in the design and development of messenger ribonucleic acid vaccines: A systematic review

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Background and aims: There is a growing interest in the application of messenger ribonucleic acid (mRNA) vaccines as an alternative to conventional vaccine approaches due to their low manufacturing costs, rapid development, safe administration, and high potency. However, unstable and inefficient in vivo delivery of mRNA has hindered their application. Moreover, the first step in developing a vaccine is to identify possible antigens. To discover and optimize new effective vaccine candidates, AI-based models have shown promising results.

In this review, we provide a systematic review of the development of mRNA vaccines through the application of AI and how AI is particularly valuable in the research and production of mRNA vaccines.

Methods: We searched PubMed, Scopus, or Web of Science for data till March 2023 for published studies of AI applications on the development of mRNA vaccines. The Systematic Reviews checklist was applied. **Keywords:** [(Artificial intelligence OR machine learning OR deep learning OR neural network OR random forest OR support vector machine) and (mRNA vaccine or messenger ribonucleic acid vaccine) and (medicine or drug)]. We used PROBAST (prediction model risk of bias assessment tool) to assess the quality of literature related to the Safety and Immunogenicity of mRNA Vaccines. The inclusion criteria for paper selection were: 1) Paper must be peer-reviewed. 2) Journals on which papers are published must be either PubMed, Scopus, or Web of Science indexed. 3) The paper should use only AI techniques. Exclusion criteria for paper selection were: 1) Duplicate studies in different databases. 2) Study which is less cited by other peer-reviewed papers. 3) MSc and Ph.D. papers.

Results: From the 107 identified records [PubMed® (n = 40); Scopus (n = 33) and or Web of Science (n = 34)], 28 studies were included. Among others, the selected studies on new mRNA vaccines were classified, as follows: studies with in-vivo and; studies with in-vivo and/or clinical data; and other studies related to mRNA vaccines. This review provided sufficient evidence to delineate the potential of AI in analyzing mRNA vaccine features for mRNA modeling on multiple aspects like evaluating the solubility and other physicochemical parameters, Immuno-informatics analyses, and molecular docking analysis. Different methods were identified, mainly from the area of machine learning. The most used techniques were support vector machine, random forest, and artificial neural network models.

Conclusion: Diverse potential mRNA vaccines were identified. AI was a suitable tool to quickly analyze large amounts of data or to develop mRNA vaccines.

Keywords: artificial intelligence, machine learning, deep learning, neural network, random forest, support vector machine, messenger ribonucleic acid vaccine, mRNA vaccine.

Artificial intelligence approaches for design/discovery of therapeutic proteins: a systematic review

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Background and aims: The development of novel proteins for disease diagnosis, alleviation, and improved health attributes has been enabled by protein engineering. Artificial intelligence (AI) has significant potential to improve smart protein engineering without a complete understanding of molecular mechanisms.

Here, we present a review of recent AI techniques and approaches for modifying proteins at different levels, which find therapeutically relevant applications.

Methods: A systematic review was carried out by two reviewers independently and manually searching English databases (PubMed, Bireme, EBSCO, OVID, Scopus, and Web of Science) for data till March 2023, resulting in 166 research articles. After the quality screening, a final selection of 133 articles was made for further analysis. Databases were searched using the terms 'artificial intelligence', 'cancer', ' therapeutic protein', ' design of protein', 'protein design and engineering', 'machine learning', 'protein prediction', and 'drug design'.

Results: As a result of our study, we identified the following outcomes: AI applications are mainly divided into four categories: 1) genomics, 2) protein structure and function, 3) protein design and evolution, and 4) drug design. Among the ML algorithms and databases used, the most common method was supervised learning (85%). The most common databases used for ML models were PDB and UniProtKB/Swiss-Prot (21 and 8%, respectively). Finally, we describe the current applications of AI-assisted protein engineering, as well as the prospects of this field in the future. Our main finding is that, as of today, there are no research road maps serving as guides to address gaps in our knowledge of the AI–PS binomial. A discussion of current limitations and methods is presented, along with a look at future directions. Across a range of disease prevalences, AI systems can deliver the main benefits of biopsy avoidance while maintaining high specificities.

Conclusion: Overall, AI is a valuable tool for the screening and designing of therapeutic proteins, with particular attention to anticancer proteins and cutting-edge AI technology embedded, leading the progress of innovative therapeutics for challenging diseases.

Keywords: artificial intelligence, therapeutic protein, protein engineering, protein design and engineering, machine learning, deep learning.

Drug-Target Interaction (DTI) prediction using Artificial Intelligence (AI):

A systematic review

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Background and aims: Drug-Target Interaction (DTI) prediction is crucial in drug discovery. Knowing that drug discovery is time-consuming and costly, predicting DTI as accurately as possible is critical. Since experimental methods are time-consuming and there is sometimes an urgent need for a specific treatment or drug to be discovered, there should be a state-of-the-art method for DTI prediction. Artificial Intelligence (AI) is any system that understands the environment and can take action based on the data comprehended to maximize the chance of achieving its goal. Artificial intelligence and various AI algorithms and models have recently been used in DTI prediction. Despite the importance of this issue, no systematic reviews or comprehensive evaluations of studies in this field had been conducted prior to the completion of this study. Few narrative reviews have addressed this issue, mainly focusing on machine learning algorithms in a restricted number of databases. In this systematic review, we aimed to systematically discuss and evaluate AI-based DTI prediction, especially network-based prediction.

Method: A comprehensive systematic literature search was conducted in electronic databases, including PubMed, Scopus, Embase, and Google scholar, up to October 2022. Two independent reviewers evaluated the retrieved publications. All studies that used AI models or algorithms to predict DTI were included. Reviews were excluded. Studies that met our inclusion criteria were then critically appraised by two authors independently. Data such as AI algorithms and databases used in studies were extracted.

Results: We retrieved 212 relevant publications in electronic databases. After thoroughly examining the titles and abstracts, removing duplicates, and in vitro studies, 83 studies remained. Full texts of these articles were reviewed, and ultimately 16 studies were included in our review. Several algorithms were used in the studies to detect drug-target interactions. Five of them used the kernel logistic matrix, six used ensemble learning, four used deep learning, and one used machine learning.

Conclusion: DTI prediction can be a time-consuming process. Using AI technology during the drug discovery process can save significant time and money. In this study, we aimed to provide a general taxonomy of various AI models used in DTI prediction in previous studies. Since these studies have only recently been proposed and developed, we see limitations and shortcomings in their models. Despite the accurate maintenance of big data by AI algorithms shown in studies, the heterogeneity of data and shortcomings of AI algorithms can cause difficulties in using AI to predict drug-target interactions. With further research in this field, we believe artificial intelligence can potentially accelerate drug-targeting applications.

Keywords: artificial intelligence, drug discovery, Drug-target interaction, AI-based DTI prediction

Prediction of Opioid Use Disorder (OUD) or Opioid Overdose using Artificial Intelligence (AI): a Systematic Review

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Background and aims: Opioid Use Disorder (OUD), defined as physical or psychological dependence on opioids, has been a global obstacle for decades and has become a major issue with the rise in opioid overdose deaths caused by OUD. Predicting the possibility of an overdose or identifying people at risk of developing OUD can be a significant step toward solving this issue. Artificial Intelligence (AI) is any system that comprehends the environment and can take action based on the information taken to maximize the chance of achieving the goal. Artificial intelligence models have recently been developed to predict these cases based on data from previous patients. Clinical data of patients with OUD and overdose history has been statistically analyzed to predict the risk of opioid use adverse events in specific populations. However, statistical analysis cannot predict the risk of adverse events in a precise patient due to differences between individuals of the same population. To indicate this risk in an individual, AI algorithms have been utilized in recent studies.

Method: A comprehensive systematic literature search was conducted in electronic databases, including PubMed, Scopus, Embase, and Google Scholar, up to October 2022. Relevant keywords such as "adverse opioid reaction,» «opioid overdose,» and «artificial intelligence» have been used for this purpose. Two authors evaluated the retrieved publications independently. All studies that used AI models or algorithms to predict OUD or opioid overdose were included. Studies that weren't written in English or conference papers were excluded. Any study that met our inclusion criteria was then critically appraised by two authors independently. Data such as AI algorithms and databases used in studies were extracted.

Results: 2071 relevant publications were retrieved from electronic databases. After thoroughly examining the titles and abstracts and removing duplicates (n=624), 27 studies remained. Full texts of these articles were reviewed, and ultimately 11 studies were included in our review. Machine Learning (ML) was used in eight of these studies, Deep Learning (DL) in two, and Natural Language Processing (NLP) in one. Most of the included articles were related to the last 10 years. The risk of OUD or overdose and also the harmless dose of opioids were predicted using AI models. Some studies evaluated early detection of OUD or overdose.

Conclusion: Predicting OUD and its overdose not only saves lives but can also help countries› security. Using AI to predict the risk of OUD and overdose is a new step, and standard AI algorithms are insufficient. Changes are required for these models to be entirely suitable for this purpose. AI algorithms have shown promising performance in maintaining big data and providing an almost exact prediction of adverse outcomes of opioid use. However, the morality of OUD-specific AI interventions and the protection of personal health data has not been discussed adequately. These AI models have been used in industry and education but they haven't emerged in medical eras due to the insufficiency of AI models.

Keywords: artificial intelligence, opioid overdose, Opioid-Related Disorders, Machine Learning, Opioid

Blockchain for Remote Patient Monitoring: A Narrative Review

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Background and aims: Medical data plays a critical role in disease diagnosis and treatment, and as technology advances, electronic medical records have become more accessible and easier to store. However, the importance of medical data and the need to keep it secure requires attention to data privacy. To address this, researchers have turned to secure data storage and transmission methods, such as blockchain. Blockchain has gained significant attention in the healthcare industry due to its decentralized and tamper-proof nature, making it one of the most popular solutions for sharing medical data.

One area where blockchain technology has demonstrated potential is in remote patient monitoring (RPM). RPM involves using technology to monitor patients' health remotely, allowing for early detection and intervention of health issues. To explore the potential of blockchain for RPM, we conducted a narrative review of the literature, searching various databases such as Scopus, Web of Science, PubMed, and Google Scholar using keywords like "blockchain", "remote patient monitoring", "healthcare", and "patient data". We included articles published between 2015 and 2022 that discussed the use of blockchain in RPM.

Method: We conducted a narrative review of the literature on blockchain for RPM. We searched Scopus, Web of Science, PubMed, and Google Scholar databases using keywords such as "blockchain", "remote patient monitoring", "healthcare" and "patient data". We included articles published between 2015 and 2022 that discussed the use of blockchain in RPM.

Results: Recent research has focused on the use of blockchain in the medical and healthcare fields, particularly in information-sharing systems. Access to a patient's complete medical history is crucial for accurate diagnosis and treatment, and blockchain technology can provide a reliable, efficient, and secure way of managing medical data. While sharing medical records can improve diagnosis accuracy, maintaining privacy and security is of utmost importance.

In addition to enhanced data security, using blockchain technology in remote patient monitoring (RPM) has several potential benefits. These include increased patient privacy, improved data interoperability, and reduced healthcare costs. However, implementing blockchain in healthcare comes with its own set of challenges, including legal restrictions, technical difficulties, and a lack of standardization.

Overall, while blockchain technology shows great promise for improving healthcare information management, careful consideration and planning are required to address the challenges and ensure successful implementation.

Conclusion: Researchers have identified multiple potential applications for blockchain technology in the medical field. One of the most promising areas is remote patient monitoring, where blockchain can provide a secure and transparent platform for storing and sharing patient data. However, there are challenges that need to be addressed for successful implementation of this technology in healthcare. Despite these challenges, blockchain's potential for improving patient outcomes and reducing costs makes it a promising technology in the medical field. Further research is necessary to explore the full potential of blockchain for remote patient monitoring and to overcome the challenges associated with implementing this technology in healthcare. With careful consideration and planning, blockchain could revolutionize the way we manage medical data and improve patient outcomes.

Keywords: blockchain, healthcare, medical records, remote patient monitoring, patient data

Artificial Intelligence and ethico-legal challenges in healthcare: A Scoping Review

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Background and aims: Artificial intelligence (AI) is currently one of the mostly controversial matters of the health. As AI continues to increase its effect on health decisions, the present study discusses AI in terms of the health ethics and legal issues involved, both existing and potential. The objective of the present scoping review is to document the current applications of AI in health and the ethical and legal concerns or challenges, they imply to highlight gaps, and to propose steps to move towards an artificial intelligence ethics framework for Iran.

Method: This scoping review followed the PRISMA guidelines. The search was conducted using two health care database (MEDLINE [PubMed] and ScienceDirect) with the following keywords: artificial intelligence [All Mesh Terms], ethics, legal, challenge, consideration and health [All Mesh Terms].The exclusion criteria were as follows: languages other than English, case studies, editorial, conference paper and reviews. No limitations on publication dates were imposed.

Results: A total of 408 articles were identified, of which 393 (96.32%) were excluded and 15 (3.68%) were included in the review. Twenty-two ethico-legal issues (related to the use AI in healthcare domains) were reported in 15 studies around three principles: data ownership, security and patient privacy (equity (1), justice (3), choice (1), privacy (11), confidentiality (2), autonomy (5), integrity (1), discrimination (1) and security (1)) 26 items (46.43%), trustworthiness and explicability (negligence (1), culpability (1), trust (2), explicability (1), accountability (4), mitigation of bios (5), liability (5), transparency (2), decision making (2), validity (1) and accuracy (2)) 26 items (46.43%) and harm minimization (beneficence and non-maleficence (3) and prevention harm (1)) 4 items (7.14%). The reports referred to ethico-legal challenges in pathology (2), radiology (2), laboratory medicine (2), cancer (2), education (1), intensive care medicine (1), gastroenterology (1), neuroscience (1), robotic surgery (1) and nuclear medicine (1) fields.

Conclusion: Since it is necessary to develop Iranian ethico-legal framework for artificial intelligence in healthcare domain, it is suggested that the core challenges presented in current article can be used for architectural design, based on the country's national laws.

Keywords: Artificial intelligence (AI), Medical ethics, Health, Ethical issues, Challenge, Ethical dimensions, Legal consideration and Ethical consideration

Development, implementation, and pilot evaluation of a web-based virtual simulated learning environment for pharmacy practice education

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Background and aims: The science of education has combined with the growth of information and communication technology and has created a new approach to learning called “e-learning”. The vast volume of information, the advent of information and communication technology, and its upward trend in a short period have led to a fundamental change in the field of medical education and e-learning as an effective method to meet new educational needs such as virtual education. The purpose of this study is to provide a tool for teaching pharmacy internships, without the need for a real educator.

Methods: This study was conducted in the first and second half of 1398 at Isfahan University of Medical Sciences. Using a computer program, a community pharmacy was simulated in as much detail as possible. The research team consisted of a project manager, a clinical pharmacist consultant, two web designers familiar with the database, and a graphic designer. In the scenario section, each student of the research group was required to enter 400 copies and write 40 scenarios on various topics. This version of the software has been designed and presented for the fourth year of pharmacy students to get acquainted with different forms of medicines and to pass the internship course in community pharmacy.

Results: All pharmacy students who are eligible to take the pharmacy internship course can use the (web-based) software. This software consists of several sections: 1. Educational materials related to internship courses, 2. Reading prescriptions and delivering the medications to the patient in a virtual pharmacy space, 3. Clinical scenarios; including teaching medical advice to the patient by a pharmacy student.

Conclusion: The prerequisite for success in the implementation of e-learning in medical universities is the establishment of the necessary infrastructure and standards before their implementation and continuation. Therefore, it is suggested that by applying the existing processes in the world and using the experiences of leading countries in this field, the most appropriate method of e-learning be selected and implemented.

Keywords: Internet-Based Intervention, Space Simulation, Education, Pharmacy,

Artificial Intelligence in Emergency Medical Services: A Systematic Review Study

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Background and aims: With the rapid advancement of emergency medical services (EMS), the integration of artificial intelligence (AI) technologies has become increasingly prevalent in pre-hospital emergency care. In view of this trend, the present study aims to provide a comprehensive overview of AI applications in EMS on a global scale. The purpose of this study is to consolidate the current state of knowledge on the subject and provide insights into potential future directions for the use of AI in pre-hospital emergency care.

Method: This study utilized the Prisma method to evaluate the quality of systematic review studies. The search was conducted using relevant keywords such as artificial intelligence, machine learning, and emergency medical services in English databases such as WoS, PubMed, and Scopus, as well as other grey resource websites, without imposing any temporal restrictions. The results of the search were reviewed separately by two researchers based on the article's title, summary, and keywords. Subsequently, the full text of relevant articles was screened and assessed according to predetermined inclusion and exclusion criteria. The included studies were then synthesized and analyzed to present a comprehensive review of the present state of systematic review studies pertaining to artificial intelligence, machine learning, and emergency medical services.

Results: Out of the initial pool of 854 studies, 25 studies were carefully selected for full text evaluation and data extraction after excluding duplicates and irrelevant studies. The results of these studies indicate that AI is being widely implemented in the pre-hospital emergency medical system for a variety of purposes. These applications include the analysis of emergency phone calls to enable early diagnosis of certain diseases, as well as the use of smart cameras in public places to detect critical medical emergencies, and access to clients and ensuring intelligent recording of emergency reports. Furthermore, researchers have developed web-based and Geographic Information System -enabled smart software to facilitate emergency response management. Additionally, traffic systems can be connected to emergency care systems to streamline response times in the event of an emergency, and the development of smart electronic bracelets can record information and track clients during mass casualty incidents. Furthermore, the creation of intelligent software for patient triage, location management, and allocation of patients to personnel during mass casualty incidents, can help ensure a more efficient and effective response to emergencies. Development and utilization of intelligent robot ambulance caregivers, predicting the type, amount, and location of future missions and identifying the healthcare needs of patients, training and simulated exercises for emergency medical personnel, and online telemedicine system between emergency medical services and hospitals were the other implications of AI in prehospital management.

Conclusion: In conclusion, the findings of this study demonstrate the critical and pervasive role of EMS within the healthcare system. Advances in artificial intelligence have the potential to revolutionize numerous EMS processes including accident forecasting, decision-making, planning, patient triage, timely treatment, and efficient patient transfer. Implementation of AI technology in EMS holds significant promise for improving patient outcomes and enhancing emergency medical care.

Keywords: Artificial intelligence, Emergency Medical Services, Pre-hospital, Emergencies, Machin learning, Health

Automatic lung classification from x-ray Images of normal and pneumonia patients

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Background: Nowadays AI (artificial intelligent) plays an important role in assisting human especially experts in many aspects. As a branch of AI, deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Recently, deep learning algorithm have been used widely in health domain including prognosis of patients with chronic obstructive pulmonary disease from chest radiographs. This study focuses on using algorithms to detect pneumonia from chest x-rays by using deep leaning.

Method: this is a retrospective applied study in which a binary classification method was developed to classify pneumonia patients and normal people based on their chest x-ray images. Firstly, for data collecting, an online dataset containing 5863 x-ray images categorized to normal and pneumonia were accessed. Given that the images in dataset were collected from different sources they came in different sizes and aspect ratios, a resizing strategy devised with average aspect ratio of all images by means of preprocessing. Images channels also divided by 255 for rescaling. The third step, a CNN model consisting of five layers of Convolutional layer plus max pooling that followed by flattening layer and connected layer with 32 neurons was designed and utilized. In the final step, the model was trained using the sigmoid function. It was also compiled with RMS prop as optimizer and binary Crossentropy loss function.

Results: True positive(TP), cases were 427, true negative(TN), False positive (FP), and false negative(FN) were 427, 122, 8, and 22 respectively. The last Epoch accuracy, the last Epoch validation accuracy, and the last epoch validation loss that model achieve was 96.64%, 94.92%, and 0.1669, respectively. Sensitivity of the model to diagnose pneumonia cases was 94.98% and 94.73% of all the normal cases were recognized true (specificity). f1-score (harmonic mean of precision and recall) of the model was 96.53% as important factors for calculating the accuracy.

Discussion and conclusion: The layers used in this model, make it different from other CNN models which caused high accuracy. In some models, some important layers like MaxPoolling2D and Conv2D are just used, nut in this model, there are some useful layers such as, Spatial Pyramid Pooling (SPP) which benefits from no need for a fixed size input. It helps to reach better validation accuracy and reduce the validation loss. Although it is useful for helping radiologists to diagnose pneumonia faster and more accurately, it is hard to develop and needs strong GPU and CPU. Artificial intelligence in radiology has undergone something of a metamorphosis and has grown as both a technology and a market. However, like most technology solutions, artificial intelligence (AI) is not perfect. It is also, most importantly, not a replacement for human beings.

Keywords: Deep learning, pneumonia, x-ray, image processing

Challenges and opportunities of artificial intelligence in the nursing profession: A systematic review

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Background and aims: Artificial intelligence can be defined as the use of software and hardware systems designed by humans to achieve a complex goal in the physical or digital dimension by understanding their environment through the collection and interpretation of structured or unstructured data. Ultimately, this data serves to decide the best actions to achieve a given goal. Artificial intelligence for healthcare offers potential solutions to some challenges facing healthcare systems worldwide. Artificial intelligence can play an essential role in improving the nursing profession. However, artificial intelligence in nursing has been associated with challenges and opportunities that are important to consider. This systematic review aimed to assess the current challenges and opportunities of artificial intelligence in nursing.

Method: This systematic review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. An extensive search was conducted in online databases including PubMed, ISI, Scopus, Google Scholar, Science direct with the keywords such as "Artificial Intelligence", "Machine Intelligence", "Nursing", "Occupations", "Profession", from the earliest records up to October 20, 2022. Also, all English-language studies related to the purpose of the present study were included. Letters to the editor, opinions, conference abstracts, interventions, and reviews were excluded from this study. The appraisal tool for cross-sectional studies (AXIS tool) was used to assess the quality of included studies. All stages of search and quality evaluation of articles were conducted by two researchers independently.

Results: Seven out of 524 studies were included in this systematic review. Challenges of using artificial intelligence in the nursing profession included loss of human-to-human interaction that can compromise the ethics of care (22%), concern about the ethical use of these technologies (15%), replacement of these technologies with nurses and bias in data management, lack of comprehensive evaluation of outcomes including the quality of patient care (12%). In addition, the burden of care (11%), patient satisfaction (9%), impact on nursing care (9%), non-compliance with professional guidelines (7%), and economic aspects of using artificial intelligence technologies that lead to insufficient communication description are among other challenges (4%). On the other hand, opportunities include providing sufficient information about artificial intelligence and creating clear discussions about artificial intelligence in nursing (4%), creating an opportunity for nurses to focus on patient-centered care (4%), and emphasizing the development of guidelines for clinical nurses on safe adoption. It is suitable for such innovations (3%).

Conclusion: In general, use artificial intelligence technologies has been associated with challenges and opportunities that require special attention. Therefore, it is suggested that policymakers of the nursing profession pay attention to the professional role of nurses in developing and implementing technologies based on artificial intelligence to implement nursing informatics and determine the qualification of artificial intelligence at all levels of nursing education.

Keywords: artificial intelligence, machine learning, machine intelligence, nursing.

Challenges and opportunities of the implementation of machine learning in geriatric clinical care: A systematic review

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Background and aims: Machine learning can play a key role in preventing, diagnosing and treating the problems of elderly patients. However, the implementation of machine learning for geriatric clinical care has associated challenges. The aim of this study was to assess the challenges and opportunities of the implementation of machine learning in geriatric clinical care.

Method: This systematic review was carried out utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. An extensive search was carried in online databases including PubMed, Web of Science, Scopus, Google Scholar, and ProQuest with the keywords such as "Machine Learning", "Transfer Learning", "Artificial Intelligence", "Geriatric", "Elderly", "Care", and "Clinical Care", from the earliest records up to October 20, 2022. Also, all English-language studies related to the purpose of the present study were included. Letters to the editor, opinions, conference abstracts, intervention, reviews were excluded from this study. The appraisal tool for cross-sectional studies (AXIS tool) was used to assess the quality of included studies. All stages of search and quality evaluation of articles were conducted by two researchers, independently.

Results: A total of 10 out of 134 studies were included in the study. The challenges of the implementation of machine learning in geriatric clinical care were including racial biases (n=7), lack of privacy (n=7), inequality (n=6), insecurity (n=6), disruption of human communication and data management (n=6), cost of care (n=6), and annotation problem (n=5). There are many opportunities to implement machine learning to improve geriatric care in the clinical setting. These opportunities include the automation of clinical tasks (n=6), optimization of decision-making (n=5), clinical support in practice (n=5), expansion of clinical capacity (n=4), improvement of the safety level of elderly patients and increase in the quality of their care (n=2).

Conclusion: One of the strategies for improving the problems of elderly patients, reducing costs and increasing the health of patients is the use of machine learning. The most challenges of the implementation of machine learning in geriatric clinical care were including racial biases, lack of privacy, inequality, insecurity, disruption of human communication and data management, cost of care, and annotation problem. In general, the implementation of machine learning to improve the geriatric clinical care is a questionable hypothesis that requires additional evidence. Therefore, these challenges are still a major concern for the implementation of ML in geriatric clinical care. Hence, more research is needed to address the challenges of using machine learning for geriatric clinical care.

Keywords: machine learning, artificial intelligence, geriatric.

Artificial intelligence-based drug repositioning for nervous system disorders: A systematic review

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Background and aims: Nervous system disorders (NSDs) are often considered the most prevalent, fatal, and most devastating form of nervous system disease. NSDs are indications characterized by high unmet medical needs, and limited available drugs. NSD drug discovery is a very expensive process that has many unique challenges as a result of which attrition rates and efficiency are extremely high. The application of artificial intelligence (AI) technologies to the discovery of NSD drugs has become increasingly attractive. The development of therapeutics for NSDs such as Alzheimer's, Parkinsonism, and schizophrenia has been provided with a new direction and thrust from AI technologies.

Here, we present a general overview of AI as it relates to drug discovery, as well as an overview of the recent developments and the applications of AI techniques in NSD drug discovery.

Methods: A systematic search of PubMed, Scopus, and Web of Science, Google Scholar was done for data till March 2023. Database were searched using the terms 'artificial intelligence', 'drug repurposing', 'drug repositioning', 'nervous system disorders', 'machine learning', 'deep learning', 'neural network', 'random forest', and 'support vector machine'. Inclusion criteria for paper selection were: 1) Paper must be peer-reviewed. 2) Journals on which papers are published must be either PubMed, Scopus, or Web of Science indexed. 3) The paper should use only AI techniques. Exclusion criteria for paper selection were: 1) MSc and PhD papers. 2) Duplicate studies in different databases. Pooled proportions were calculated for categorical variables. The random-effects model was used to account for heterogeneity between studies.

Results: From the 865 identified records [PubMed® (n = 359); Scopus (n = 285) and or Web of Science (n = 221)], 98 studies were included. NSDs-related articles were classified with subjects: vascular disorders, infections, structural disorders, functional disorders, and degenerations. Moreover, repurposing novel therapeutic candidate drugs for of NSDs was identified. In addition, we provide a comprehensive background of AI in drug repurposing while specifically focusing on the applications of a network-based approaches to drug repurposing in NSDs, data sources, and tools used. Finally, limitations of AI-based approaches in general and specific to a networks are stated along with future recommendations for better AI-based models.

Conclusion: The pharmacological, biological, and epidemiological principles of drug repositioning identified from the meta-analyses could augment therapeutic development.

Keywords: Artificial intelligence, network analysis, machine learning, deep learning, drug discovery, drug repositioning, drug re-purposing, nervous system disorders.

Challenges and opportunities of the implementation of machine learning in burn clinical care: A systematic review

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Background and aims: Machine learning as one of the components of artificial intelligence is known to play an effective role in increasing the accuracy of diagnosis, sensitivity and clinical features for predicting complications related to burns such as acute kidney injury. However, the widespread adoption of machine learning has challenged the development of clinically relevant models due to the lack of expert programming in the medical community and access to health data. The aim of this study was to assess the challenges and opportunities of the implementation of machine learning in burn clinical care.

Method: The protocol of this systematic review followed the PRISMA guideline. An extensive search was carried in online databases including PubMed, Web of Science, Scopus, Google Scholar, and ProQuest with the keywords such as "Machine Learning", "Transfer Learning", "Artificial Intelligence", "Burn", "Burn Unit", "care", "clinical care", from the earliest records up to October 20, 2022. Also, all English-language studies related to the purpose of the present study were included. Letters to the editor, opinions, conference abstracts, intervention, reviews were excluded from this study. The appraisal tool for cross-sectional studies (AXIS tool) was used to assess the quality of included studies. All stages of search and quality evaluation of articles were conducted by two researchers, independently.

Results: A total of 6 out of 215 studies were included in the study. The challenges of machine learning in burn clinical care were including lack of complete expertise in using machine learning, lack of expert programming and inappropriate access to health data. On the other hand, these challenges lead to the creation of opportunities such as the development of automatic machine learning platforms to facilitate clinical studies to fully understand the high capabilities of artificial intelligence in the health field, especially burn clinical care, extensive education of healthcare workers, especially doctors, and improving the standard of burn clinical care.

Conclusion: The most challenges of machine learning in burn clinical care were including lack of complete expertise in using machine learning, lack of expert programming and inappropriate access to health data. In general, the use of machine learning, despite the challenges raised, can avoid heavy costs for the patient, family and medical systems by accurately and early diagnosis of complications when care resources are limited and expensive. Therefore, these challenges are still a major concern for the implementation of machine learning in burn clinical care. Hence, more research is needed to address the challenges of using machine learning for burn clinical care.

Keywords: machine learning, artificial intelligence, burns.

Potential roles and applications of machine learning for burn wound management

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Background and aims: Machine learning helps predict and make decisions about the diagnosis and treatment of diseases using data and previous experiences through statistical techniques and computer programs. Machine learning models have been designed to predict outcomes, diagnoses, and mortality within health care. One of the machine learning applications is the diagnosis and management of burn wounds. However, machine learning for burn wound management is still questionable and challenging. Considering the growth of ML in medicine and the complexities and challenges of burn care, this review specializes on machine learning applications in burn wound management. This study aimed to assess the potential roles and applications of machine learning for burn wound management.

Method: The systematic review protocol followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. An extensive search was conducted in online databases including PubMed, ISI, Scopus, Google Scholar, and Science direct with the keywords such as "Machine Learning", "Transfer Learning", "Artificial Intelligence", "Burns", "Wounds and Injuries", "Wound Healing ", from the earliest records up to October 20, 2022. Also, all original English articles related to the purpose of the present study were included in the study. Letters to the editor, opinions, conference abstracts, interventions, and reviews were excluded from this study. The appraisal tool for cross-sectional studies (AXIS tool) was used to assess the quality of included studies. All stages of search and quality evaluation of articles were conducted by two researchers independently.

Results: Six out of 524 studies were included in the study. Various roles include preparing machine learning algorithms for burn assessment and burn wound management (n=5), improving the accuracy and sensitivity of burn-related complications such as acute kidney injury (n=5), and preparing machine learning algorithms for burn assessment and burn wound management (n=4). Using laboratory images' color and texture characteristics makes it possible to classify and identify burns at different depths (n=3). A concept of spatial frequency domain imaging to diagnose burn wounds and decide whether to perform skin grafts has been developed to predict burn space and severity (n=2).

Conclusion: Overall, the results of this study show that machine learning could be considered a potentially new and promising technology for the management of burn wounds in the future. However, there is a lack of evidence to support this claim. Accordingly, it is recommended that future researchers design good studies that evaluate the role of machine learning in the accurate assessment of patients and diagnostic and therapeutic measures for patients with burn wounds within future studies.

Keywords: machine learning, artificial intelligence, burns, wounds and injuries, wound healing.

Diagnostic sensitivity of NeuroAdvise, an innovative medical application in diagnosis of neurological disorders

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Background and aims: In recent years, artificial intelligence-based computerized systems are being widely used by doctors in their clinical practice.

Doctors need to be ensured regarding sensitivity and accuracy of the diagnoses and recommendations of a computerized system to trust and use it.

In this study, we have evaluated the sensitivity of an innovative computer-assisted diagnostic system developed for diagnosis and evaluation of neurological disorders.

Method: We reviewed documents of two groups of patients including 100 patients with a definite diagnosis of ischemic stroke as a common disease and 53 patients with a diagnosis of multiple sclerosis as a relatively uncommon disorder who were admitted to Imam Reza Hospital in 2018. The discharge note , CT scan and MRI examination report related to each patient were extracted and their clinical data entered to our innovative clinical decision support system, called "NeuroAdvise" that is available as an Android application.. The inclusion criteria for this study were patients hospitalized in 2018 with a definite diagnosis of ischemic stroke and multiple sclerosis, and the exclusion criteria were incomplete clinical documents. NeuroAdvise is an intelligent system with different approaches that allows the user to diagnose the disease according to the clinical information entered into it. In this study we evaluated "anatomic approach" and "clinical approach". The sensitivity of this system was evaluated by defining the percentage of patients that were correctly reached the definite diagnosis by using the system.

Results: NeuroAdvise system diagnosed the ischemic stroke as the first diagnosis in 95% of cases and one out of top three diagnoses in 99% of cases. Accordingly, multiple sclerosis was the first diagnosis in 44.8% of cases, and was within top three diagnoses in 75.45% of cases. By considering the complete list of differential diagnosis provided by the system for each patient, the sensitivity was 100% for both groups of ischemic stroke and multiple sclerosis patients.

Conclusion: NeuroAdvise expert system, is more sensitive in diagnosis of common disorders and more specific in diagnosis of more rare disorders. NeuroAdvise, as an smart assistant, can provide a practical guide to doctors in the field of examination, differential diagnosis and step-by-step investigation and can help in correct and timely diagnosis of neurological disorders. NeuroAdvise can reduce medical errors, improve neurology patients care and reduce unnecessary costs.

Such intelligent systems, cannot currently replace the physicians, but can help them in making better clinical decisions.

Keywords: *Artificial Intelligence*, NeuroAdvise, CDSS (Clinical Decision Support System), *Medicine*

The capability of chatbots to manage chronic diseases: a systematic review

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Background: Chatbots are easy to use and simulate a human conversation through a smartphone or computer. In chronic diseases, chatbots can improve patient information, monitoring or treatment adherence. Therefore, this study was conducted with the aim of investigating the ability of chatbots to manage chronic diseases in 2022.

Methods: This study was conducted based on PRISMA guidelines. Keywords were searched in PubMed, Scopus and Web of Science databases from 2015 to 14 October 2022 to identify English studies related to the objective. First, the articles were selected based on the title, then their abstracts were reviewed, and finally, they were selected based on the full text. The included studies were evaluated for quality and risk of bias using the CASP criteria by two authors. All non-English, non-original studies and studies that were not related to our purpose were excluded.

Results: Of 4650 retrieved articles, 7 met the inclusion criteria. Capabilities of chatbots in chronic diseases include: monitoring the condition of cancer patients, checking adherence to treatment, improving health literacy, supporting decision-making, tracking the patient's diet and activity, advising the patient, tracking environmental data and health signals for asthma patients.

Conclusion: Conversational agents may be useful in chronic disease management. If the quality of these softwares is not fully evaluated, they may be dangerous. If chatbots are effective and safe, they can be prescribed like a drug to manage chronic conditions.

Assessment of HDL functionality by a newly cell free method: Cholesterol Uptake Capacity (CUC)

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Background: The efficacy of HDL cholesterol uptake capacity (CUC) to reverse cholesterol transport (RCT), was exploited to evaluating the anti-atherosclerotic functions of HDL that are considered as a new clinical index to predict the risk of cardiovascular disease. We aimed to investigate serum CUC by a novel technic in subjects from Birjand longitudinal aging cohort study (BLAS).

Method: This cross-sectional cohort study was conducted of 129 cardiovascular patients and 231 healthy ones from bassline of BLAS. We used a modified CUC method to investigate serum high density lipoprotein (HDL) cholesterol uptake capacity in subjects Result: The mean serum cholesterol uptake capacity was significantly higher in the healthy subject compared to cardiovascular disease (CVD) ones (p=0.04). Despite there were no significant differences in serum HDLC between the subjects and also with the risk of progressive CVD, a significantly negative association was found between CUC serum samples and risk of CVD in the unadjusted model so that with increasing level of CUC, the risk of heart disease decreases (p <0.05). Multivariate logistic regression analysis represent that there was a significantly negative association between CUC and risk of CVA with the elimination of confounding parameters (OR=0.33, 95% CI= 0.12–0.93, P=0.03). Using a decision tree based on the results from analysis and data mining in the study population, we investigated the most important parameters which can be used to evaluate cardiovascular patients. The decision tree has 5 layers of different risk factors contributing to the risk of CVD. According to the results, there was a subgroup of samples with a history of hypertension (HTN) which had a CUC>1.6; half of which got elected as the cardiovascular disease group. For the control group, 88% of samples that had a history of HTN and a CUC≥1.6 got elected. As is reflected in nominal logistics table for evaluating the risk of CVD, the results showed that male sex and high blood pressure were simultaneously the most prominent risk factors associated with cardiovascular diseases. Age was the third factor associated with an increased risk of cardiovascular disease. We found that the CUC rate is statistically associated with the risk of CVD. Discussion: According to this study's results, there was no significant difference in the HDL levels between the CVD group and the group with no history of CVD. Also, there was no significant association between HDL levels and the progression of cardiovascular disease. However, changes in the functionality of HDL were statistically significant and an increase in the functionality of HDL could reduce cardiovascular diseases; as median CUC rates in the healthy group were significantly higher than in the CVD group. The results from the study of Aghasizade et al. corroborate with the results of this study, showing that the CUC rates in the CVD group are significantly lower compared to the control group (p=0.01) and that changes in the serum HDL-C levels over time have no significant association with the risk of CVD progression. Furthermore, using the Cox proportional models analysis, we showed that CUC rates have a negative association with the risk of CVD (HR=0.62, 95%CL=0.41-0.94, P=0.02). Also, the results show that the

mean HDL levels and Cholesterol uptake capacity (CUC) were significantly different between the stroke group and the group with no history of cerebrovascular accident, and although stroke was not associated with HDL levels, there was a negative association between the stroke and CUC rates. Previous studies showed that hypercholesterolemia and hypertriglyceridemia are associated with an increase in vascular diseases and strokes, while HDL and LDL levels showed a poor association with vascular disease and the outcome of cerebral diseases (14, 15). Corroborating with the results of this study, Harada et al. in their study (n=389) reported that HDL is statistically significant and odds-relevant to stroke. According to the study conducted in 2017 on 156 samples with a history of coronary complications, being adjusted for the LDL levels, the only variable that is significantly associated with the risk of future coronary complications is CUC rates (12). According to the results of this study, there is no significant association between the serum levels of HDL, CUC, and CAD. However, in another study, researchers using logistic regression analysis showed that a decrease in the CUC rate is independently correlated to the neo-atherosclerosis (OR، 0.79؛ P <0.001) and future vascular complications (OR: 0.88، P=0.003). Conclusions: HDL cholesterol uptake capacity was associate with reverse incidence of heart disease in population sample from BIRJAND cohort study.

Keywords: cholesterol uptake capacity (CUC), HDL function, cardiovascular disease (CVD), cohort study

Application of in silico techniques and artificial intelligence for the design of a recombinant vaccine based on SARS CoV-2

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Background and aims: SARS CoV-2 Infection is initiated by binding of spike protein to ACE2 receptor on host cell surface. Therefore, spike protein can be considered as a target for the development of a potential vaccine against COVID-19. The aim of this study is to design in silico using artificial intelligence and production of a recombinant vaccines against SARS CoV-2.

Method: To date, numerous studies have been conducted on SARS CoV-2. Considering the important role of spike protein in SARS CoV-2 infection, its sequence was obtained from the NCBI database at https://www.ncbi.nlm.nih.gov/.The obtained sequence was used to perform a BLAST search at https://blast.ncbi.nlm.nih.gov/Blast.cgi. The PSI-BLAST (Position-Specific Iterated BLAST) tool of the protein BLAST was employed to find the highly similar protein sequences. Different parts of the spike sequence were investigated for their role in host cell entry of SARS CoV-2, alongside its glycosylation regions, disulfide bonds and predicted epitopes. Important domains such as receptor binding domain (RBD), fusion peptide (FP), and cleavage site (CS), which played key roles in the binding and fusion of the viral genome into the host cell, were selected. Then, the sequences that had the most suitable epitopic index were selected from these parts. The selected sequences were evaluated in regards to their expression limitations in prokaryotic hosts (such as post-translational modifications), then the selection of such parts were disregarded. Furthermore, the selected sequences were analyzed in terms of their epigenetics, antigenicity, allergenicity, physicochemical properties, signal peptides, glycosylation sites, toxicity, disulfide bonds, primary structures, secondary structures and tertiary structures using in silico techniques and different data bases .the Jcat tool at http://www.jcat.de/ was employed to optimize the DNA sequences for high levels of protein expression (the E. coli codon usage bias was used for the optimization).Following the final confirmation of the selected parts, the 3D structure of the recombinant spike protein was predicted by the Robetta server whereas the 3D structure of ACE2 was obtained RCSB, and they were applied to assess the binding capability of the recombinant spike protein to ACE2 using the HDOCK server.

Results: Bioinformatic studies showed that the selected protein sequence was proper for expression in the prokaryotic system in terms of epigenetic and antigenic indicators and the absence of post-translation modifications, etc. furthermore, the results of intermolecular docking of designed protein with ACE2 receptor indicate a strong connection between ligand and receptor.

Conclusion: According to the bioinformatic studies results, the recombinant protein designed to be used in a vaccine has the potent potential to start in vitro studies. Considering the advantages of producing this type of vaccines (including: rapid growth rate, continuous fermentation capacity, low cost of culture medium, high expression level and lower risks compared to the production of viral vaccines after it was confirmed in the laboratory stage, we conclude that it is a suitable option for the production of recombinant vaccines against SARS CoV-2

Key word: “SARS CoV-2”, “spike protein”, “vaccine”, “recombinant protein”, “bioinformatics”

Artificial intelligence in herbal medicine and drug discovery

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Background and aims: Artificial intelligence (AI) plays a crucial role in different fields of medicine and healthcare. Persian medicine takes the center stage in healthcare system of Iran. Treatment in Persian Medicine is mainly based on herbal drugs and preparations. There is large dataset in Persian manuscripts and growing number of scientific research to verify using typical medicinal plants in special ailments. AI could be used to categorize and analyze those large amount of information for extraction and interpretation of information.

Methods: this is a review manuscript containing data regarding application of AI in herbal medicine. Clustering algorithms could be a data analyzing technique to automatically recognize the pattern between the patient's symptoms and the proper herbal preparation selection. These networks could be designed based on integration of clinical practice, patient's outcomes and the selected herbal medicine. This could be helpful especially when there is neither any therapeutic pattern nor clear evidence for herbal therapies in special ailments.

Results: Using AI could be an unprecedented step to reduce superfluous trials and to decrease time to acquire data. It could assist in selection of tailored herbal medicine according to patient's genetics, physiological, pathological characteristics, and temperament which can efficiently lead to apply personalized medicine. AI could assist in acquiring prediction power to conduct more efficient trails, to use whether a single herbal drug, or the combination of herbal medicine for complex disease such as cancer or MS. AI could gather information from datasets to gain networks of potential interactions between phytochemicals, proteins, genes, and organs.

Conclusion: AI is a practical tool to predict molecular activity of natural compounds in the body which paves the way for drug discovery with consuming much less time and money.

Immunoinformatics vaccine design against neurological disorders; Machine learning-based reverse vaccinology approaches

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Backgrounds and Aims: Vaccines have been used to prevent infectious diseases. However, their use can be extended to confer protection against non-infectious diseases, such as neurological disorders. Vaccines are designed in multiple forms, such as inactivated (killed), toxoid, and live attenuated. Multiple approaches are employed in vaccine design. New advances in computational medicine/biomedical engineering and immunobiology have resulted in the emergence of novel vaccines through machine-learning based tools. We discuss new tools in the field of computational vaccinology with emphasis on targeting neurological disorders.

Methods: This is an expert perspective and narrative review that discusses frequently used bioinformatics methods in application of computational vaccine design in neurological disorders. We also review literature from PubMed and Scopus using the search terms Immunoinformatics, neurology, machine learning. No time limit has been considered for publication. mRNA and protein vaccines are reviewed and common methodology are described for each stage of in silico vaccine design. We review most-frequently used machine learning-based tools used in reverse vaccinology (RV).

Results: The computational process of vaccine design starts with selection of biologically significant antigens in the pathogenesis of neurological disorders. For example, amyloid plaques are a good selection for Alzheimer's disease (AD). Also, viral proteins involved in nervous system infections may be targeted to design vaccines against CNS infections. Machine learning tools are utilized to identify helper and cytotoxic T-cell as well as B-cell epitopes. Servers that carry out such processes include Immune Epitope Data Base (IEDB), and CTLPred (based on ANN, KNN). Linker peptides including ALL, AGGGA, SSL, and EAAAK are then used to connect the epitopes. Linkers act as spacers that prevent the conformational clash of epitopes. A peptide adjuvant is sometimes inserted in the sequence to boost immunization. The final sequence should be modelled to produce a tertiary structure of the vaccine. This can be performed using UCSF MODELLER, RaptorX server, GalaxyWeb. Next, the structure quality is verified by Ramachandran plot (based on torsion angles) and ProSA (based on NMR/X-ray structures' Z-score). The vaccine undergoes physicochemical and antigenic (VaxiJen server) properties analysis. Docking with immune receptors such as TLRs are also performed. To make mRNA vaccines, in silico tools are utilized to design and predict the RNA sequence, as opposed to protein sequences which are modelled in the process of protein vaccine construction. The interaction of Vaccine-receptor is confirmed via molecular dynamics analyses (GROMACS, Schrodinger, amber, or others). Finally, the Immune inducing potential of vaccine and its booster dosages are simulated via the C-ImmSim server. This server enables simulation of adaptive and innate immune response following multiple injections of vaccine with or without adjuvant.

Conclusions: Using machine learning-based Bioinformatics tools, RV has produced candidates

which need to be tested in experimental and clinical studies. There is a need to benefit from the use of RV approaches in a wider range of neurological disorders. Compared to traditional vaccinology, RV is faster in designing good quality candidates which can be further tested in experimental research. RV pipelines can be applied to neurodegenerative disorders such as AD, Parkinson's disease (PD), and Amyotrophic lateral sclerosis (ALS). The development of immunogenic candidates may not be limited to common neurodegenerative disorders. In fact, the process has been applied to brain tumors such as glioblastoma multiforme (GBM) and tested in molecular studies. However, these immunotherapies may be started after being diagnosed with the disease and identification of a target population is difficult in such cases.

Keywords: Neuroimmunology, Immunoinformatics, Machine learning, Molecular dynamics simulation (MDS), Immune simulation, Artificial neural network (ANN)

Applications and capabilities of Augmented Reality in surgery: a systematic review

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Background: Through the use of Virtual Reality and Computer assisted guiding systems, surgeons can improve surgery, but they need to build a mental relationship between a virtual image representing their patient, and the real patient. This image-guided surgery is easier with augmented reality, the virtual information being superimposed onto the real view of the patient. But this guidance remains limited to gesture precision and accuracy of surgeons. Augmented Reality has provided surgeons with extensive visual information of surgical anatomy to assist them during surgery. Although setups based on augmented reality have been used for various neurosurgical pathologies. he success of this technology has been proven in surgeries, more studies are needed to clarify its potential, especially in developing countries. Therefore, this study was conducted with the aim of investigating the applications and capabilities of Augmented Reality in surgery in 2022.

Methods: This study was conducted according to PRISMA guidelines. PubMed, Scopus and Science Direct databases were searched to identify English-language studies relevant to the research objective. Included studies were assessed for quality and risk of bias using CASP criteria by two authors. Then they were used after separation, review and final approval.

Results: Of 6300 retrieved articles, 13 of them were selected. Augmented Reality has been used mostly in neurosurgery, but it has been used for orthopedic, urology, gastroenterology, vertebra, biopsy, breast cancer, skull, The 3D modeling of patients from their CT-scan or MRI, maxillofacial and plastic surgeries. Visualization of tumor location, training of surgeons, reduction of exposure to ionizing radiation and nerve navigation were among its capabilities.

Conclusion: Augmented Reality shows promising capabilities in surgeries, but these simulation systems remain in their early stages and few prospective RCTs are available. In recording the different ways in which the Medtronic, PACS and IBIS systems were used, we saw the shortcomings of traditional neuronavigation systems and a benefit of using AR. By bringing together into one view pre-operative patient information and the intra-operative field of view, it can aid in the localization of pertinent anatomy and planning of surgical resections. Due to the rapid growth of this technology, more studies are needed to reveal its capabilities. Overall, with the further development of robust visualization techniques and rigorous evaluation of their usefulness in the OR, AR should become regularly used in the OR.

Keywords: Augmented Reality, Mixed Reality, surgery, augmented reality assisted surgery, image-guided surgery.

Remote Dental Examination through a Newly Designed Mobile Application

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Since the emergence of COVID-19, virtual educations and services have been expanding and proved to be successful. Teledentistry by using mobile applications has been used vastly by clinicians and patients, since nowadays most people have access to the smartphones. Teledentistry has prevented patients' unnecessary visits, hence it saves time and expenses.

We developed and tested an application to improve patients' oral health knowledge, and perform dental examination based on the oral images, which they took by their smartphones. We also collect data and information about patients and their oral health behaviors, and keep the connection between patient and dentist for further treatments.

First, patients download the app, use the manuals for sending 5 intra-oral images and fill the necessary forms. Afterwards, the images are reviewed and examined virtually. We determine patients' decayed, missed, and filled teeth (DMFT), gingival health and orthodontics relations. After the examination, we contact the patients and guide them for their needed treatments.

Application is tested on 80 patients mainly dental students of Mashhad dentistry faculty. All patients filled the necessary form through application and all pictures were taken by one person instructed through the application instruction part.

The main goal of the remote clinical examination is to detect visible decays, missing and filled teeth.

The second goal is to detect molar and canine relations, crowding and spacing and general oral health.

For missing teeth, it was 100% compatible with visual examination. Also 100% compatible with amalgam fillings and severe decays.

Inaccurate examination was detecting 2 and 15 teeth which are very hard to take pictures from and palatal and lingual surfaces which are inaccessible to take photos.

Some white-colored restorations like zirconia crowns and some composite restoration were undetectable, which cannot be distinguish in visual examination too.

Angiographic images modeling and processing of coronary artery disease patients in order to determine coronary artery stenosis

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Background: Advances in computer science have led to the emergence of existing cardiovascular assessment tools. CTA (computed tomography angiography) is an imaging method for visualizing arterial and venous vessels throughout the body, which is widely used today. Clinical evaluations mainly rely on visual evaluation or manual measurement by cardiologists, which are naturally not free from human errors. On the other hand, due to the increase in mortality due to cardiovascular diseases and its significant growth as the first cause of death in Iran, the study and prevention of this disease has a high priority. Among cardiovascular diseases, coronary artery disease is the most important and the main cause of heart attacks. The aim of this research is to implement image processing techniques on coronary angiography images to automatically detect the degree of coronary artery occlusion.

Methods: The process of current research includes: 1- Preprocessing (Image reprocessing), 2- Image Enhancement, 3- Separation of coronary vessels (Image Segmentation), 4- Centerline Extraction and diameter calculation, 5- Stenosis Detection, 6- Evaluation of system performance and accuracy

Results: Image processing and modeling results, high performance to detect the degree of coronary artery occlusion and can be used as a second opinion for experts.

Discussion: In this research, the processing of coronary angiography images, resulted a high performance model to automatically detect the degree of coronary artery occlusion. As the next process, due to increasing the usability of model, Establishment of a decision support system (DSS), should be considered.

Keywords: **Angiography images processing**, **coronary artery disease**

Designing and psychometric analysis of an instrument to assess the attitude of medical science faculties towards the use of ChatGPT in medical education

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Purpose: Considering the ChatGPT is a valuable tool for medical education, for example, for providing students with personalized learning experiences, this research was conducted with the aim of designing and psychometric analysis the attitude of medical science faculties towards the use of ChatGPT in medical education.

Materials and methods: The present study is methodological research conducted in two parts. Based on a literature review and qualitative content analysis, the instrument was developed. A quantitative and qualitative content and face validity were conducted. The construct validity of the instrument was checked by exploratory factor analysis. 250 qualified faculties of medical sciences with the age range of 29 to 62 years were selected from Iran in 1402 by available sampling method. Written informed consent was obtained from them. In order to measure the internal consistency of the instrument, after distributing the questionnaire among 20 medical science faculties, Cronbach's alpha coefficient was determined. For the reproducibility of the instrument, the test retest and correlation coefficients were used. The Intraclass Correlation Coefficients was measured by distributing questionnaires among 20 faculties eligible to participate in the study. Data were analyzed by SPSS software using exploratory factor analysis, Intraclass Correlation Coefficients and Cronbach's alpha.

Results: The initial tool version had 80 items. At the face and content validity stage, 15 items were removed. Factor analysis identified eight factors by removing 20 items. Interclass correlation coefficients and Cronbach's alpha were 0.842 and 0.854, respectively.

Conclusion: The findings of this study show that the 45-question instrument designed with a five-point Likert response scale (none to very much) can be used as a valid and reliable tool to evaluate medical science faculties regarding the use of ChatGPT in medical education.

Keywords: ChatGPT, attitude, instrument psychometrics, medical education

Psychometric analysis of an instrument to assess the attitude of medical students towards the use of Artificial Intelligence in medical education

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Purpose: Artificial intelligence (AI) can enhance efficiency and facilitate complicated tasks in medical education. Despite the growing applications of AI in learning, instruction, and assessment, further research is required, this research was conducted with the aim of psychometric analysis the attitude of medical students towards the use of Artificial Intelligence in medical education.

Materials and methods: The present study is descriptive research. A quantitative and qualitative content and face validity were conducted. In order to measure the internal consistency of the instrument, after distributing the questionnaire among 30 medical students, Cronbach's alpha coefficient was determined. For the reproducibility of the instrument, the test retest and correlation coefficients were used. The Intraclass Correlation Coefficients was measured by distributing questionnaires among 35 medical students eligible to participate in the study.

Results: The initial instrument version had 32 items. At the face and content validity stage, 5 items were removed. Interclass correlation coefficients and Cronbach's alpha were 0.62 and 0.95, respectively.

Conclusion: The findings of this study show that the 27-question instrument designed with a five-point Likert response scale can be used as a valid and reliable tool to evaluate medical students' attitude regarding the use of Artificial Intelligence in medical education.

Applications of Ensemble learning techniques for Knee Arthroplasty surgery: a systematic review

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Background and aims: Ensemble models consist of multiple algorithms that individual results are aggregated in various ways. Compared to individual predictors, such as a neural network, they are more stable and provide better predictions. usage of artificial intelligence in the clinical area recommends the outstanding accuracy of these hybrid models. In knee arthroplasty, single algorithms have been widely used to improve the decision-making process, surgical planning, accuracy, and repeatability of surgical procedure, however, there is no evidence to review applications and capability of ensemble methods for knee arthroplasty. This study aims to provide a systematic overview of the ensemble learning techniques were used for Knee Arthroplasty surgery.

Method: A systematic search of PubMed, Embase, the Cochrane Library, ERIC database, and google scholar was conducted for articles published in English between 2010 and 2023. The search terms used related to "ensemble learning" and "stacking", "boosting", "bagging", "artificial intelligence", and "machine learning" algorithms in" knee arthroplasty" "TKA" and "UKA surgery. since this paper focuses on machine learning techniques applied in medicine, a combination of strategies from two related guidelines was implemented to conduct the systematic literature review (SLR) which includes 17-item checklist of the Preferred Reporting Items for clinical Systematic reviews and Meta-Analyses (PRISMA) statement and Software Engineering Guidelines for Conducting Systematic reviews.

Results: After applying inclusion and exclusion criteria, we identified 36 studies of which 23 were boosting and 10 were stacking designs, and three used bagging methods. The review showed that the most common classes of combining different models were boosting and stacking. we also found that stacking with neural networks was mostly recommended. The development of an Ensemble deep learning technique for TKA/UKA using Fluoroscopy, x-ray, and MRI images perform well with an average of accuracy 90.05% to build a 3D model of customized implants and predicting preferred intraoperative sagittal alignment of the implant during arthroplasty.

Conclusion: Applications of meta-approach to machine learning for knee arthroplasty surgery are expanding rapidly and offer significant improvement in a forecast of the final model. This study provides evidence that ensemble algorithms have the potential for better strategies with more capabilities than single classifiers to predict accurately.

Keywords: Ensemble learning, Knee arthroplasty, Machine learning

Applications of AI in Veterinary Medicine

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Background and aims: Nowadays, AI development has shown its capabilities to many fields and this useful technology has solved a lot of problems. Accepting AI is inevitable in any field, veterinary medicine, like any other part of the world, has unmet potentials for AI. In this review article those potentials have been investigated.

Method: This research is a review type of study in which authentic articles published in reliable databases such as Google Scholar and PubMed as well as library search were used. Statements "AI in Veterinary Medicine", "ML in DVM" and "DL in DVM" were used for searching in foregoing databases.

Results: Since Veterinary Medicine has many fields, AI can provide its different services in different fields of it such as "Disease prediction", "Managing livestock health", "Image analysis", "Pathology" and "Aquaculture".

Conclusion: There are several applications of AI services in different fields of veterinary medicine:

Disease prediction: Large scales of information about diseases can be analyzed by ML algorithms, so prognosis can be faster and more accurate.

Managing livestock health: AI can provide automated monitoring of livestock health and early detection of diseases.

Image analysis: By training CNN (Convolutional Neural Network), objects can be classified in new, unseen images like pathology slide, image of a blood smear and ultrasound images.

Pathology: AI-based automated feature detection systems that can automatically analyze blood smear or pathology-stained slides offers tremendous potential efficiencies and quality improvements in veterinary medicine.

Aquaculture: Same as managing livestock health, Internet of things and AI can be used for automated monitoring and early detection of diseases.

Keywords: AI in veterinary medicine, ML, DL

The Future of Epilepsy Management: Advancements in AI Diagnosis, Treatment, and Prognosis

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Background and aims: The incidence of epilepsy, a neurological disorder, is increasing. The causes of epilepsy vary among individuals and include congenital gene mutations, traumatic injury, and infections. The heterogeneity of the causes has made it difficult to diagnose and select appropriate treatments accurately. The diagnosis of epilepsy is based on a combination of EEG signals, biological markers, clinical data, and other information recorded from the patient, which are classified into epileptic and normal cases. The recent surge in medical data and computing power has facilitated an increase in big data analysis and AI studies in the field of epilepsy. This article provides an overview of epilepsy, big data, and AI, and reviews the use of a common data model for seizure detection, epilepsy treatment, and forecasting through big data analysis.

Method: To collect data related to the topic, we conducted a search of Google Scholar, NCBI, and Scopus databases, and identified relevant articles including case reports, case series, case-control studies, reviews, editorials, and cohort studies. We then extracted relevant information from these sources.

Results: Understanding an Electroencephalography (EEG) signal and clinical data with accuracy can be a monotonous and time-consuming task. To address the challenges in this field, Artificial intelligence (AI) methods, like machine learning and deep learning, are being used more frequently to manage the vast amounts of data. AI applications play a vital role in automating seizure detection, pre-surgical planning, predicting medication response, and forecasting medical and surgical outcomes from the examination of EEG, clinical data, and other imaging. Computational studies are making significant advancements in precise diagnosis of seizure types and determining the best treatment for patients with epilepsy. These studies are separated into two categories: 1) studies using artificial intelligence that employ computational machines with particular functions, such as machine learning methods based on large amounts of data from several patients for automatic diagnosis and prognosis prediction for individual patients, and 2) patient-specific modeling-based studies that use biophysical in-silico platforms to understand pathological mechanisms and find the best treatment for each patient using their individual data by reproducing their brain network dynamics. These computational approaches are valuable as they can merge various types of data gathered from patients and analysis results into a single platform, presenting a new paradigm for precision medicine if implemented effectively.

Conclusion: Artificial intelligence (AI) is not only useful for analyzing medical data to prevent diseases, diagnose them, monitor patients, and develop new protocols, but it can also help clinicians manage large volumes of data more precisely and efficiently. This can enable patients to monitor seizures before they occur and aid doctors in their diagnosis and treatment. As computational capabilities improve, more effective machine learning algorithms become available, and larger datasets accumulate, clinicians and researchers will increasingly reap the benefits of being familiar with these techniques and the significant progress already made in their application in epilepsy.

Keywords: Artificial Intelligence, epilepsy, personalized therapies, predicting prognosis, AI algorithms

Recommendation Systems Used in the Field of Nutrition; A Systematic Review Study

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Background and aims: Healthy diet is essential for health, physical and mental growth, performance and productivity and overall well-being. Nutrition recommendation systems (NRS) facilitate changing eating behavior and making healthier food choices. NRS can also provide recommendations on diet and eating habits, detect health problems, and guide user behavior modification. The aim of this systematic review study is to investigate different recommendation systems used in the field of nutrition.

Method: This systematic review was conducted based on PRISMA guideline through an advanced search in PubMed, Scopus, Web of Science, IEEE (Institute of Electrical and Electronics Engineers) and GoogleScholar search engine without time limitation (up to February 2023). The keywords based on MeSH terms used include "Nutrition", "Diet" and "Recommendation System". After removing the duplicate titles using EndNote software, articles were screened and evaluated in three stages by reviewing the title, abstract and full text according to the inclusion criteria (original articles, focusing on NRS and health promoting goals, papers with English language and having access to full text). In order to be more accurate and lessening the error, screening was done by two individual reviewers in parallel and disagreements were discussed by the third reviewer. Also review articles and letters were excluded. Related articles were examined using the MMAT tool. Finally, 19 articles out of 695 articles found in the initial search, were eligible to be included in this study.

Results: Studies show that hybrid recommender systems (10 studies) and knowledge-based recommender systems (8 studies) were most used in NRS. Collaborative-based recommender systems (4 studies) and content-based recommender systems (3 studies) were also used in NRS. Frequently techniques used in NRS, were rule-based (10 studies) and ontology (6 studies). Other techniques used are K-means (6 studies), self-organizing map (SOM) (3 studies), multi agents (3 studies) and genetic algorithm (3 studies). Mobile application was the frequented platform applied in NRS (7 studies). Web application (5 studies) and desktop application (1 study) were other types of system's platform.

Conclusion: NRS have been designed in different types, with different artificial intelligence techniques and different main modules on different system platforms. NRS has a significant potential to improve dietary intake and promote a healthier life style if it is well designed, implemented and evaluated. Nutrition informatics specialists can design and develop a more useful NRS by being informed about the frequented types, AI techniques and modules.

Keywords: Nutrition, Recommendation System, Diet, Informatics

Artificial intelligence (AI)-assisted systematic review and meta-analysis in medical sciences; How close are we to automated synthesis of evidence? A perspective

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Background and aims: SR/MA is still considered somewhat new. Meta-analysis is less than a century old. Yet, the methods and guidelines on conducting them is ever changing. Artificial intelligence (AI) is often discussed as an accelerator of complex tasks in various health-related fields. This paper discusses the feasibility, reliability, and validity of synthesized evidence using AI-generated SR/MA. We also discuss if AI is, or in the future could be, a smart enough means to provide reasonable clinical decision-making based on such analyses.

Method: We searched PubMed, Google Scholar, and Scopus for studies utilizing AI in health-related research. The studies were analyzed in the format of narrative review in terms of feasibility and validity of using AI for qualitative and quantitative synthesis of evidence, field of study, addressing risk of bias, and other criteria. No limit was considered for search data.

Results: In a recent work, AI synthesized evidence for toxicity of hydroxychloroquine by combinational use of AI with human analysis. Study produced a clinical guidance in 30 minutes. Authors identified 11 articles evaluation ocular toxicity as an adverse event of hydroxychloroquine and approximated the rate to be 3.4%. Heterogeneity among individual articles was excessive. Although the use of AI was able to significantly accelerate the process, the time for preparation of the AI algorithm for each use case should also be considered. This was still not fully automated. It is difficult to tweak AI to replace an expert panel that suggest how clinically relevant each result may be. Another advanced form of SR/MA is network meta-analysis (NMA) which summarizes more complex study designs. For instance, NMA is able to rank more than two treatments, given the original studies are of proper design and quality. The model writing and choosing parameters are time-consuming and difficult. Often, NMAs are conducted via Markov chain Monte Carlo tools like WinBUGS, demanding a model and information to be determined using a specific syntax. Automation is useful for simulations in which the significant number of NMAs that have to be estimated may prevent manual model specification and analysis. The authors present a method for generation Bayesian homogeneous variance random effects consistency models, such as selecting base settings and trial baselines, priors, and initial values for the Markov chains. In 2022, a SR showed that significant human confirmation still seems mandatory currently in implementing AI methods for health SR/MA. The application of AI in systematic analyses of evidence has a lot of room for improvement. An AI with the ability to fully-automate meta-analysis from protocol to design to providing clinical advice may be the ultimate goal that the field is currently far from, but is slowly approaching.

Conclusion: As the evidence stands, AI accelerated conducting a SR/MA, making what is normally possible in months possible in minutes/hours. Decision-makers should consider the time and effort put into developing AI technology. Optimal AI should be tweakable for different use cases of meta-analysis. AI-based studies on preclinical research are lacking, possibly due to diverse designs.

Keywords: Artificial Intelligence, systematic review and meta-analysis, health sciences, research methodology

Using Artificial Intelligence Chatbots To Promote Physical Activity, Healthy Diet, And Weight Loss

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Background and aims: Artificial Intelligence (AI) chatbots, also called conversational agents, utilize dialogue systems to enable natural language conversations with users through speech, text, or both. By using natural language processing and cloud computing infrastructures, AI chatbots can participate in a wide range, from constrained (i.e., rule-based) to unconstrained conversations (i.e., human-to-human-like communication). Physical inactivity, inappropriate diet, and obesity are worldwide health issues. They are well-known modifiable risk factors for cardiovascular diseases, type 2 diabetes, particular types of cancers, cognitive decline, and premature death. This systematic review aimed to evaluate if AI chatbot interventions were successful in changing physical activity, healthy eating, weight management behaviors, and other related health outcomes.

Method: This study is a review study by analyzing articles from databases, including PubMed, EMBASE, ACM Digital Library, Web of Science, PsycINFO, and IEEE. This research has been done with keywords " artificial intelligence", "chatbot ", "diet" and "weight loss" from 2013 to February 2023. Only randomized controlled trials or quasi-experimental studies were included. The National Institutes of Health quality assessment tools were used to assess risk of bias in individual studies.

Results: Most studies focused on changes in PA, and majority reported considerable improvements in PA-related behaviors. The number of studies with the aim to change diet and weight status was relatively small. Two studies found noticeable improvements in diet-related behaviors. Although only 1 study reported weight-related outcomes, it reported significant weight change after the intervention. In summation, chatbots can improve PA, but the study not able to make definitive conclusions on the potential efficacy of chatbot interventions on promoting PA, healthy eating, or weight loss. Eighty-nine and thirty-three percent of the studies specified a name and gender (i.e., woman) of the chatbot, respectively. More than half (56%) of the studies used a constrained chatbot (i.e., rule-based), while the remaining studies used unconstrained chatbots that resemble human-to-human communication.

Conclusion: Chatbots can improve physical activity, but we were not able to make definitive conclusions regarding the efficacy of chatbot interventions on physical activity, diet, and weight management. In addition, theoretical frameworks that can capture the unique factors of human-chatbot interactions for behavior changes need to be developed and used to guide future AI chatbot interventions. Application of AI chatbots is an emerging field of research in lifestyle modification programs and is anticipated to grow exponentially. Therefore, standardization of designing and reporting chatbot interventions is warranted in the near future.

Keywords: Artificial Intelligence, Chatbots, Diet, Weight Loss

Using four common machine learning methods to classify breast cancer

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Cancer is the second leading cause of death in the world. Among the types of cancer, breast cancer is the most common disease of women worldwide,30% of women's cancers are included.Our effort is to study and research breast tissue cancer cells using machine learning methods, which are considered a subset of artificial intelligence.

Machine learning techniques have great potential in diagnosing and classifying cancer and normal cells

Methods: In this study, 120 patients with breast cancer were examined, all of whom underwent surgery. 6 characteristics were considered for each person and these characteristics were examined using machine learning techniques. Decision tree, random forest and Support vector machine are the methods that we used to check them. We attempt to measure the relationship between these data.

Result: In this research, support vector machine showed 77% accuracy, decision tree 82% and random forest showed 60% accuracy. Among these techniques, the decision tree method was more powerful than others.

Conclusion: To improve the accuracy of the methods used to predict cancer cells, increasing the number of patients and combining different characteristics that affect cancerous cells is very effective.

Keywords: Artificial intelligence, machine learning, breast cancer, prediction and early diagnosis

Virtual Reality and Augmented Reality in Dentistry: A Review Study

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Background and aims: Virtual reality is a virtual 3D environment that is created from scenes close to reality and allows the user to interact with it. Augmented reality adds virtual data to the real world to create a better user experience. Due to the sensitivity of the anatomical areas of the head and neck and the increasing skill of dentists, the use of these two technologies is vital. The purpose of this review is to examine the opportunities and challenges related to virtual reality and augmented reality in dental science.

Method: This research is a review study based on the PRISMA 2015 guidelines and advanced search in PubMed, Scopus, Web of Science, and Google Scholar search engines. Articles with keywords Virtual Reality, Augmented Reality, and Dentistry from 2013 to February 2023 were evaluated. After the initial search, two stages of screening took place; First, the title and abstract of the articles were examined in terms of relevance to the study objectives, and then the restriction of the English language and access to the full text was applied. Also, to ensure the completeness of the search results, the sources of the entered articles were also checked. The articles related to the research were evaluated with the JBI tool.

Results: Studies have shown that virtual reality and augmented reality increase the quality of students' learning during the pre-clinical training course and make complex and abstract concepts understandable to the audience. Tactile feedback is used in virtual reality to improve manual dexterity and improve clinical training. In addition, they can be used to reduce the fear of dentistry and increase the pain tolerance of patients. Virtual reality and augmented reality increase the accuracy of implant placement and intraoperative navigation in orthognathic surgery. The overall number of included studies was small and currently, scientifically proven recommendations for clinical protocols cannot be made; But studies show that virtual reality and augmented reality are valuable educational tools that can enhance current traditional educational methods.

Conclusion: Virtual reality and augmented reality cause better visualization, reduction of operation time, and better consultation with the patient. These two technologies are considered useful tools for the intelligent education of dental students; They can also lead to safe and predictable outcomes for treatments and increase the quality of patient care. Future research should focus on establishing standards with high-quality data and developing validated applications for use in clinical dental practice.

Keywords: Dentistry, Virtual Reality, Augmented Reality

The Application of Artificial Intelligence in the success rate of In Vitro Fertilization

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Background and aims: In vitro fertilization (IVF) is a complex series of procedures used to help with fertility or prevent genetic problems and assist with the conception of a child. During IVF, mature eggs are collected from ovaries and fertilized by sperm in a lab. Some of the factors that affect the success rate of IVF are age, previous pregnancy, previous miscarriage, BMI, and lifestyle. However, the most effective factors that can help predict the best conditions for IVF are optimal embryo selection and implantation-based factors. On the other hand, artificial intelligence (AI), or machines that mimic human intelligence, have been gaining traction due to their potential to improve outcomes in medicine. Artificial Intelligence represents the combination of machine learning, and a moderation and self-adapting prediction model. Artificial Intelligence can aid in selecting the best oocyte and sperm combination as well as predicting embryo quality and implantation time. Furthermore, Artificial Intelligence has the potential to assist clinicians in developing an optimal patient-specific treatment regimen to improve IVF success.

Method: In this review article, the keywords "In Vitro Fertilization," "Implantation," "Embryo," "Convolutional Neural Networks," "Artificial Intelligence," and "Spiking Neural Networks" have been searched in international databases of articles such as Pubmed, Google Scholar, Science Direct, Elsevier, Scopus, and proper articles were extracted and reviewed.

Results: Implantation-based factors that need to be considered in IVF are maternal age, embryo transfer day, endometrial thickness, total gonadotrophin dose, and estradiol concentration. Also, embryo-based factors like embryo viability, morphology, euploid/aneuploid status, developmental stage, the metabolic and proteomic profile, and the number of embryos are some other factors that should be assessed in order to predict the optimal embryo for a perfect IVF with a high success rate. Selecting the optimal embryo is a complex task. The transferred embryos must be carefully selected among others based on the above-mentioned factors. For this purpose, Machine learning methods have been used to predict implantation and rank the most promising embryos. Machine learning solutions usually combine ranking embryos' steps by optimizing for implantation prediction and using the same model for ranking the embryos within a cohort. So, A machine learning–based decision support system would be useful in improving the success rate of IVF treatment. Also, Deep Learning can replace human assessment of embryonic developmental potential and thus contribute to implementing a single-embryo transfer methodology. Furthermore, Artificial Neural Networks can detect the best embryos from a euploid cohort which can lead to a higher IVF success rate.

Conclusion: In IVF treatments, early identification of embryos with high implantation potential is required to shorten the time of pregnancy while avoiding clinical complications to the newborn and the mother caused by multiple pregnancies. In conclusion, the wider use of AI in precisely assessing patient characteristics, such as ovarian reserve, age, endocrine status, and clinical diagnostic tests, will undoubtedly increase the efficiency of IVF. All mentioned findings suggest machine learning algorithms based on age, BMI, and clinical data have an advantage over logistic regression for the prediction of IVF outcomes and therefore can assist fertility specialists.

Keywords: In Vitro Fertilization, Implantation, Embryo, Convolutional Neural Networks, Spiking Neural Networks, Artificial Intelligence

Use of Artificial Intelligence in the Diagnosis of Dental Caries: A Review Study

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Background and aims: The term artificial intelligence refers to the ability of machines to think like humans. Machine learning and deep learning are branches of artificial intelligence that use statistical methods to learn the relationship between data and return output with high accuracy. Dental caries is the most common disease related to oral health. Early and accurate diagnosis of caries and their treatment prevents more aggressive treatments. Therefore, the use of artificial intelligence can help to increase the accuracy of detecting dental caries. The purpose of this review is to investigate the use of artificial intelligence in the diagnosis of dental caries.

Method: This research is a review study based on PRISMA 2015 guidelines with advanced search in PubMed, Scopus, Web of Science, and Google Scholar search engine. Articles with the keywords Artificial Intelligence, Dental Caries, Machine Learning, and Deep Learning were evaluated based on MeSh from 2013 to February 2023. After the initial search, two stages of screening took place; First, the title and abstract of the articles related to the objectives of the study were examined, and then the restriction of the English language and access to the full text was applied. Also, to ensure the completeness of the search results, the sources of the entered articles were also checked. The articles related to the research were evaluated with the JBI tool.

Results: Studies show that the accuracy of artificial intelligence for detecting dental caries is high and their accuracy is the same as that of trained experts; Of course, in some studies, it was found that these systems can even surpass dentists in terms of performance. Artificial intelligence can help in mass surveillance of the population and improve the referral system. Artificial intelligence can effectively detect caries that are overlooked by dentists' eyes. Deep learning and machine learning models improve the accuracy of diagnosis and increase clinical decision-making and treatment prognosis. However, dental applications of AI models are still under development and their use in the clinic is rare due to limitations such as lack of reliable data and predetermined criteria.

Conclusion: Artificial intelligence is introduced as a reliable tool to increase the accuracy of dental caries diagnosis. Artificial intelligence can play an important role in helping dentists in the diagnosis process and help in providing the best quality services to patients. Therefore, it is recommended that more studies be done to solve the challenges and limitations of its use in the clinic.

Keywords: Artificial Intelligence, Dental Caries, Machine Learning, Deep Learning

Application of machine learning and deep learning in diagnosis and treatment of anterior cruciate ligament and meniscus tears. New techniques and outcomes. Review

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Background and aims: Innovative technology such as artificial intelligence (AI) is an essential component of orthopedic surgery. Deep learning is one of the branches of artificial intelligence that can be used in the interpretation of magnetic resonance imaging (MRI) images and help surgeons in the diagnosis of injuries to the anterior cruciate ligament (ACL) and meniscus tears, and has a great impact on improving the treatment process. In this research, the use of artificial intelligence, especially deep learning and machine learning, in the diagnosis of anterior cruciate ligament injury and meniscus tear is discussed.

Method: For this purpose, articles registered in the last 5 years in the PubMed database were analyzed. Articles related to the use of artificial intelligence in the diagnosis of ACL injuries and meniscal tears were carefully reviewed with related terms. The terms included: 'artificial intelligence', 'deep learning', 'machine learning', 'knee injury', 'ACL', 'meniscus tear'. The papers were further classified and reviewed according to the type of artificial intelligence algorithm used. Algorithms used in the desired topics were reviewed and the results were presented based on the factors of accuracy and correctness of the used models.

Overall, 55 papers were reviewed: 40 on deep learning and 12 on machine learning and 3 for both. Three papers also focused on the use of the two artificial intelligence algorithms.

Results: Reviewing the studies showed that 78% of the studies of the last 5 years in the field of artificial intelligence application to diagnosis of injuries in anterior cruciate ligament and meniscus tears were using deep learning algorithms and only 12% of the studies were using machine learning algorithms and the accuracy of artificial intelligence algorithms in knee injuries prediction is in high range.

Deep learning algorithms for ACL and meniscus tear detection have AUC (area under curve) and predictive accuracy better than machine learning ones and are closer to specialists.

Conclusion: The use of artificial intelligence in the diagnosis of knee injuries based on deep learning algorithms is expanding and more than machine learning one, due to the growing number of articles presented in this field. The review of the articles submitted shows that the use of AI algorithms (deep learning and machine learning algorithms) gives acceptable results, but before using on a large scale, it is necessary to mention some of its limitations.

The limitations of deep learning algorithms are: the imbalance and homogenization of input data, the inability to generalize the models according to the technological level of imaging devices, and the lack of damage classification studies in this field. With the ability to expand artificial intelligence algorithms and the low cost of developing algorithms, it can be expected that these algorithms will widely help doctors in diagnosis in the near future.

Keywords: artificial intelligence, deep learning, machine learning, knee injury, ACL, meniscus tear.

How virtual reality laughter therapy affects the severity of depressive disorders: a narrative review

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Introduction: Major depressive disorder is one of the most common psychiatric diseases. Laughter therapy, as a non-pharmacological and alternative treatment method, has a positive effect on mental health and psychiatric diseases. It has been challenging to find empirical data on the use of humor with clients who are depressed or nervous in a clinical context. This review study was conducted with the aim of determining the effect of laughter therapy using virtual reality on the severity of depressive symptoms in patients with major depressive disorder.

Materials and methods: To access the studies, the researcher searched the Google Scholar search engine and international information databases such as PubMed, ScienceDirect and Iranian databases such as SID and Magrian in the period from 2010 to 2022 with keywords including laughter therapy, Major depressive disorder, Virtual reality. The criteria for entering the study included these items: a) articles in English and Persian. b) participants were adults (18–65 years); c) meta-analyses and systematic reviews; randomized controlled trials; observational studies with a primary focus on humor as a therapeutic intervention; case studies with a primary focus on humor as a therapeutic intervention; cross-sectional studies that include humor as at least one aspect of the client's or therapist's personality; and correlational studies that link humor to one or more factors that are important for therapeutic interventions. From the 44 articles searched, 19 articles related to the article title were selected.

Results: Improvements in severity of depressive symptoms were found at post-treatment. At follow-up, depressive symptoms had decreased. These improvements were maintained at follow-up. No increase was observed in social activity. According to these findings, a sense of humor is correlated with fewer symptoms of depression. Although it can make people feel better, laughter cannot cure illness. The findings also support an earlier finding that empirical studies in the field use a variety of population- and design-based approaches to translate the concept of humor into quantifiable observations. The methodological limitations of the research to date call for caution when interpreting the outcomes.

Conclusion: The laughter therapy technique based on reality therapy can lead to a reduction in the severity of depression symptoms, which is recommended to be used in the treatment of patients with major depressive disorder along with other treatment methods. Some authors support a multidisciplinary strategy to carry out future research on humor in psychotherapy. We advise conducting studies using reliable methodology and concentrating initially on the many elements of humor.

Keywords: laughter therapy, Major depressive disorder, Virtual reality

How virtual reality laughter therapy affects the severity of depressive disorders: a narrative review

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Keywords: laughter therapy, Major depressive disorder, Virtual reality

The effect of online peer feedback on learning outcome and academic motivation

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Introduction: Feedback, one of the main components of learning-oriented evaluation, has received special attention in recent decades. However, there are controversial statements regarding the priority and importance of peer feedback. Therefore, the present study was conducted with the aim of the effect of online peer feedback on the learning outcome and academic motivation of Medical students.

Methods: This study was a semi-experimental intervention with a pre-test-post-test design. The research community in this study was all medical students of Shiraz University of Medical Sciences. The studied samples (60 students) were randomly divided into intervention and control groups. To measure the learning outcome, a researcher-made instrument was used, and Harter's standard academic motivation questionnaire was used for academic motivation. The type of intervention was online peer assessment and feedback. The pre-test and post-test were completed by the participants through the link sent via WhatsApp. Data analysis was done using SPSS version 25 software.

Results: The results showed that the difference in the learning outcome variable before online feedback and after online feedback according to the value of T statistic is higher than ($<\pm1.96$) and the P value is lower than the significance level of 0.01 (<0.01) ($T=<12.21\pm1.96$, $P=0.001$). The results showed that the difference between the pre-test and the post-test of the academic motivation variable was significant according to the value of the T statistic less than ($<\pm1.96$) and the P value is lower than the significance level of 0.01 (<0.01) ($T = 1.43 \pm 1.96$, $P = 0.02$).

Conclusion: online peer feedback is effective on the learning outcome and academic motivation of medical students.

Keywords: peer feedback, online, learning outcome, academic motivation, student

The effects of education on spirituality through virtual social media on life satisfaction among gastrointestinal cancer patients

in patients with major depressive disorder: a narrative review

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Introduction: Gastrointestinal cancers are one of the most important health problems in the world and one of the most common cancers in different societies, and their incidence and mortality rates are increasing in many countries. Cancer disease is known as one of the most important obstacles to increasing life expectancy and dissatisfaction with life in the world. Education based on spirituality has been the focus of researchers in the psychological support of people with cancer. Therefore, the purpose of this study was to determine the effect of the effects of education on spirituality through virtual social media on life satisfaction among gastrointestinal cancer patients

Method: The current research was a semi-experimental study. The research environment was Namazi Hospital (intervention group) and Shahid Faqihi Hospital (control group) in Shiraz city. Two groups of 60 people were selected non-randomly and based on the information of the medical records unit of the hospital from April 1401 to July 1401 among the people suffering from gastrointestinal cancer who were referred to these centers. The intervention group received virtual spirituality training during 6 sessions Twice a week for three weeks, they were contacted through the WhatsApp social network, and the control group was under the usual care of the medical center. The level of life satisfaction of the participants in the study before and one month after the intervention was measured and recorded using the life satisfaction scale of Diener et al. (1985). The mean score of life satisfaction was recorded and compared using SPSS-16 software.

Results: The results showed that the two groups had significant differences before the intervention in terms of demographic characteristics and disease characteristics. The Mean score of life satisfaction in the test group before the intervention was 14.16±4.18 and after the intervention was 17.83±3.19, which is statistically significant (P<0.001). In the control group, the Mean score of life satisfaction score showed a significant increase (P < 0.001). The comparison of the changes in the Mean score of life satisfaction in both the test and control groups shows that the spiritual educational intervention had a greater effect on the intervention group (P < 0.001), while these changes were not significant in the control group (P < 0.05).

Conclusion: It seems that the use of spirituality in the education of people with gastrointestinal cancer has been associated with improving the level of life satisfaction, and its use as an educational intervention in the formulation of palliative care guidelines for people with gastrointestinal cancer and support their spirituality is confirmed.

Keywords: Social media Spiritual teaching, life satisfaction, Gastrointestinal cancer

A Review on Various Machine Learning Algorithms for Classification of Urine Sediments

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ABSTRACT

Background and aims: Analyzing urine can reveal the presence of a variety of issues and illnesses in the human body. It is a well-known fact that patients' urine is collected in order to diagnose a variety of illnesses, particularly diabetes, metabolic, urinary, and kidney diseases. Also, information concerning the presence of infection in the urine is provided by urine culture. Traditionally, sediment swabs are examined under a microscope, and the particles are counted and sorted manually. This can be a time- consuming and labor-intensive process. It also fails to meet the standards of today's clinics and is subject to human error and observer skill. An automated method that can assess and quantify urine sample images would be very helpful to clinicians and patients.

Method: We searched Science Direct and Google Scholar for papers on machine learning studies for urine sediment classification published between January 1, 2018, and March 31, 2023. We summarized them into categories based on the following axes: year of publication, data types, sample size, algorithm used, preprocessing methods, types of urine sediments, and model performance. We selected 38 articles in total for the comparison among different types of machine learning algorithms for urine sediment classification.

Results: These literatures reviewed the several machine learning algorithms used for automatic recognition of urine particles, including erythrocytes, cylinders, leukocytes, crystals, bacteria, yeast, sperm, casts, epithelial cells, bacteria, RBC, WBC, etc. from urine sediment microscopic images. Based on the literature review, it turned out that SVM, AdaBoost, KNN, different CNN architectures, DFPN, and the Markov model were employed in urine sediment classification. We found that the CNN algorithm (GoogLe-Net, ResNet, developed Alex-Net, LeNet-5, VGG-16, VGG-19, yolov3, R-CNN, Inception V3, Xception) is applied most frequently (in 33 studies). However, a deep learning model based on CNN's Inception V3 algorithm showed superior accuracy (0.994) comparatively for the detection of RBC, calcium oxalate, and bacteria in urine image samples.

Conclusion: This paper gives a thorough analysis of the relative effectiveness of various traditional machine learning and deep learning algorithms for classifying urine sediments. Particularly deep learning approaches require a larger number of training instances, which makes the process time-consuming. Researchers can use this crucial comparative performance data to help them choose the best machine learning algorithm for their project.

Keywords: Artificial intelligence, Urine sediment, Machine learning, Urine analysis, CNN, Automatic classification

Toward modeling Liver Fibrosis in Hepatitis Patients using soft computing techniques

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ABSTRACT

Background and aims: Globally 8 percent of people have the Hepatitis B or Hepatitis C virus. Diagnosis and treatment of this disease are guided by liver biopsies where a small amount of tissue is removed by a surgeon and examined by a pathologist to determine the fibrosis stage from F0 (no damage) to F4 (cirrhosis).

Biopsies are costly and carry some risks for the patient. Non-invasive techniques for determining the fibrosis stage have been developed and evaluated. Noninvasive approaches have utilized serum markers, imaging tests, and genetic studies. The accuracy of these non-invasive techniques has not achieved sufficient acceptance and so the invasive biopsy is still considered the gold standard. The current paper applies two soft computing techniques including artificial neural networks (ANN) and support vector machine (SVM) to the available dataset on 1385 Hepatitis patients.

Method: This paper investigates the ability of two different data-driven methods, artificial neural networks (ANN) and support vector machine (SVM) in predicting liver fibrosis based on 1385 Hepatitis C virus patients. Artificial neural networks are biologically inspired computational models constructed of many simple interconnected elements called neurons (processing elements) connected with coefficients (weights and biases) which constitute the neural structure. ANNs are capable of recognizing underlying relationships between input and output procedures. The foundations of Support Vector Machines (SVM) have been developed by Vapnik. SVM gained popularity due to many promising features such as better empirical performance. SVM is an approximate implementation of the method of structural risk minimization. This principle is based on the fact that the error rate of the learning machine on test data (i.e., the generalization error rate) is bounded by the sum of the training error rate and a term that depends on the Vapnik-Chervonenkis (VC) dimension.

Results: Different scenarios are decided by implementing linear regression and ANOVA methods. The available data includes 29 features. By application of stepwise regression and ANOVA, the most important features (i.e. gender, BMI, ALT36, HGB, and EPI) are selected for the modeling procedure. The results indicated the superiority of SVM over ANN in the prediction of liver fibrosis based on accuracy, specificity, and sensitivity. The accuracy, specificity, and sensitivity of the SVM model were 94.3%, 95.4%, and 93.8%, respectively.

Conclusion: Two reliable and efficient data-driven models based on ANN and SVM were developed for accurate classification of baseline histological staging (i.e., portal fibrosis, few septa, many septa, and cirrhosis). The results of the current study can be helpful for the treatment of liver fibrosis.

Keywords: artificial neural networks, support vector machine, liver fibrosis, classification

Analyzing Science and Innovation-Related Indicators and Their Relationship with COVID-19 Pandemic Control Using Statistical and Machine Learning Experiments

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Background and aims: The COVID-19 outbreak was one of many global illnesses and was declared a pandemic by the World Health Organization. When the pandemic was announced, scientific research and innovations were swiftly proposed, created, and carried out worldwide to manage the disease. Nevertheless, it is unclear whether these scientific research and innovations were effective in helping countries control the COVID-19 pandemic. The purpose of this article is to address this question.

Method: This study aims to determine if the level of science and innovation in a country, measured by H-index and GII_Score, can predict the effectiveness of controlling the COVID-19 pandemic. Data were collected from 102 countries in 2020 and 2021, including COVID-19 death and case numbers, test ratios, case fatality ratio (CFR), and test positivity ratio (TPR). H index and GII_Score were obtained in 2020 using SCImago and WIPO. The data was analyzed using Python 3.9.

Results: The study's results showed a significant and decreasing correlation between GII_Score and TPR (P-value < 0.001, r=-0.37), as well as GII_Score and CFR (P-value < 0.001, r=-0.40). Additionally, there was a significant and decreasing correlation between H-index and TPR (P-value < 0.016, r=-0.23), as well as H-index and CFR (P-value < 0.005, r=-0.27). Moreover, the K-means algorithm categorized countries into three clusters, and the study obtained the average H-index, GII_Score, TPR, and CFR values for each cluster.

Conclusion: This study examined the relationship between innovation and scientific indicators of countries and COVID-19 control. The study found that countries with higher GII_Score and H-index in 2020 had better COVID-19 control in 2021. The K-means algorithm clustered countries based on innovation and scientific indicators, and countries in the group with the highest indicators had lower CFR and TPR. The study suggests investing in innovation and scientific research can help control pandemics, and governments should have a coherent plan to guide innovation toward crisis resolution.

The interaction of artificial intelligence tools and development of Parkinson's drugs: a new glance to near future

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Background and aims: Parkinson (PD) is the second-most common neurodegenerative disease after Alzheimer's disease that is a degenerative condition of the brain associated with motor symptoms (slow movement, tremor, rigidity and imbalance) and other complications including cognitive impairment, mental health disorders, sleep disorders and pain and sensory disturbances. Currently, PD has no cure and no early diagnostics methods exist. Mitochondrial dysfunction is presented in the early stages of PD, and it is considered an important pathophysiology component. The supreme point is that reinforcing a positive compound effect in mitochondrial can occur using the machine learning model, confirming the platforms for mitochondria-based drug target interaction (DTI).

Method: A comprehensive systematic search by using the terms such as "Artificial Intelligence", "machine learning", "Parkinson's disease", "Drug target interaction" as keywords, was conducted in four Online Databases: Web of Science, Scopus, PubMed, and Embase up to February 2023. Also, for screening and data extraction, some applications such as "Rayyan" were used. Reviews and studies that did not use artificial intelligence for Parkinson's disease DTI were excluded. Studies that met our inclusion criteria were then critically appraised by two authors independently.

Results: We retrieved 950 relevant publications from online databases. After a thorough examination of the titles and abstracts and the removal of duplicate publications (n=73), 505 studies were eliminated. In 38 cases of disagreement between two authors, the opinion of the third author was the determiner. The full texts of ninety- four papers were reviewed. Eventually, thirteen studies met our inclusion criteria and included in our study. About 62 percent of studies used ML (machine learning) algorithm to improve drug target interaction and modeling of new drug targets for patients with PD. In some studies, the QSAR model developed with artificial intelligence was used to identify drug targets.

Conclusion: Based on the results of the studies, artificial intelligence approach can be useful in identifying drug targets and developing them. A logical target in the drug treatment of Parkinson's disease is leucine-rich repeat kinase 2 (LRRK2). It is also related to the treatment or reduction of symptoms. Structure-based and ligand-based approaches can be used. Using artificial intelligence, QSAR models have been developed with the aim of using them for pharmaceutical purposes. This model can be used in virtual screening to identify inhibitory proteins. There are several software available for QSAR development that are either commercial or free to use.

Keywords: Parkinson, Drug development, Artificial Intelligence, Drug target interaction, Deep Learning

A Scoping Review of Clinical Diagnosis, Classification and Treatment of Patients in Huntington's Disease: An Artificial Intelligence Approach

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Background and aims: Huntington's disease (HD) is a hereditary disorder arising from neurodegeneration individualized by chorea, dystonia, impaired gait and dementia. Degeneration occurs when there is mutation of HTT gene which encodes the protein is called Huntingtin. Also, there is considerable domain of genes associated with Huntington's disease in addition to the mentioned one. Nowadays, numerous methods are utilized to detect these genes, prominent examples are Artificial Intelligence methods. We aim to clarify AI-based impact on delineation of Huntington's disease.

Method: Four databases including PubMed, Scopus, WOS and Embase were searched according to terms related to diverse algorithms of Artificial Intelligence. All aspects of Machine Learning in detecting, classification and analyzing of genetic factors and also, verification of previous studies were considered in search. 165 results for PubMed, 159 for WOS, 347 for Scopus, 490 for Embase and then 1161 from all databases were found. After duplication, 707 articles left for screening. Three independent reviewers screened based on title and abstract to elucidate if the full text is related or not. Studies, in which the interaction of three features above completely were presented, included and then review, animal and nonoriginal studies were excluded. Finally, we did hand-searching to recognize missing studies in database searches.

Results: The paper search obtained 1161 studies. After screening titles and abstracts, full-text screening where done for 87 studies, then 52 studies yielded based on the eligibility criteria. 22 studies exclusively utilized single AI technique to detect Huntington's disease and it's related aspects, 17 used for classification, 9 for predict and two used for treatment. Plenty of Machine Learning algorithms were used, artificial neural networks for 6 and support vector machine for 8 studies, individually were used. Also, researchers used multiple Machine Learning methods in 3 studies. Twenty of 52 included papers conforming to Machine Learning were investigating genetic factors on Huntington's disease. In two of 12, studies were directly following the extraction of genes associated with various traits of disease. In the first one, BioDCV system using support vector machine identifies top-ranking genes, finally two ARFGEF2 and GOLGA8G genes were chosen as an up-regulated from 20 recognized genes. On the other hand, 4 algorithms utilized including decision tree (accuracy=90.79%) noticed EPHX1, ALDH1A1, and GLI1 (EPHX1 as the most efficient), Rule induction (accuracy=89.49%) identified EPHX1, OTP, and ITPKB (OTP as the most efficient), Random forest (accuracy=90.45%) identified 49 genes (KLHDC5 as the most efficient) and Generalized linear model)accuracy=97.46%) identified 53 genes(OTP as the most efficient one).

Conclusion: This study provides generalized evaluation of AI function on detection, classification, treatment and above all, interaction of Al and diagnostic or therapeutic systems associated with Huntington's disease. Due to the hereditary origin and declining executive function in Huntington, improving genetic tests and accelerating the therapy is fundamental in patients, thus AI can lead to discriminative performance to achieve these goals.

Keywords: Huntington's Disease, Artificial Intelligence, Genetics, Classification, Diagnosis, Scoping Review

Schizophrenia: Artificial Intelligence approach and Drug Development

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Background and aims: Schizophrenia (SZ) causes psychosis and is associated with considerable disability and may affect all areas of life functioning. G-protein-coupled receptors (GPCRs), also known as 7-transmembrane receptors, are the single largest class of drug targets. Consequently, a large number of preclinical assays having GPCRs as molecular targets have been released to public sources like the Chemical European Molecular Biology Laboratory (ChEMBL) database. One of the aims of this study is to develop a computational model with artificial intelligence (AI) able to predict new GPCRs targeting drugs taking into consideration multiple conditions of the assay. Some receptors are altered in SZ and represent drug targets for antipsychotic therapeutic activity by using AI.

Method: A comprehensive systematic search using the terms such as "Machine Learning", "Schizophrenia", "Artificial Intelligence", "Drug development" and "Drug target" as keywords, was conducted in four Online Databases: PubMed, Web of Science, Embase and Scopus up to January 2023. Also, for screening and data extraction some applications such as "Rayyan" and "Microsoft Excel (2019)" were used. All research that shows SZ drug development and way of improvement and with using AI models or machine learning (ML) were included. Reviews and studies that had not used AI or drug development to improve SZ were excluded. Then studies that met our study criteria were critically appraised by two authors independently.

Results: We retrieved 684 relevant publications from online databases. After a thorough inspection of abstracts and titles of research and the removal of duplicate publications (n=32), 445 studies were eliminated. In 72 cases of disagreement between two authors, the opinion of the third author was the determiner. Full texts of ninety-seven papers were reviewed. At last, eleven studies met our inclusion criteria and were included in our study. About 64 percent of studies used ML and Support Vector Machine (SVM) algorithms to improve drug development and modeling of new drug targets for patients with SZ.

Conclusion: Following the results of studies, using AI for the improvement of drug development and finding new ways of designing new drugs can be the most effective. AI does this by pinpointing GPCRs coupled receptors that are altered during SZ. In addition, drug development with AI can be faster and have a lower cost. Despite this, conducting new studies with small sample sizes is one of the limitations of such studies.

Keywords: Schizophrenia (SZ), Artificial Intelligence (AI), Drug Development, Drug Target Interaction (DTI)

Computer vision application in diagnosis of the need for apicoectomy surgery

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Background and aim: Diagnosing the need for apicoectomy surgery with manual methods is often costly and time-consuming. When the infection progresses and reaches the end of the tooth root and root-end opening, endodontists are forced to rift the gum and remove the infection from the end of the tooth root. This procedure is called apicoectomy surgery. If the infection progresses are ignored there will be consequences which include possible tooth loss, jaw, brain and other organs infection. Therefore, early diagnosis of the need for this surgery is essential. This article aims to present and report the performance of a machine learning model that diagnoses the need for apicoectomy surgery in panoramic images by using computer vision techniques and deep neural networks.

Method: This model is a deep neural network that learns to fulfill several related tasks simultaneously with the help of self-supervised learning techniques, this leads to extraction of meaningful features. Therefore, the proposed model can diagnose the need for surgery with high accuracy. The data used to train the model consists of orthopantomogram (OPG) images taken from patients' jaws and collected from clinics and labeled by skilled endodontists. The dataset contains 799 samples in total with positive or negative labels. The samples have widths and heights of 700 pixels. The data were fed to the model after augmentation, segmenting regions of interest, and preprocessing. In this study we used F-1 score as an evaluation metric of methods. Moreover, K-fold cross-validation technique was used as an assessing method.

Results: The proposed model obtained a mean F-1 score of 86% in cross-validation. This result suggests that the model has reached desirable accuracy on new samples.

Conclusion: Misdiagnosis can endanger the patient's health in addition to incurring extra costs and irreversible damages. The study results demonstrate that the deep learning system shows high accuracy in the diagnosis of the need for apicoectomy surgery. Additionally, unlike the previous methods, which endodontists required more information regarding the patient besides the radiographic image to make their decision, this research shows that proposed model has made it possible to handle this task with only one image of the patient's jaw. In the light of these improvements, this model can operate as a doctor's assistant in clinics, leading to increased accuracy and faster diagnosis of the need for this surgery. Among the works to improve the proposed method, we mention training the model on a larger volume of data and assigning more parallel tasks to extract more meaningful features.

Keywords: Medical image processing, Computer vision, Dentistry, Deep learning, Self-supervised learning, Apicoectomy

Predicting, Detecting, and Monitoring Cognitive Impairments using Artificial Intelligence: A Systematic Scoping Review

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Background and aims: Due to an aging population and changing lifestyles, cognitive decline is a controversial research topic. Also, advances in artificial intelligence (AI) are being used to improve healthcare, including monitoring and diagnosing cognitive impairment. In this study, we decided to explore the global use of AI for monitoring and diagnosing cognitive disorders through a scoping systematic review.

Method: Using the PRISMA guidelines, we searched comprehensively in PubMed without language or time restrictions. Two researchers independently reviewed the articles based on titles and abstracts and finally extracted relevant data from the included articles.

Results: Initial records identified through PubMed searching included 355 articles. Accordingly, 169 met the eligibility criteria and were included in data extraction.129 studies (76%) had been performed in the three last years. The USA and South Korea had the most studies (17.6% and 9.5%, respectively).

Mild cognitive impairments and Alzheimer's were the top diseases surveyed (both at 55%). Apart from the significant volume of studies that focused on neurological and mental diseases, four studies dealt with cognitive disorders of internal diseases (Diabetes Mellitus and breast cancer (two studies for each topic). Among studies, assessment of six cognitive domains varied including, memory: 135 (80%), attention: 124 (73%), language: 121 (72%), executive function: 65 (38%), perceptual-motor function: 49 (29%), and social cognition: 12 (7%). Evaluation of awareness and behavior were assessed in 100 (59%) and 25 (15%) studies, respectively.99 (59%) studies were conducted with the purpose of diagnosis, while 35 (21%) studies were directed for prediction, and 34 (20%) studies were conducted for monitoring or classification. The most used assessment questionnaire for AI data were A Mini-Mental State Examination (MMSE) (106), Montreal Cognitive Assessment (MoCA) (41), and Clinical Dementia Rating Scale (40). However, some neuroimaging tools were commonly used, including magnetic resonance image (MRI) and positron emission tomography (PET) (91 and 24 studies, respectively). Among the AI approaches, Support Vector Machine (86), one of the neural network methods (51), Random Survival Forest (53), and Logistic Regression (41) were used more than other algorithms. Cross-validation of AI was done via five methods including, K-fold (123), Leave-one-out (16), Stratified K-fold (3), Monte Carlo (2), and Holdout (1).

Conclusion: AI-based prediction, diagnosis, and monitoring of cognitive impairment is a growing field that has received more attention in recent years. AI can potentially assist both neuropsychological and internal diseases with cognitive impairment. Combining various AI methods yields better results, with Support Vector Machine, Random Survival Forest, and Logistic Regression commonly used among machine learning algorithms. In general, the more complex models combined with multimodal data (clinical, cognitive, and neuroimaging) achieved the best performance. It is critical to resolving the ambiguities in future studies.

Keywords: Cognitive Impairments, Artificial Intelligence, Machine Learning

A systematic review and meta-analysis of Machine Learning Models for early detection of Coronary Heart Disease Using Nutritional data

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Background and aims: According to Who statistics, heart disease is the first cause of mortality in the world. Coronary heart disease (CHD) is the most common type of heart disease, Nearly 7.2% of adults have this disease. The diagnosis of this disease usually happens late and when the disease reaches its acute stages and complications such as appear pain and discomfort in the chest. Therefore, early diagnosis of this disease can greatly reduce the occurrence of problems such as heart attack and death. Today, there are solutions based on diagnosis and prevention using dietary data and artificial intelligence that can do this in a short period of time.

Method: Keywords "diet", "nutritional science", "coronary heart diseases", "artificial intelligence" and "pattern recognition" was used for a comprehensive systematic search in 3 databases PubMed, Scopus, Web of Science and the results were up to March 2023 were considered. Two reviewers reviewed the results independently and separately. Studies that used methods other than artificial intelligence to diagnose and prevent coronary artery disease were excluded. Finally, studies that met the necessary inclusion criteria were critically appraised by two authors separately. "Rayyan" platform was used for screening and Microsoft Excel 2019 software was used to extract data related to diet and artificial intelligence diagnostic solutions.

Results: At first, 437 related publications collected from online databases were retrieved, screening of titles and abstracts was performed, and duplicate publications(n=49), and 388 were removed. The full texts of 77 articles were reviewed. Finally, the studies that met the desired inclusion criteria were included in the 6 studies.

The algorithm "Logistic regression" was the most used in the field of diagnosis of coronary artery diseases related to nutrition and it was used in 4 studies. The total number of data included in the studies from healthy patients was 37070. The ultimate accuracy which was obtained from these studies was 0.882.

Conclusion: Since heart diseases have a significant impact on the economic conditions of the country, the use of artificial intelligence methods, which is a non-invasive method, is a more practical solution and separates many nutritional factors and starts diagnosis and prevention earlier. But the accuracy of the studies shows that more work should be done in this field to reach the desired accuracy for high-certainty diagnosis.

Keywords: Coronary Heart Diseases (CHD), Artificial Intelligence, Nutritional Sciences, detection

Deep learning for the classification of Attention-deficit/hyperactivity disorder (ADHD) using neuroimaging data: A Systematic review

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Background and aims: Attention deficit hyperactivity disorder (ADHD) is a disease that is often observed in young children. ADHD diagnosis includes psychological tests and depends on ratings of behavioral symptoms, which can be unreliable. Thus, an objective diagnostic tool based on non-invasive imaging can improve the understanding and diagnosis of ADHD. This study aims to classify brain images using Deep learning to diagnose ADHD.

Method: Three electric databases (PubMed, Scopus, and Web of Science) were searched for records in English from inception to April 21, 2022. Searches were performed using combinations of the following keywords: "ADHD" AND "Deep Learning"; Search didn't Search the above words and any synonyms included in the strategy; Original studies that classified ADHD by neuroimaging and deep leering methods were included. The Newcastle–Ottawa quality assessment scale was used to assess the quality of the included studies.

Results: The systematic review on deep learning for the classification of Attention-deficit/hyperactivity disorder (ADHD) using neuroimaging data included a total of 21 studies for qualitative analysis. Among these studies, the majority (N=18) utilized the widely used ADHD-200 dataset for their analyses. Furthermore, 17 studies incorporated functional magnetic resonance imaging (fMRI) as input in their deep learning models. Notably, 12 studies focused on the classification of ADHD subtypes using various deep learning techniques. The results revealed that for bivariate classification of ADHD, the maximum accuracy achieved in the included studies was approximately 90%. These findings highlight the potential of deep learning approaches for accurate classification of ADHD using neuroimaging data, although further research with larger sample sizes and standardized methodologies is warranted for conclusive results.

Conclusion: The findings indicate that deep learning is a promising predictor for the diagnosis of depression. These methods have shown potential in outperforming classical approaches, such as support vector machines, logistic regression, and other methods used in previous studies.

Keywords: Deep learning, Artificial Intelligence, Neuroimaging, Schizophrenia, Psychiatry, Machine learning

Brain tumor diagnosis and prediction using artificial intelligence

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Background & aims: Advances in technology have been able to affect all aspects of human life, especially in the field of medical sciences. Advances in medical imaging techniques, artificial intelligence, machine learning, and computer vision offer new opportunities for building intelligent decision support tools. Due to the expensive and invasive nature of cancer diagnosis, the need for cost-effective and non-invasive methods has increased. This study is an overview of the diagnosis and prediction of one of the most common and deadly diseases, brain tumor, using machine learning and deep learning methods.

Method: We obtained this title by searching the scientific database of Pubmed using the keywords brain tumor, MRI, GAN, central nervous system cancer, CT scan, deep learning, machine learning and artificial intelligence. References and related articles were cited.

Results: The use of artificial intelligence reduces the percentage of errors compared to human diagnosis. Also, compared to machine learning, deep learning provides better performance for diagnosis and subdivision.

Conclusion: Cancer grading is an important aspect of targeted therapy. In this article, we examined the application of artificial intelligence in early tumor diagnosis, classification of prognosis, metastasis, prediction, challenges and potential of these techniques. Given that magnetic resonance imaging (MRI) is the most common method for diagnosing brain tumors. In this article, we have made efforts to apply different types of deep learning methods on MRI data and identified the challenges in the field in search of potential future paths. One of the branches of deep learning that has been successful in image processing is CNN. In this review, we have also worked on different architectures of CNN.

Keywords: MRI, brain tumor , Diagnosis , artificial intelligence, Deep learning, Machine learning

The Role of Multimodal Machine Learning in Alzheimer's Disease: A Review

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Background and aims: Alzheimer's disease is a progressive brain disorder that affects millions of people worldwide. It is the most common cause of dementia and is characterized by a decline in cognitive function, memory loss, and behavioral changes. Despite extensive research efforts, Alzheimer's disease remains incurable, making early detection and diagnosis crucial for effective treatment and management of the disease. Machine learning models have shown great potential in the accurate diagnosis and prediction of brain disorders, including Alzheimer's disease. However, the accuracy of these models can be further improved by using multimodal data, which combines multiple types of data such as medical images, clinical assessments, and genetic information. This review aims to summarize the state-of-the-art research on Alzheimer's disease that utilizes machine learning techniques with multimodal medical data.

Method: The following search strategy has been used in PubMed, Web Of Science(WOS), and IEEE Xplore databases:((neuroimaging) OR (CT scan) OR (PET scan) OR (MRI) OR (radiology) OR (Electroencephalogram)) AND (multimodal*) AND ((“deep learning”) OR (“Computer vision”) OR (“Neural Network*”) OR (“machine learning”) OR (“artificial intelligence”)) AND (Alzheimer's disease). To conduct our literature review, we included all the words in the title/abstract as part of our search strategy and searched PubMed using relevant MeSH terms. The study excluded duplicated and non-journal articles. Title and abstract screening resulted in the exclusion of review articles and irrelevant publications. During the full-text screening, duplicated articles, irrelevant publications, and those lacking full-text availability were also excluded.

Results: Different studies utilized different combinations of data modalities such as structural MRI (sMRI), resting-state functional MRI (rs-fMRI), different types of Positron Emission Tomography(PET) such as amyloid-PET, genetic markers such as single-nucleotide polymorphisms (SNPs), cognitive scores, and CSF biomarkers. Additionally, different machine learning models such as support vector machines(SVMs), convolutional neural networks(CNNs), recurrent neural networks(RNNs), and random forests have been deployed. Studies comparing the outcomes of utilizing multimodal data and unimodal data have demonstrated superior performance when utilizing multimodal data. Additionally, using the Alzheimer's Disease Neuroimaging Initiative(ADNI) database in most studies under review facilitated direct comparisons of different models' performance, aiding in identifying the optimal approach.

Conclusion: This review highlights the important role of multimodal machine learning in the early detection and diagnosis of Alzheimer's disease. An evaluation was conducted on the performance of the models recommended in the reviewed literature. Additionally, the assessment encompassed the analysis of diverse data modalities utilized, the type of machine learning model implemented, and the evaluation of the utilized datasets. In conclusion, the application of multimodal machine learning presents a promising opportunity for revolutionizing the timely detection and diagnosis of Alzheimer's disease, signifying a hopeful avenue for future research in this field.

Keywords: Alzheimer's disease, multimodal, machine learning, neuroimaging

The use of Machine Learning models in the diagnosis of Parkinson's Disease with fMRI data: a Systematic Review and Meta-Analysis

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Background and aims: Parkinson's Disease (PD) is a commonly occurring neurodegenerative disorder worldwide, affecting approximately 1% of individuals over the age of 60. Early detection of PD is crucial in managing symptoms and improving the quality of life for patients. Resting-state functional magnetic resonance imaging (rs-fMRI) has shown to be widely accepted for detecting inherent brain function changes during the early stages, enabling early diagnosis before structural changes emerge. The use of Artificial Intelligence (AI) has proven successful in diagnosing other conditions, such as breast cancer. Therefore, we can expect more accurate detection of PD using AI to improve diagnostic outcomes.

Method: A comprehensive systematic search using relevant keywords such as "fMRI", "Artificial Intelligence", "machine learning", and "Parkinson's disease" was conducted on four Major Online Databases; PubMed, Scopus, Web of Science, and Embase up to March 2023. The search of the database encompassed not only published literature but also grey literature as well as manual search. After the initial search, two independent reviewers screened the retrieved publications, ensuring that all studies that followed the criterion of employing Artificial Intelligence (AI) models or machine learning algorithms for predicting or diagnosing Parkinson's Disease with the use of fMRI data were included. Subsequently, the studies that met the inclusion criteria underwent a critical appraisal by two authors independently. The quality of studies was evaluated according to the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) checklist. Furthermore, for data extraction purposes, Microsoft Office Excel 2021 software was employed to collect information such as machine learning algorithms, the accuracy of models, and fMRI Image properties. Pooled Accuracy for detected PD was calculated using CMA v.3.7 software and a p-value less than 0.05 was considered a significant level.

Results: We retrieved 1122 relevant studies from online databases. After a thorough examination of the titles and abstracts and the removal of duplicate publications(n=277), 710 studies were eliminated. In 25 cases of disagreement between two authors, the opinion of the third author was the determiner. The full texts of 140 papers were reviewed. Eventually, 13 studies met our inclusion criteria and were included in this study. All of the studies have different levels of bias. However, regarding the type of study design of included articles are considered as low risk. Approximately 77% of studies utilized the SVM (Support Vector Machine) algorithm for differentiating patients with Parkinson's disease from healthy controls. The overall accuracy was determined to be 83.8% using the random effects model (accuracy = 0.838, 95% CI = 0.788-0.878, p-value < 0.001), indicating a significant predictive power.

Conclusion: Machine Learning can be a useful tool in early PD diagnosis and could also aid in prognosis orientation at lower costs. Nevertheless, the possibility of overfitting in machine learning algorithms means that more research is necessary to determine the full potential of this approach. While machine learning can be a valuable tool in early PD diagnosis, the limited number of cases studied in current literature must be taken into consideration.

Additionally, since fMRI data contains a vast amount of information, overfitting remains a significant concern. However, the SVM algorithm's widespread use in these studies is due to its resilience to overfitting.

Keywords: Parkinson's Disease (PD), Machine Learning (ML), Functional Magnetic Resonance Imaging(fMRI), Diagnosis

Visible-Near-Infrared Spectroscopy System for Non-Invasive Blood Glucose Monitoring

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Background and aims: In recent years, diabetes is one of the most important causes of death in the world. The main reason is an unhealthy lifestyle. In this disease, blood glucose concentration increases greatly, which is an important indicator in the diagnosis of diabetes. Preferably, in order to prevent diabetes or control it, while being safe from its complications, the blood glucose level should be checked regularly. So far, various researches have been conducted and many products have been distributed to the world market, which is the most reliable method of using invasive blood glucose devices, but usually this method is associated with pain and discomfort in people. Also, this method increases the possibility of contracting infectious diseases. In the last few decades, researchers have sought to compare different methods of measuring blood glucose with non-invasive methods. For this purpose various electrochemical sensors have been made, But these sensors have problems such as expensive materials, sensor instability and lack of calibration. As a result, they are not a good substitute for invasive blood sugar testing devices. In fact, with the aim of improving the conditions, we have designed a device that regularly monitors blood glucose levels using a visible-near infrared optical sensor.

Method: In this system, the waves used are in the range of near-infrared and visible waves with a specific wavelength, which have the highest amount of blood glucose absorption in this wavelength. According to Beer-Lambert's law,the intensity of the light passing through the ear tissue is measured and amplified in the circuit designed in the system. Then the data (blood glucose concentration) is transferred to the computer by USART serial, and based on the voltage change created in the hardware, and as a result, the blood glucose level is calculated in the LabVIEW software based on the Beer-Lambert's law. In calculating blood glucose, parameters such as age, gender and skin color are used to measure the thickness of the ear tissue. In this project,the blood glucose concentration of healthy people and people with diabetes was compared. To compare the results of this research the specified tests were performed with the mentioned two non-invasive devices and the other invasive, Care Sense N(It has FDA, ADA, CE standards)device.

Results: One of the general results in this experiment is the comparison and measurement of the blood concentration of people with two invasive and non-invasive devices. This test was taken from Asian people(10women and 10men in the age range of 20-50 years).Each person has two aggressive and non-aggressive blood concentration numbers. The average error percentage measured in the non-invasive device is 12%.

Conclusion: Optical detection technology is more popular than other detection technology that, near-infrared spectroscopy has more potential for commercialization and general use in society due to its cheapness and accuracy.

Keywords: diabetes, spectroscopy near-infrared, non-invasive blood glucose monitoring, glucose concentration.

Presenting a predictive model for the death of COVID-19 patients based on the machine learning method using HRCT images

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Introduction: The epidemic of the Covid-19 disease and its impact on the health of people all over the world has caused serious concern for international policy-making organizations. The spread of this disease has caused the lack of medical equipment, the exhaustion of the treatment staff and the lowering of the quality of life. The aim of this study was to provide an algorithm to predict the death of hospitalized patients with covid-19 using machine learning methods.

Implementation method: This study was conducted on 581 inpatients with covid-19 hospitalized in Qaim and Imam Reza hospitals of Mashhad University of Medical Sciences. HRCT images, demographic characteristics, underlying diseases, laboratory results of patients were entered into the model as predictor variables. Using the pulmonary toolkit package of MATLAB software, values related to lung tissue and size were obtained. In the machine learning model, the Chi2 feature selection algorithm was used to select the significant variables, and finally, using the AdaBoost method, which is a subset of the decision tree, the important variables for predicting the death of covid-19 in the order of lymphocyte variables, CRP, age, average lung density, percentage Lung tissue, RBC cancer, D-DIMER and emphysema were obtained. The area under the ROC curve was 0.96.

Conclusion: Many models based on machine learning algorithms have been used to predict the death of covid-19. The present study can be used as a decision support system for the treatment of covid-19 patients.

Keywords: machine learning, covid-19, HRCT images

Artificial Intelligence for Improving the Proactive Intelligent Safety of Pedestrians

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Background and aims: Road traffic injuries are the main threat to public health and a serious cause of concern across the world, especially in low and high-income countries. Pedestrian injuries and fatalities, as vulnerable road users, have increased nearly every year. Recently, simultaneously with increased urbanization, Artificial Intelligence (AI) opened up new opportunities for intelligent traffic safety and has been widely used in order to deal with road traffic injuries and deaths. The high vulnerability of pedestrians in road traffic crashes highlights the need to explore and implement effective interventions in the realm of AI to protect pedestrians. The aim of this study was to study the applications of AI for improving pedestrians' safety.

Method: This study has been done according to Arkesy and O'Malley's framework according to a review of related literature from January 2000 to February 2023. Six main steps were conducted in this study as follows: identifying the research question, identifying relevant studies, study selection/screening, charting the data, collecting, summarizing, and reporting results, and providing practical recommendations. To explore the relevant studies, the databases of PubMed, Science Direct, Scopus, and Web of Science were searched using predefined keywords. Literature screening and selection were done according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses, which extended to Scoping Reviews (PRISMA-ScR). Endnote software edition 7 was used for data management.

Results: The findings of the literature review and screening showed that there are different approaches for the application of AI in order to deal with road traffic accidents and prevent pedestrian injuries and deaths. Applications of AI in preventing pedestrian accidents and improving their safety were in various fields, including the main categories of 1) pedestrian identification and detection systems using the Vehicle-to- Pedestrian (V2P) wireless communication technology, adaptability of autonomous vehicles (AVs) to communicate with pedestrians, and visibility related systems, 2) pedestrian accident prediction using the approaches like vehicle to everything (V2X) systems, and 3) pedestrian-assistance devices to help them by providing navigation and orientation information.

Conclusion: AI involves a variety of technologies that facilitates proactive intelligence in pedestrian safety and is widely used in this area. Some of these technologies such as Vehicle-to- Pedestrian communication systems, or autonomous vehicles can be used in limited countries because of the need for high technology and strong infrastructure. Although all countries should move towards using different approaches to pedestrian safety promotion, it seems the use of pedestrians-assistant devices is more suitable for countries with limited needed infrastructures. These findings can be useful for road safety policy-makers, technologists, and inventors in the design of systems and devices to promote pedestrian safety.

Keywords: artificial intelligence, public health, pedestrians, safety, proactive safety

Applications and Outcomes of Using Chatbots in Medical and Health Sciences, Feasible or Not: A Review of The Literature

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Background and aims: Chatbots are conversational agents with the ability to communicate with users using natural language in a way that simulates interaction with a real human. Chatbots are used in the medical field as a tool to facilitate access to information for patients and reduce the workload of doctors. The purpose of this study was to review the literatures to identify and classify the areas and outcomes of using chatbots in medical and health domains.

Method: This review of the published literatures was conducted by searching the "Web of Science" and"PubMed/Medline" databases to retrieved related articles from 2019 to 2023 years. Combination of different keywords include "chatbot", "chat-bot", "chat bot" AND "medic*", "health", "disease" was searched in selected databases. Studies investigated the implemented chatbots in medical and health domain were included. Review and systematic reviews, protocols, letters, non-English articles, and studies that only deal with propose and design the chatbot and have not been evaluated in real environment were excluded from the review. EndNote X9 is used to manage and code references in the conduct and reporting of the papers.

Results: In this study, 756 articles were retrieved, and after removing the unrelated and duplicated articles, 333articles were reviewed ultimately. We found that the most common use of chatbots in the medical and health domains are respectively include: mental disorder/ stress, anxiety, depression management and empathic (n=104, 31.23%), covid-19 (n=58, 17.42%), disease control and management (n=34, 10.21%), educational and learning (n=28, 8.41%), physical activity/ diet/ nutrition (n=19, 5.70%) and others domains (pregnancy/ parenting/ mother care, obesity/diabetes, recommendation, drug management, post-surgery care, self-management bots, genetic counseling, virtual physician and items developed for elderly care). The findings also showed
that, the reported outcomes of using chatbots in medical and health domains can be classified into different categories like technology effectiveness, acceptance, usability, feasibility, accuracy, user tendency and etc.

Conclusion: The use of chatbots in medical and health sciences is growing, and there is a tendency for using this technology for apply in different group like elderly, pregnant women, parents, physician, nurses, staff and other people. Also, according to results, the chatbot was a functional and innovative tool that could easily be integrated into usual medical practice and could help patients and professionals to tackle the health problems.

Keywords: chatbot, medical, health, disease

Implementation of national eLogbook AI-BI dashboards for residents' clinical performance assessment

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Background and aims: logbooks are purposeful assessment tools to record the learner's clinical performance. They facilitate self-reflection, self-assessment and helps medical residents to achieve their educational goals. In this study we aimed to design the logbook Artificial Intelligence-Business Intelligence (AI-BI) dashboard based on Integrated data from eLogbook systems in all universities of medical sciences with the aim of the national policy makers, residency program board members, academic managers to make intelligent decisions about the residents learning and assessing process.

Method: This applied cross sectional study was conducted by the Information Technology working group of the Education deputy at the Ministry of Health and Medical Education in 1401. Medical universities that hold medical residency programs were included to the study. the Universities that use the electronic logbook system were identified. The ETL technique was used to integrate logbook data from different universities sources into a national warehouse platform. To build intelligent dashboard at first thematic analysis was performed to explore the effective key performance indicators (KPI) for national monitoring of medical resident performance on logbooks. Based on the result of thematic analysis, a questionnaire was developed to conduct a Delphi method to rank and consensus the KPI metrics. Then we used OLAP engine to create cubes and process KPIs from logbooks data panel.

Results: 44 out of 67 medical universities hold residency programs. They use four eLogbook different products for the medical resident clinical assessment. The data in the following three years (2019 and 2023) from all universities databases integrated into a national eLogbook warehouse to build an AI-BI enabled dashboard. The results of the thematic analysis and the two Delphi round finally led to selection of seven main KPIs for analysis and reporting resident academic achievement at the national level. eLogbook dashboard was deployed based classification and deep learning algorithms and used to visualize multidimensional data about residents. deep learning algorithms predicted the resident academic achievement with an AUC of 0.82. Machine learning classifiers (SVM and RF) trained to predict residents' progress in in- training examinations. THE deep learning algorithm had the highest performance (AUC, 0.74).

Conclusion: In this study we designed and implemented the artificial intelligence dashboard to report medical resident's performance on logbooks in the whole country. AI-BI logbook dashboard has provided the ability to gain insight about learning process and make reform to increase resident' learning achievements in different medical specialties. Deep learning algorithms are more reliable and accurate for predicting student performance.

Keywords: artificial intelligence, business intelligence, electronic logbook, medical resident, medical university, dashboard

Improvements, Performance, and Application of Artificial Intelligence in Dentistry

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Background and aims: Artificial intelligence (AI) utilizes machines to mimic human intelligent behaviors. In recent years, Artificial intelligence (AI) has made deep inroads into dentistry. This review aimed to show the improvement of AI applications that are used in dentistry broadly and evaluate their performance in terms of clinical decision-making, diagnosis, and predicting the prognosis of the treatment process.

Method: A comprehensive search had been conducted in five databases: PubMed, Google Scholar, Magiran, Elmnet, Civilica. Our study comprises a review of papers published between 2018 to March 2023 that reported the role of AI in dentistry diagnosis, prediction, detection, and clinical decision-making.

Results: A total of 196 relevant studies were retrieved from our databases, of which 25 eligible studies met all criteria for inclusion in this narrative study. AI-based technologies are widely implemented in an extensive range of dentistry specialties. AI has been utilized in the diagnosis and detection of dental caries, vertical root fractures, maxillofacial cysts, apical lesions, cancerous lesions, salivary gland diseases, periodontal diseases, maxillary sinusitis, TMJ disorders, cervical lymph nodes metastasis, osteoporosis, alveolar bone loss, predicting orthodontic extractions, orthodontic treatments, cephalometric analysis, determination of gender and age. By having larger data sets AI can predict the precancerous occurrence conditions. AI can aid in population-wide surveillance and also in making decisions about referrals to specialists. AI can detect microfeatures that are beyond the human eye efficiently and also in critical diagnosis, AI can augment its predictive power. The advantages of AI are better precision, efficiency, and time saving during the treatment planning and diagnosis.

Conclusion: The review of these studies shows that the performance of an automated system that is based on AI is outstanding. They mimic the accuracy and precision of trained specialists. Some studies indicated that these systems were even able to outstrip dental specialists in terms of precision and performance. The future implications of AI in dentistry promise a novel formation of practicing dentistry.

Keywords: artificial intelligence, dentistry, diagnosis, prediction, clinical decision-making

Content Analysis of Persian Language Mobile Applications For Liver Diseases Using The Mobile App Rating Scale (MARS)

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Background and aims: The rapid growth of liver diseases has led to the design of a large number of mobile applications for the management and control of these diseases. This creates the need to analyze and review related applications in this field. The purpose of this study was to evaluate the Persian language mobile applications in liver diseases.

Method: In order to content analysis, comprehensive search was conducted using words such as “liver”, “جگـر”, “hepat” in Cafe Bazaar and Myket markets in December 2022. The mobile app rating scale (MARS) was used to review the content of applications.

Results: After removing unrelated applications, 8 items were included in the study. According to the results, the focus of all applications was on change behavior and physical health. The initial version of two applications were paid and six items were free. According to the results of MARS questionnaire, the minimum and maximum of application quality score were 2.53 and 3.67, respectively. Also, none of the applications were evaluated by end-user and various parameters such as acceptance, applicability and satisfaction were not measured.

Conclusion: The Persian liver mobile applications is in low level, and developers must pay more attention to the functions and quality measures in design stage.

Keywords: mobile application, liver, MARS

A Machine Learning Based Model to Identify the Relative Location of CT Scan Slices

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Background and aims: Registering CT scans in a body is an important technique for aligning and comparing different CT scans. This method is required for navigating automatically to certain regions of a scan. In this, a unique correspondence is created between one point of one image and another point of the second image in such a way that both of them represent the same point of the image. Considering a large number of slices of CT scan images. This method is one of the new methods for aligning and comparing different CT scan images. The purpose of this study is to provide a model based on machine learning algorithms to identify the relative location of CT slices.

Method: In this study, the data set of the UCI database titled relative location of CT slices was used. 53500 CT scan images belonging to 74 patients (43 men and 31 women) were used to build the prediction model. Each CT scan slice was described by two histograms in polar space, which showed the position of the skeletal structure and the air inclusions inside of the body. The target variable was a number between 0 (top of the head) and 180 (soles of the feet) that indicated the relative position of an image. Considering that the target variable was continuous, two ML methods including linear regression and artificial neural network (multilayer perceptron: MLP) were used to build the prediction model. Prediction models were evaluated by 10-fold cross-validation and are implemented in MATLAB environment.

Results: The results showed that MLP with the Lunberg-Marquardt training algorithm with R2 and RMSE values equal to 0.9947 and 2.261 have better performance compared to the linear regression method with R2 and RMSE values 0.9286 and 8.291 respectively.

Conclusion: The results revealed that the neural network prediction model achieved better performance compared to the linear regression method for predicting the relative location and the same areas in the CT slices.

Keywords: image registration, CT scan, machine learning, artificial neural network, linear regression

Application of machine learning and deep learning algorithms in osteoporosis classification, diagnosis, prediction and screening.Review

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Background and aims: Osteoporosis is one of the most frequent diseases in the elderly, especially in postmenopausal women. In addition to the usual methods used to diagnose osteoporosis, Artificial Intelligence (AI) algorithms such as machine learning (ML) and deep learning (DL) have recently found many capabilities for diagnosis, classification, prediction, and screening. In this review research, these algorithms have been investigated in the above areas, as well as their comparison with the usual diagnostic methods and the strengths and weaknesses of each have been discussed.

Method: For that, articles registered in the last 5 years in the PubMed database, which dealt with the use of artificial intelligence in the diagnosis, classification, prediction, and screening, with relevant terms were analyzed. Terms such as "artificial intelligence", "deep learning", "machine learning", and "osteoporosis" are searched. The documents were then classified and reviewed, depending on the type of domain in which the AI algorithm was used. The algorithms used in the desired subjects were examined and the results were presented based on the precision factors of the models used.

In all, 45 papers were reviewed: 4 on osteoporosis classification, 14 on osteoporosis prediction, 14 on osteoporosis diagnosis, 7 on osteoporosis screening, and 6 review papers focused on the use of the two artificial intelligence algorithms.

Results: Reviewing the studies showed that: in the field of 'classification' 50% of studies have investigated the issue using deep learning algorithms and the others using machine learning algorithms. In the field of 'prediction,' 57% of studies have investigated the issue using ML, 35.7% using DL, and 7.1% using both ML and DL algorithms. In the field of 'diagnosis' 57% of studies have investigated the issue using ML, 43% using the DL algorithm. In the field of 'screening' 38.5% of studies have investigated the issue using ML, 62.5% using the DL algorithm.

Dual-energy X-ray absorptiometry (DXA) is underused in the measurement of bone mineral density (BMD) and assesses the risk of fracture. Artificial intelligence-based algorithms present automated tools for identifying fractures, predicting BMD, and assessing fracture risk through X-rays that may help identify patients for osteoporosis. Such algorithms can predict BMD by CT scan interpretation and, because of this, can predict the risk of osteoporosis and modified neural networks like CNN can classify and diagnose osteoporosis.

Conclusion: While these models are very useful for the classification, diagnosis, prediction, and screening of osteoporosis, their improvements, such as the inclusion of positive-negative class bias, are maintained. With the ability to expand artificial intelligence algorithms and lower cost development algorithms, it can be expected that these algorithms will widely help specialists in the near future.

Keywords: artificial intelligence, deep learning, machine learning, X-ray, bone mineral density, osteoporosis.

Applications of artificial intelligence for pre-implantation kidney biopsy pathology practice: a systematic review

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Background and aims: Kidney biopsy is a crucial diagnostic tool used in the management of kidney disease. It involves the procedure of removing a small piece of kidney tissue to be examined for any abnormalities. The success of pre-implantation kidney biopsy depends on the accuracy of the pathologist's diagnosis. Pathological evaluation of kidney biopsy is complex, and at times the interpretation can be subjective, leading to inter-observer variability. The use of artificial intelligence (AI) applications presents an opportunity to improve the diagnostic accuracy of pre-implantation kidney biopsy pathology practice. The aim of this systematic review is to evaluate the state of the art in AI applications for pre-implantation kidney biopsy pathology practice.

Method: We conducted a systematic literature review of articles published in three electronic databases: PubMed, Scopus, and IEEE Xplore. We looked for articles published in English from 2010 to 2022 and carried out the search using keywords such as "kidney", "biopsy", "transplantation" and "artificial intelligence" and their aliases. We reviewed the studies and extracted the relevant data on AI applications used in pre-implantation kidney biopsy pathology practice.

Results: The systematic review included 33 studies that used AI applications to augment or replace the traditional pathological evaluation of kidney biopsy specimens. Machine learning (ML) algorithms were the

most commonly used AI technique. Several studies employed ML techniques to develop predictive models that could differentiate between different kidney pathologies, such as glomerulonephritis, tubulointerstitial nephritis, or acute tubular necrosis with high precision. Other studies used AI-based systems to classify the severity of

kidney damage in biopsy samples. Moreover, AI applications have been shown to reduce inter-observer variability through training pathologists with a standardized system.

Conclusion: The use of AI in pre-implantation kidney biopsy pathology practice has shown promising results in improving diagnostic accuracy, reducing inter-observer variability, and streamlining the review process. However, applying AI-based systems to a clinical setting is a challenging task, and concerns should be raised regarding patient safety, accuracy, and data protection. Future research will require extensive study to validate and refine the utility of these AI applications in a practical clinical setting. Further development, validation, and integration will be crucial in assisting physicians in making a more accurate and precise diagnosis in pre-implantation kidney biopsy pathology practice.

Keywords: Artificial intelligence, Digital pathology, Kidney biopsy, Pre-implantation biopsy, Review, Transplantation.

Deep Learning-Based Pediatric Bone Age Estimation Using Enhanced Images and Pretrained Models

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Background and aims: Pediatric specialists usually apply radiography images to evaluate the maturity of bones where a large discrepancy between the evaluated age and chronological age suggests a growth disorder. This procedure usually takes time and is subject to intra-observer and inter-observer variability. This procedure usually takes time and is subject to intra-observer and inter-observer variability. Therefore, using artificial intelligence, especially deep learning methods, is vital for automated bone age assessment.

Methods: In this study, a convolutional neural network is used for pediatric bone age estimation, where pre-trained models are used for transfer learning. Prior to fine-tuning the pre-trained model, the input images are preprocessed to enhance the poor quality of images.

Results: The presented method in this study is evaluated on the RSNA pediatric bone age dataset. The results show that fine-tuned DensNet-121 pre-trained model satisfactorily outperforms other pre-trained models with a mean absolute error (MAE) of 9.8 months, which is comparable to cutting-edge techniques.

Conclusion: These results show that preprocessing and transfer learning can effectively enhance the predictive power of the proposed method.

Keywords: Artificial Intelligence, Bone Age, Deep Learning, Transfer Learning

An Adaptive Neuro-Fuzzy Inference System to predict Acute Lymphocytic Leukemia prognosis in children

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Background and aims: Leukemia is the most common cancer in children, and the most common leukemia is Acute Lymphocytic Leukemia (ALL). Prognosis can play an important role in timely treatment and reduction of subsequent complications. Therefore, the aim of this study was to develop an Adaptive Neuro-Fuzzy Inference System to predict Acute Lymphocytic Leukemia prognosis in children.

Method: This study was conducted in 2022 and consisted of two main phases. In the first phase, the prognostic parameters were determined based on the literature review and by investigating specialists' perspectives by using a questionnaire. The face and content validity of the questionnaire was approved by the experts in the field of medicine. The reliability of the questionnaire was calculated by using the test-retest method. In the second phase, this system was designed and implemented by using ANFIS toolbox in MATLAB. Then, system performance was evaluated. An online dataset was used to test the sensitivity, specificity, and accuracy of the system.

Results: According to the physicians, the most important parameters were age, sex, white blood cell count at diagnosis, rate of decrease in cancer blood cell count after initial treatment, whether the source of cancer blood cells is B lymphocytes or T lymphocytes, specific changes in lymphocyte chromosomes, Leukemia was found in the brain and spinal cord, the child had Down syndrome, the duration of the cancer, and the type of treatment. The system was designed and the evaluation results showed that the values of sensitivity (87%), specificity (91%), accuracy (85%) were in good condition.

Conclusion: The results of the system were largely similar to the patients' records and showed that the designed system can be used to help physicians to predict prognosis of ALL patients and to improve the quality of care services and life for these patients.

Keywords: Adaptive Neuro-Fuzzy Inference System, Artificial Intelligence, ANFIS, Prognosis, Acute Lymphocytic Leukemia

Robust Deep Stack Auto-encoder Approach for Image Classification: A Novel Fuzzy Attitude

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Background and Objectives: Deep learning has been recently integrated with fuzzy logic to learn efficient models against uncertainty factors. Due to the daily spread of imaging equipment, different types of uncertainty appear in image analysis tasks. In general image analysis applications, uncertainty management is a challenging issue. Furthermore, image analysis issues involve uncertainty in low-level and high-level features, which are not evaluated in related research works already. Developing a novel image classification approach to evaluate the uncertainty in several feature levels is the main motivation of this study. The main purpose in this paper, a robust deep stack auto-encoder model is proposed for image classification while uncertainty is evaluated in several levels of features.

Methods: Deep learning-based models have demonstrated outperformance in different image classification tasks in recent years. To address uncertainty issues, we employ a fuzzy attitude to deep learning that decrease the effects of uncertainty in image data. A deep stack auto-encoder model is proposed in this paper in which fuzzy membership degrees are applied to the activation function of the neurons in the deep model. More adaptability and especially higher degrees of freedom in fuzzy parameters contribute to better manage the inherent uncertainties in complex data to a large extent.

Results: The experiment is performed on three imbalanced image datasets, including CIFAR-10, Caltexh101, and Caltech256. The experimental results of the proposed classification method applied to these datasets demonstrate that the deep stack auto-encoder model with fuzzy attitude can adequately minimize the negative effects of uncertainty in input images.

Conclusion: Comprehensive comparisons between the proposed model and some other state-of-the-art classification methods are performed. The performance results show the outperformance of the proposed model compared to other recent strategies. Additionally, the evaluation results indicate the robustness and efficiency of this model in uncertainty management.

Keywords: Deep auto-encoder, Image classification, Fuzzy logic, Uncertainty, Activation function.

A deep learning framework for Segmentation of acute ischemic stroke lesions on multimodal MRI images

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Background: Accurate segmentation of stroke lesions on MRI images is very important for neurologists in planning of post stroke care. Segmentation helps clinicians to better diagnosis and evaluation of the any treatment risks. However, manual segmentation of brain lesions relies on the experience of neurologists and is also a very tedious and time-consuming process. So, in this study, we proposed a deep convolutional neural network (CNN-Res) that automatically performs segmentation of ischemic stroke lesions from multimodal MRIs.

Methods: CNN-Res used a U-shaped structure, so the network has encryption and decryption paths. The remaining units are embedded in the encoder path. In this model, to reduce gradient descent, the remaining units were used and to extract more complex information in images, multimodal MRI data were applied. In the link between the encryption and decryption subnets, the bottleneck strategy was used, which has reduced the number of parameters and training time compared to similar research.

Results: CNN-Res was evaluated on two distinct datasets. First, it was examined on a dataset collected from the Neuroscience Center of Tabriz University of Medical Sciences, where the average Dice coefficient was equal to 85.43%. Then, to compare the efficiency and performance of the model with other similar works, CNN-Res was evaluated on the popular SPES 2015 competition dataset where the average Dice coefficient was 79.23%.

Conclusion: This study presented a new and accurate method for segmentation of MRI medical images using deep convolutional neural networks called CNN-Res, which directly predicts segment maps from raw input pixels.

Keywords: ischemic stroke, Convolutional network, Lesion segmentation, MRI, Informatics, Deep learning

An efficient approach to deal with the lack of data in medical image segmentation applications using Capsule Networks

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Backgrounds/Aims: Gathering huge dataset is the first step towards successful implementation of the AI-based medical applications. Availability, prevalence and the hardness of annotating a large amount of data is the main obstacle for training Deep Convolutional Neural networks (DCNN). In another point-of-view the tradeoff between the model complexity and the intrinsic complexity in the feeding input is the vital point as it could lead to over-fitting and under-fitting problems and made a model with less convergence and generalizability. Many methods have been developed to handle the lack-of-data based on some data processing and multi-stage training in standard CNNs. Capsule networks are robust and efficient techniques to handle this problem in medical applications . The goal of this research is to evaluate the outcome of the SegCaps network by employing a limited amount of data rather than the state-of-the-art segmentation methods. We committed with the principles of the capsule networks and tried to converge the network utilizing less than 1.2 million of training parameters.

Method: In this research almost 20 percent of the entire of two public datasets, the BRATS2020 and LIDC-IDRI CT, selected in which slices extracted randomly then be applied Capsule networks. Capsule networks besides having dynamic routing, gain vector encoding to extract more informative features even in shallower levels of the model structure. We removed the reconstruction loss and proposed a prediction layer based on one-dimensional convolution filters. Using this technique the texture features inside the target regions could be utilized to regularize the network toward extracting output capsules with similar orientation. Finally Disc score was evaluated for every dataset and compare with previous results that gotten by U-Net architecture.

Results: The results showed that the proposed architecture and the proposed loss function has enough capability to train on a limited dataset with fewer parameters than U-Net. We achieved the Dice score of 88.1 and 95.71 in BRATS2020 and LIDC-IDRI CT dataset respectively. The results are comparable with state-of-the-are U-Net using the smaller training dataset and less than 1.2 million of parameters compare to the 31 million parameters of the U-net network.

Conclusion: SegCaps is the first development of the basic capsule network into the segmentation applications. Utilizing limited spatial window and routing inside these kernels between capsule types, the network could effectively route the capsules to the next level. The study implied reasonable result can be obtained by following principles of the capsule networks and tried to converge the network utilizing less than 1.2 million of training parameters. In fact SegCaps is able to manage lack of data and reduce the number of parameters of U-Net architecture.

Keywords: Capsule Network, Deep Learning, CNN, Medical image, lack of data

Management of Thyroid Nodules Based on ACR-TIRADS in Ultrasound Images by Deep Learning

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Background and aims: Interpreting thyroid ultrasound images is time-consuming and has inter-observer variability. This study develops a computer-aided diagnosis system for thyroid nodules risk stratification and management recommendations based on the American College of Radiology (ACR) Thyroid Imaging Reporting and Data System (TIRADS) by deep learning to improve diagnosis accuracy and reliability.

Methods: In this retrospective analysis, 2450 thyroid ultrasound images with 3250 nodules were acquired from 1037 patients from 2018 to 2020 at a single institution. Our proposed automated method had four main steps: preprocessing and image augmentation, nodule detection, nodule classification based on ACR-TIRADS, and risk-level stratification and treatment management. We trained different state-of-the-art pre-trained convolutional neural networks (CNN) to choose the best architecture in the detection and classification stage. We compared the performance of our method and three experienced radiologists.

Results: Comparison results show that the Faster R-CNN ResNet-101 has a better performance in the detection stage and fine-tuned Xception model with attaining 0.98% accuracy, 0.99% AUC, 0.967% precision, and 0.912% recall selected as the backbone of the classification stage. the result demonstrated that the performance of our algorithm was better than three radiologists by achieving a mean kappa value of 0.85% in five ACR-TIRADS categories compared with the gold standard.

Conclusions: This study, in addition to generating a valuable database of thyroid US images, demonstrates that our method can effectively improve the performance of thyroid nodule assessment and can assist the radiologist as an adjunct clinical tool to improve efficiency, reliability, and diagnosis performance in clinical practice.

Keywords: Deep learning, thyroid nodule, nodules risk stratification, ultrasound

Analysis of Lung Scan Imaging Using Combination of Image Processing Algorithms and Deep Multi-Task Learning Structure for Covid-19 Disease

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Background and aims: COVID-19 is a global health challenge with over 458 million confirmed cases and 6.1 million deaths worldwide as of March 2023. Accurate diagnosis of lung infections through computed tomography (CT) scans is crucial for effective treatment. However, manual diagnosis is time-consuming and subjective. Therefore, this study proposes an automated multi-task deep learning model for the segmentation and classification of CT scans to detect infected areas. To increase the efficiency of the model, CT scan images were enhanced using image processing algorithms before entering the network.

Method: In this study, an encoder-decoder model based on the U-net architecture was used. In the pre-processing phase, a median filter and mathematical morphology operation were applied to the input images to improve their quality. The encoder was responsible for feature extraction, and the number of filters increased from 64 to 1024 in the encoder. Skip connections were used following each convolutional block to preserve information. Then, the decoder level began with a sampling layer, followed by a convolution to decrease the number of features by a factor of 2 in the segmentation task to detect areas affected by COVID-19 and other infections, as well as healthy regions. In the classification task, a multilayer perceptron was used, and 4 neurons were considered for each class of the task in the last dense: COVID-19, normal, other infections, and combined infections. Since both classification and segmentation tasks used the same dataset, it was necessary to use a dataset that had both masks and labels. The proposed model was trained using two-dimensional CT scans with allocated masks and labels obtained from the Italian Society of Medical and Interventional Radiology, and by applying data augmentation techniques to the dataset, the number of slices increased to 1311 images. Images were segmented by a radiologist. However, in the segmentation task of the proposed model, infected areas infections and healthy regions were considered as segmentation labels.

Results: The model achieved an accuracy of 97.16%, MSE of 0.02, and mean dice of 88.89±0.02 in the segmentation task. In the classification task, the model used a combination of median filter and morphology operation to achieve an accuracy of 97.75% and AUC of 0.97. The median filter alone achieved an accuracy of 0.96 and mean dice of 88.78 ± 0.06 in the segmentation task and an accuracy of 0.97 and AUC of 0.97 in the classification task. Similarly, the morphology operation achieved an accuracy of 0.96 and mean dice of 88.79 ± 0.04 in the segmentation task and an accuracy of 0.96 and AUC of 0.97 in the classification task. The model successfully identified infected areas in lung CT scans and segmented them accurately.

Conclusion: This paper proposes an efficient deep multi-task learning structure for Covid-19 disease, which uses image processing algorithms in the pre-processing phase. The model showed the highest results among previous studies. The proposed model could be applied as a primary screening tool to help primary service staff better refer suspected patients to specialists.

Keywords: COVID-19, Lung infections, Computed Tomography scan, Automated diagnosis, Multi-task structure

The Impact of Using the Electronic Disease Process Form in Improving the Performance of Diagnosis, Prescribing the Type and Dose of Medicine by the Health Care Providers and the Patient's Response to Treatment in the Electronic Hospital of Mashhad Velayat in 2022

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Background and aims: In health care organizations such as hospitals, medical record forms such as the disease course form are the most important tools for storing and retrieving information and analyzing health care. Their incomplete registration, besides threatening the patient's health, creates many problems for the patient in pursuing treatment and legal issues, such as referring cases to legal medicine, supplementary insurance, occupational accidents, and disability, on the other hand, it also causes problems for hospitals such as increasing hospital deductions and medical errors. As a result, hospitals turned to innovative models based on advanced medical technologies such as electronic health, intelligentization of processes, and smart hospitals. Data and a huge amount of information in these forms can be very useful for physicians' better decision-making. This study aimed to investigate the impact of using the electronic disease course form on improving the performance of diagnosis, prescribing the type and dose of medicine by the health care providers, and the patient's response to treatment in Mashhad Velayat hospital in 2022.

Method: The disease process form is the documentation of the patient's response to the treatment, including the notes of the patient's admission in the form of subjective information, all the treatments provided and the patient's response to the treatment, the final notes of the patient's condition at the time of discharge, recommendations at the time of discharge such as the patient's physical activity and diet, notes related to the progress of the disease at the time of death, which should all be recorded. On the other hand, recording general and vague things to show the patient's condition, such as "the general condition of the patient is good", should be avoided. In the electronic Velayat hospital of Mashhad, the disease process form was prepared and designed according to the promulgated instructions by the Ministry of Health, Treatment, and Medical Education. To implement it, an expert system has been used, which is one of the branches of artificial intelligence and is being greatly expanded. One of the ways that knowledge can be presented in an expert system is through a rule-based system that follows an if/then structure. The information that appears in the 'If' section is logically related to the information that appears in the 'Then' section. By choosing each item (if) different decisions (then) are obtained. Finally, by displaying the response of the patient to the treatment in the section of the patient's condition, which includes surgery and medication, the clinicians are helped in determining the type and dosage of the medication.

Results: In other hospitals, the process of recording disease process form is paper-based without any intelligence or warning alarm. In this study, in the process of electronic recording by displaying the tests of the patient that are outside the normal range ("If" in the rule of an expert system), how the response of the patient to the treatment is determined ("Then" in the rule of an expert system), which leads to the improvement of the performance of diagnosis and prescription, systematic recording of the disease by the physician. It is possible to check the effect of the medicine and the recovery process of the patient by displaying the status of the vital signs of the patient and changes in paraclinical tests, such as blood tests during patient visits.

Conclusion: In this study, based on the electronic prescribing approach, by displaying the patient's paraclinical tests and vital signs in the form of the disease process, the performance of diagnosis and prescribing of the type and dosage of the medication by the physicians was improved.

Keywords: Artificial Intelligence, Expert Systems, Disease Process Form, Electronic Health, Smart Hospital

Telepharmacy Research Trends; Current Situation and Future Perspective

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Background and aims: Revelation of the Internet and common pharmaceutical care methods limitations have caused the invention of the telepharmacy concept, defined as "providing pharmaceutical services to patients through communication technologies". So far, telepharmacy has made significant achievements in patient telecare in rural areas and providing pharmaceutical services during the Covid-19 pandemic. Studying this field trend can be a valuable basis for determining future perspectives of this field. In the current research, the bibliometric maps of telepharmacy studies and their prospects are reviewed and analyzed.

Method: Considering Aidi Ahmi standards for bibliometric studies, TITLE-ABS-KEY("Telepharmacy"OR"Telepharmacy") search formula was used to extract all Scopus-indexed studies until 2022-09-5 (n=270). Published articles data were included in VOS viewer software (version.6.1.180) and checked with various analysis types, including co-authorship, co-occurrence, and citation, and analysis units including authors, countries, sources, documents, and keywords. Finally, various maps and bibliometric tables were designed, and related quantitative and qualitative analyses were reported.

Results: Our study showed that the first article in this field was published in 1998. The most active author in this field has contributed to only eight articles. International collaborations in this research showed weak relationships. The USA and Spain, with the most articles, were the most focused countries (n=107, 15). Some countries, such as Iran and Australia, had only national research productions. In the case of Iran, only three articles have been published and a leading author has contributed to all of them. The recently published articles used "medication adherence", "virtual pharmacy", "medication dispensing", "emergency medicine", and "hospital disturbing system" keywords more than before.USA, Italy, Spain, and Australia had the most cited articles, all of which were published in American journals. These articles were often prepared with an interdisciplinary approach, especially in collaboration with medical profession researchers.

Conclusion: This study showed that telepharmacy is still a novel research topic. The Covid-19 pandemic was a driving force for it, and our research revealed telepharmacy trends, importance, and future perspectives for scientific communities. The international cooperation of authors needs much more development. We found that authors often consider telepharmacy as an extra field of research. The USA has a critical role in research outputs of telepharmacy research; Iranian researchers need to pay special attention to telepharmacy as their main research field considering future trends. Also, the review of published articles shows that conducting interdisciplinary studies, especially in medicine, provides more opportunities. All in all, we believe that focused, interdisciplinary, international teams should study telepharmacy technology and administration to flourish in this field of research.

Keywords: Telehealth, Telepharmacy, Bibliometrics analysis, VOS viewer

Self-care software for early diagnosis of preeclampsia syndrome

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Background and aims: Preeclampsia is one of the main warning factors for fetomaternal complications. High risk patients need to be carefully monitored for signs and symptoms of preeclampsia to make an early diagnosis and prevent cosmplications. Progress in digital communication and medical technologies has led to the digitization of health care to increase the quality of care and reduce costs, emphasizing the importance of self-care in all medical fields, including fetomaternal medicine.

Method: In the design of this software that was done at obstetrics and gynecology department of Isfahan university of medical sciences between June and September of 2022, minimal data set (MDS) which obtained by preliminary review of guidelines, was finalized by a survey of experienced prinatologists. At first, the most effective risk factors of preeclampsia and diagnostic signs and symptoms of preeclampsia were extracted by preliminary review of guidelines. Then, in 2-round based on expert`s opinions, risk factors in predicting preeclampsia and important diagnostic signs and symptoms, were finalized.

Results:

MDS for risk factors of preeclampsia considered as maternal age, nulliparity, multiple pregnancy, BMI, previous history of PIH and underlying maternal diseases. MDS for diagnostic signs and symptoms was obtained as blood pressure measured digitally, epigastric pain and neurological symptoms. If the mother has at least 2 of the 6 final effective risk factors, it is considered high risk and it will be recommended to use this software during the pregnancy. In the case of diagnostic criteria, patients were categorized in three groups including routine care, refer to the health care provider as soon as possible and the urgent need to refer to the health care provider; based on systolic blood pressure, diastolic blood pressure and sever signs.

Conclusion: This software can reduce fetomaternal complications caused by preeclampsia in high-risk pregnant women.

Keywords: artificial intelligence, pregnancy, hypertension

Developing data visualization tools to improve the efficiency and ease of healthcare analysis

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Background and aims: Clinical practice units, teams, and hospitals are increasingly relying on electronic medical records to collect, store, retrieve, and analyze patient-related data. physicians often have to use multiple tools to gather patient status from heterogeneous databases to get a complete health assessment. Therefore, this research was carried out by developing a dashboard based on augmented reality for efficient visualization of data in the nephrology department of Imam Khomeini Hospital in Urmia.

Method: The current research is in three stages: 1. Determination of data elements using the Delphi method. 2. Nephrology dashboard design and AR interface using PHP and Java. 3. The implementation of the dashboard system in the nephrology department and its evaluation was done using the questionnaire of effectiveness, applicability and interview.

Results: Data elements in 4 classes of demographic information, historical information, clinical information and discharge recommendations for kidney disease dashboard were identified as necessary from the experts' point of view. The results of the evaluation showed that the dashboard has gained the satisfaction of users and is acceptable.

Conclusion: The clinical dashboard of the nephrology department was effective in providing quick access to patient information, in accordance with the user's needs, and maintaining comprehensive patient information to review the treatment process. Also, the designed dashboard facilitated the ability to personalize information to improve patient safety. Therefore, according to the evaluation results, it is necessary to implement such systems to the needs of the target society.

Keywords: dashboard, visualization, augmented reality, kidney disease

A MobileNetV2-based Android Application for Acute lymphoblastic Leukemia diagnoses and classification of its subtypes

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Background and aims: B-cell acute lymphoblastic leukemia (ALL) is a common type of cancer, and a conclusive diagnosis involves intrusive, expensive, and potentially harmful diagnostic procedures. However, in many locations, access to accurate ALL diagnostic tools is restricted. Blood microscopic analysis has long been the main ALL screening and diagnosis method. However, there are inherent limits to the microscopic analysis of blood performed by laboratory staff and hematologists. In contrast, image analysis of blood microscopy data using artificial intelligence (AI) approaches has demonstrated encouraging outcomes. This study's goal was to create and use a well-optimized deep convolutional neural network (CNN) to identify the subtype of ALL by first detecting ALL instances in hematogenous.

Method: A mobile application was developed with the objective of accurately differentiating between instances of ALL and hematogone cases, utilizing a well-designed and optimized model. The segmentation of images was carried out during the modeling stage using a specialized technique based on unique segmentation. The K-means clustering algorithm was applied to segment the images and remove irrelevant components, followed by the addition of a mask to the clustered images. After evaluating the performance of six popular lightweight CNN architectures (MobileNetV2, ResNet50, DenseNet121, MobileViT, ShuffleNetV2, and NASNetMobile), the most effective model was chosen. The proposed model was then configured and fine-tuned based on this selected architecture.

Results: The proposed model exhibited a remarkable accuracy rate of 99.98%. Based on this state-of-the-art model, a mobile application was developed. The mobile application, built upon the suggested model, effectively differentiated ALL cases from other classes in a real laboratory setting, demonstrating a 99.88% sensitivity and specificity. This successful implementation establishes the mobile application as a reliable screening tool for ALL.

Conclusion: The mobile application, which incorporates preprocessing and deep learning (DL) algorithms, can be employed by hematologists and clinical specialists as a powerful screening tool to potentially reduce unnecessary bone marrow biopsy cases and expedite the diagnosis of ALL. This application has the potential to significantly shorten the time required for ALL detection and diagnosis, thereby improving clinical efficiency and patient care.

Keywords: Mobile Application, Acute Lymphoblastic Leukemia, MobileNetV2, ResNet50, DenseNet121, MobileViT, ShuffleNetV2, NASNetMobile

Mortality risk assessment of COVID-19 Patients using Cause-specific hazard regression models: The Khorshid COVID-19 Cohort study

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Background and aims: Simple tools are needed so that clinicians can identify high-risk from low-risk patients during hospitalization. Predicting the clinical course of COVID-19 patients helps manage patients in the hospital and make correct and timely clinician decisions. It has been proven that Machine learning and survival analysis methods effectively predict the mortality of COVID-19 patients.

Method: Using Cause-specific hazard regression models on the Khorshid Cohort COVID-19 (KCC) data set, a color risk chart was presented using the following variables at hospital admission: age, gender, oxygen saturation, Charlson comorbidity index, Blood Urea Nitrogen, Creatinine, Bicarbonate (HCO3), Partial Pressure of Carbon Dioxide (PCO2), Lymphocyte, and blood platelet count. The evaluation of the model was performed on the validation data, and the area under the receiver operator curve (AU-ROC) and the calibration curve with the related parameters, including calibration-in-the-Large, calibration in Slope, and R-Square, was provided.

Results: Age over 75 years (HR=3.10 [CI95%: 0.59-16.21]) was the most effective variable in the mortality of COVID-19 patients. The risk analysis method in the validation set had excellent diagnostic accuracy and suitable coverage for the entire risk values regarding the calibration curve (Calibration in the Large =0, Calibration on Slope =1). In the validation data, = 0.72 and AUC = 0.97 [CI95%: 0.86-0.91] were reported. Figure 1, shows the ROC curve (Fig 1.a) and calibration curve (Fig 1.b) of the validation data.

Conclusion: The proposed risk chart can help with resource allocation and management of medical centers during the pandemic as part of the pandemic preparedness. The external validation of the proposed model is the focus of our future activity.

Keywords: Machine Learning, COVID-19, Mortality, Prognosis, Risk assessment, Risk chart, Calibration.

Designing a multi-Epitope Vaccine against Parkinson's Disease: An Immunoinformatics and AI approach

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Background and aims: Parkinson's disease (PD) is caused by significant loss of nigral cells and the proliferation of α-synuclein in distinct regions of the cortex, spinal cord, and brain stem. It is estimated that between 5 to 20 cases of PD occur per 100,000 people in years. While some cases of PD can be linked to genetic inheritance patterns, some cases could be related to environmental elements or a combination of genetical and environmental aspects. There is controversy surrounding the potential role of infections in causing PD. A neurovirulent strain of influenza type A virus has been displayed to particularly target the substantia nigra. However, some infections, such as chickenpox, mumps, measles, and Helicobacter pylori, are inversely related to PD. Additionally, proteins such as glucocerebrosidase (GBA), leucine-rich repeat kinase 2 (LRRK-2), and α-synuclein could play a vital function in susceptibility to PD. In this article, we designed a multi-epitope vaccine against human proteins, bacteria, and viruses that are predisposing factors for PD. We used computational reverse vaccinology to deviate immune response and Th1/Th2 balance via the introduction of a novel immunogenetic chimera protein.

Method: Epitopes from proteins, bacteria, and viruses were identified. Predicting MHC-1, MHC-2, and CTL epitopes using bioinformatics online tools. Then these epitopes were linked together with a TAT peptide, adjuvant, and IL-10 inducer sequence to form a chimeric vaccine. The vaccine sequence was created using MODELLER, and the 3D structure was refined using a Ramachandran plot. The vaccine and TLR-4 were docked, and a molecular dynamics (MD) simulation of the vaccine-TLR4 complex was performed using GROMACS. The C-ImmSim server was used to stimulate the immune response to the chimeric vaccine. We predicted the solubility, antigenicity, and allergenicity of the structure.

Results: The developed model was confirmed to be stable with an enhanced ERRAT outcome above 80%. The Ramachandran plot exhibited that over 95% of the residues resided in a favorable and permissible location. Molecular dynamics simulations (MDS) demonstrated that the docked vaccine-TLR4 had a stable formation. Moreover, the result related to solubility, antigenicity, and allergenicity were acceptable. GRAAVY evaluation showed the vaccine was mildly hydrophilic. We designed a vaccine against viruses that have a protective role against Parkinson›s as by such pathogenic epitopes the immune system will be stimulated in a similar manner. Ultimately, simulations of the immune response showed a good reaction from both the innate and adaptive immune systems. The memory response and cytokine profiles were favorable. SnapGene cloning and gel simulations showed successful cloning of the vaccine protein in pET-21 b(+) / MEV.

Conclusion: We developed an immunogenic vaccine against PD using Immunoinformatics and corroborated its favorable properties. This vaccine has significant value because it serves multiple purposes, providing immunity against all mentioned risk factors and PD itself. The results obtained through computer simulation can aid researchers in developing a vaccine for PD in real-world preclinical and clinical experiments.

Keywords: Parkinson's disease, chimeric vaccine, Immunoinformatics, bioinformatics

An Intelligent e-clinic for Computer-aided Diagnosis and Prognosis

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Background and aims: Digitalization influences every individual's everyday private and professional activities. Integrating health information technologies (HITs) significantly improves diagnostics and therapy. The application of machine learning and biostatistical methods could improve public health. We hypothesized and implemented computer-aided diagnosis and prognosis methods for e-clinics.

Method: Cardiovascular diseases, cancer, diabetes, chronic kidney diseases, and Alzheimer's diseases remain the top Years of life lost from mortality (YLLs) and deaths attributed risk factors in the Iranian population by 2040, based on the Global Burden of Diseases (GBD) Foresight Visualization. Over the last 13 years, we have worked on computer-aided diagnosis and prognosis methods in various medical fields. Some of our preliminary web-based programs and Android Apps were provided at http://www.prognosis.ir/. They are based on our international publications on various Cohort studies. One of which, a 10-year non-laboratory-based risk prediction chart developed for fatal and non-fatal CVD using Cox Proportional Hazard (PH) regression, is presented in this work.

Results: Age, smoking status, Systolic blood pressure (SBP), self-reporting history of diabetes, and waist-to-hip ratio (WHR) were used as predictors. The implemented model showed acceptable discrimination and proper calibration. For a 52-year-old smoking diabetic female with a WHR of 1.1 and an SBP of 160 mmHg, the estimated CVD risk is 19%. For a person of the same age and sex but without the risk factors, the risk is 2%, while for the risk factors related to the general Iranian population, it is 3%.

Conclusion: The digital clinic offers a unique design to improve treatment outcomes and public health. We are now working on a broad e-clinic implementation of the diseases with high burden in the Iranian population.

Keywords: e-clinic, intelligent systems, machine learning, digital health, medical diagnosis, and prognosis.

RayaTabib, a new Persian medical advisor application based on artificial intelligence

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Background and aims: In recent years, the use of self-service healthcare systems, that allow people to manage their medical concerns, has become a global trend. Mobile applications are widely used and play an important role in this regard.

Method: We have developed an innovative artificial intelligence-based symptom-checker application, called "RayaTabib". First, a team of 10 medical students, extracted background scientific data, including symptom-disorder lists, as well as epidemiologic data, common clinical findings and risk factors of disorders from several medical textbooks and online databases in the field of differential diagnosis. We revised the collected data according to Iranian population epidemiology, unified the terminology and translated the entire textual material into Farsi. Then, a team of 3 software engineers organized the server database, designed the graphic materials and developed both server and client sides of the system. The output product is a web application that can be used on any device regardless of its operating system type.

Results: The current version is beta version in Farsi language, and covers more than 200 symptoms and 3000 disorders in all medical fields. RayaTabib, is a decision-support system based on artificial intelligence. The user enters age, gender and one symptom, then the system asks specific questions about other symptoms and underlying risk factors, and then analyzes the answers on the server and displays the result within seconds. Database on the server, includes all lists and correlations between symptoms, disorders and risk factors. A software on the server extracts the list of disorders common between all selected symptoms, and computes an index for each disorder according to the information entered by the user. The final list of possible disorders is being sorted according to indices and is completely unique for each patient. RayaTabib, also provides recommendations about whether the patient needs urgent hospital care, family physician visit or specialist visit. This feature is rule-based and is compatible with Iranian healthcare referral system. We have not presented RayaTabib for public use and we first need to evaluate its usability and accuracy, and define our business model.

Conclusion: RayaTabib as a virtual primary care provider, can facilitate access to various healthcare services, reduce unnecessary visits or costs, and ultimately improve Iranian society health. We have conducted several steps of systematic test and user experience test and early results are promising. According to the experience of similar projects in developed countries, RayaTabib seems to be usable in Iran as the first Iranian symptom-checker and medical advisor application. We will conduct a study to evaluate the accuracy of the application regarding its clinical diagnosis and recommendations.

Keywords: artificial intelligence, RayaTabib, symptom-checker, medical application

Introducing a deep neural network structure with practical implementation capability for polyp detection in endoscopic and colonoscopy videos

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In recent years, deep learning has gained much attention in computer assisted minimally invasive surgery. Researches have shown that the use of deep learning models in colonoscopy can be divided into four main categories: analysis of surgical images, analysis of surgical operations, evaluation of surgical skills, and surgical automation. Analysis of surgical images can be one of the main solutions for early detection of gastrointestinal lesions and taking appropriate actions for treatment of cancer, which deep learning has shown exceptional performance in this area. Recent studies show that the high accuracy of lesion detection by these models significantly improves colonoscopy efficiency. Therefore, in this study, a simple and accurate structure of deep neural networks for polyp detection is introduce. This model can be implemented with low-cost hardware and provides high-precision polyp detection in real-time. For this purpose, due to the shortage of labeled colonoscopy images, transfer learning was implemented to extract appropriate features from the input images. In addition, multi-task learning with two goals of classifying the images and detecting the bounding boxes of existing polyps in the images. Considering the appropriate weight for each task in the total cost function is crucial in achieving to the best results. Due to the lack of datasets with non-polyp images and the need for them to evaluate the performance of the proposed structure on both polyp and non-polyp images, data collection was carried out. The proposed deep neural network structure was trained on KVASIR-SEG and CVC-CLINIC datasets and tested using cross-validation. Experimental results verify that the proposed structure classifies the images into polyp and non-polyp ones with 100% accuracy. Moreover, it detects the bounding boxes of the polyps with an accuracy rate of 86%, and processing time of 0.01 seconds.

Keywords: Automatic polyp detection. Deep learning. Transfer learning. Image processing.

Designing and evaluating a nutrition recommender system for improving food security in a developing country

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Background: Due to the increased price of foods in recent years and the diminished food security in Iran, nutrition recommender systems as a novel nutrition informatics technology can suggest the most suitable and affordable foods and diets to users based on their health status and food preferences to ensure their food security.

Objective: The present study aimed to design and evaluate a recommender system to suggest healthy and affordable meals and provide a tele-nutrition consulting system.

Methods: This applied three-phase study was conducted in 2019-2020. In the first stage, the food items' daily prices were extracted from credible sources, and accordingly, meals were determined in three price categories. After conducting a systematic review of similar systems, the requirements and data elements were specified and confirmed by experts. In the second stage, the software was designed and developed based on the findings. In the third stage, system usability was evaluated by four experts based on Nielsen's heuristic evaluation.

Results: Initially, 72 meals complying with nutritional principles were determined in three price categories. Following a literature review and expert survey, 31 data elements were specified for the system, and the experts confirmed system requirements. Based on the information collected in the previous stage, the Web-based software TanSa in the Persian language was designed, developed, and presented on a unique domain. During the evaluation, the mean severity of the problems associated with Nielsen's 10 principles was 1.2, which is regarded as minor.

Conclusions: To promote food security, the designed system recommends healthy, nutritional, and affordable meals to individuals and households based on user characteristics. To improve access to nutritionists and enhance the nutritional status of society, this system also allows users to receive a tele-nutrition consulting system. Regarding the current conditions of Iran, nutritionists and researchers are recommended to use this system.

Keywords: Nutrition informatics; recommender systems; food security; mealss

Improving Left Ventricular Segmentation in Echocardiographic Images using two-dimensional UNet Architecture

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ABSTRACT

Background and aims: Cardiac disease is a leading cause of death globally, and segmenting the left ventricle is crucial for assessing cardiac function and diagnosing cardiovascular diseases. Manual segmentation of echocardiographic images is subjective, time-consuming, and error-prone. Recent studies have shown promising results with deep learning networks in left ventricle segmentation, and the article proposes a 2D-UNet architecture to improve accuracy and clinical applicability.

Method: In this study, the CAMUS dataset published by Leclerc et al. was utilized. The dataset consists of 2D four-chamber and two-chamber view sequences acquired from GE Vivid E95 ultrasound scanners, using a GE M5S probe. For each patient in the dataset, B-mode images were acquired at both end-diastole (ED) and end-systole (ES), along with ground truth annotations of the cardiac structures. The dataset included different-quality images from 500 patients with varying degrees of ejection fraction (EF).

For left ventricle segmentation, the UNet deep learning network was employed. The UNet architecture comprises two paths: the encoder and decoder. In the encoder path, the number of features was gradually increased by passing the input through multiple layers of convolution and downsampling. In the decoder path, multiple upsampling steps were used to recover the original image resolution.

Results: The TensorFlow library in Python and an NVIDIA GeForce GTX 1050 Ti graphics processing unit (GPU) were utilized for all experiments in this study. The LV ground truth from the CAMUS dataset was used, with 50 cases reserved for testing and 70% of the remaining 450 cases used for training, and the remaining 30% for evaluation.

To assess the quality of the test results, we employed the Dice Similarity Coefficient (DSC), which is a statistical validation metric that measures the overlap between the segmentation results and the ground truth. Specifically, DSC is defined as twice the absolute value of the shared area of overlap between the segmentation results and the ground truth divided by the sum of the absolute value of each.

The proposed method achieved a DSC score of 83.27% and an accuracy of 97.32% on the evaluation dataset after 46 training epochs. The network comprised 7.7 million parameters. These results indicate that the proposed 2D-UNet architecture is effective in segmenting the left ventricle accurately.

Conclusion: In conclusion, the proposed 2D-UNet architecture showed promising results in segmenting the left ventricle accurately in echocardiographic images. The CAMUS dataset was utilized for training, testing, and evaluation of the proposed method, and the results were validated using the DSC metric. The proposed method can be used as a clinical tool for accurate left ventricle segmentation and assessment of cardiac function. Future studies can explore the application of the proposed method in a larger and more diverse dataset to validate its effectiveness further.

Keywords: Artificial intelligence, Echocardiography, Cardiac, Segmentation, 2D-UNet

Automated Mandible Segmentation using 3D-UNet for Virtual Surgical Planning:

A Deep Learning Approach

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ABSTRACT

Background and aims: Conventionally diagnosis and surgical planning for Mandibular orthognathic surgeries such as tumor resections, displacements, and flap reconstruction of the mandible were based on two-dimensional images. Virtual surgical planning (VSP) is a modern approach that enables surgeons to plan and simulate surgeries in a virtual environment before performing real surgery. In VSP, accurate segmentation of anatomical structures, such as the mandible, is crucial for creating accurate 3D models that can be used for surgical planning. Mandible segmentation is a challenging task due to the complex shape and varying density of the bone. Traditional segmentation methods require manual intervention and are time-consuming and error-prone. Recently, deep learning methods have emerged as a promising approach for accurate and efficient mandible segmentation. Deep learning methods, such as convolutional neural networks (CNNs), have shown remarkable success in various medical imaging tasks, including segmentation. To this end, accurate mandible segmentation using deep learning methods can facilitate virtual surgical planning by providing accurate 3D models of the mandible. This research aims to implement 3D-Unet architecture for accurate and efficient mandible segmentation, which can improve the accuracy of virtual surgical planning and ultimately improve patient outcomes.

Method: In this study, we used 3D mandible image data to train a 3D-UNet for automatic mandible segmentation from CT images with the aim of facilitating virtual surgical planning (VSP). The dataset was taken from Public Domain Database for Computational Anatomy (PDDCA). The accuracy of this method was also assessed by using the DICE Score coefficient (DSC).

Results: The proposed segmentation method outperformed the UNet and received a better Dice score over the validation dataset.

Conclusion: In this paper, we describe our proposed model for automatic mandible segmentation of CT images. Moreover, to evaluate the performance of our proposed method, a similar experiment was performed with the U-Net. Experimental results demonstrate that our model has the accurate fully automated segmentation of the mandible and high DSC compared to UNet.

Keywords: VSP, 3D-UNet, Mandible segmentation, Orthognathic surgeries.

An Overview to Real-Time Automated Liver Segmentation during Laparoscopic Cholecystectomy

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ABSTRACT

Background and aims: During laparoscopic cholecystectomy (the operation of removing gallbladder from the patient's abdomen), liver deformation avoids accurate detection of the liver boundaries. Troubles in detection of vessels and tumor edges of the liver may damage the tissue. Currently, injection of indocyanine green and near-infrared fluorescence imaging technique is used to detect the liver boundaries as well as its vessels, gallbladder, and biliary structure by changing their color to green in real-time during laparoscopic cholecystectomy. There are some challenges in using indocyanine green. It takes time for indocyanine green to flow inside the vessels before liver visualization by the fluorescence camera. Moreover, this technique is not permanent and needs to indocyanine green injection per detection. The study objective is to propose an automated deep learning based technique that segments the liver in real-time.

Method: In this paper public dataset CholecSeg8k is employed for network training, validating, and testing. A private dataset from KPJ Damansara specialist hospital, Malaysia is also used just for testing. For liver segmentation coding, Segmentation Models which is a public library is utilized. U-Net architecture as network model and SE-ResNet152 architecture as backbone specify the border of the liver by using labeled laparoscopic cholecystectomy images as input of the network.

Results: Mean IoU score of 0.96127 and mean F-score of 0.97989 are obtained from the validation set in the first top experiment result.

Conclusion: Experiments exhibit desirable result of liver segmentation in the CholecSeg8k dataset. During laparoscopic cholecystectomy, conventional real-time liver segmentation technique based on indocyanine green injection and near-infrared fluorescence imaging can be replaced by an automated technique. In the future, improvement of the result for the private dataset will be investigated. In addition, a robotic arm that handles a laparoscopic camera will be developed which will work based of the automated liver segmentation technique proposed here and surgical instrument detection.

Keywords: deep learning, liver segmentation, laparoscopic images, laparoscopic cholecystectomy

The accuracy of Convolutional Neural Network-Long Short Term Memory (CNN-LSTM) in diagnosing different types of Acute Lymphocytic Leukemia based on Peripheral Blood Smear

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ABSTRACT

Background and aims: ALL (Acute Lymphoblastic Leukemia) is the most prevalent type of leukemia in children and its screening and diagnosis process is often expensive, invasive, and needs to be done by experts. The initial screening process is commonly done by acquiring a Peripheral Blood Smear (PBS) from the suspected patient and examining the sample under a microscope. Further confirmation and diagnosis of the subtype are necessary for determining the right treatment protocol; which includes bone marrow aspiration and flow cytometry or specific molecular tests. Recently, new Artificial intelligence methods have provided more economical and available ways to diagnose different types of diseases. These methods are not only efficient in distinguishing between malignant and benign images, but also, they can classify subtypes of ALL. Thus, this research intends to implement a CNN-LSTM (Convolutional Neural Network-Long Short Term Memory) model for classifying ALL subclasses.

Method: In This Pipeline, we first divided our dataset into training (90% of the whole dataset) and test (10%) subsets, then preprocessed our data (Segmentation: RGB to LAB, Clustering, Binary Thresholding, Filling holes). LSTM as a kind of Recurrent Neural Network (RNN) first was used to tackle the long-term dependencies problem. This problem was due to the fact that Classic RNNs could not give accurate predictions based on long-term information. Later on, investigations showed promising results in mixing the LSTM model within CNN architecture. We used CNN-LSTM as the model and LSTM was implemented before fully connected hidden layers. Then Adam Optimizer and Cross-Entropy loss function were employed in training the model. In this project, we used the dataset provided by M Amir Eshraghi and Mustafa Ghaderzadeh (Blood Cells Cancer (ALL) dataset), which includes 3242 Peripheral Blood Smear (PBS) images of 89 patients: 512 benign, 955 Pre-B, 796 Pro-B, and 979 early Pre-B labeled images (using flow cytometry).

Results: Our model reached accuracy, precision, recall, and specificity equal to 96%, 95.21%, 95.15%, 98.64% respectively after 22 epochs.

Conclusion: This method achieved fairly good results, especially because it can differ ALL subtypes with such accuracy that in traditional clinical settings can only be done by flow cytometry. Using these methods can reduce human errors, laboratory costs and the time between diagnosis and the start of treatment. In general, the development of such models can assist clinicians in the process of initial screening of hematological malignancies, using only a peripheral blood smear. For future work this method can be further expanded on other datasets and for other types of hematological cancers such as AML, CML or CLL.

Keywords: Acute Lymphocytic Leukemia, Deep Learning, Peripheral Blood Smear, Classification, Long Short Term Memory

A Machine Learning Based Model to Identify The Relative Location of CT Scan Slices

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ABSTRACT

Background and aims: Registering CT scans in a body is an important technique for aligning and comparing different CT scans. In this method required for navigating automatically to certain regions of a scan. In, a unique correspondence is created between one point of one image and another point of the second image in such a way that both of them represent the same point of the image. Considering the large number of slices of CT scan images. This method is one of the new methods for aligning and comparing different CT scan images. The purpose of this study is to provide a model based on machine learning algorithms to identify the relative location of CT slices.

Method: In this study, the data set of UCI database titled relative location of CT slices was used. 53500 CT scan images belonging to 74 patients (43 men and 31 women) were used to build the prediction model. Each CT scan slice was described by two histograms in polar space, which showed the position of the skeletal structure and the air inclusions inside of the body. The target variable was a number between 0 (top of the head) and 180 (soles of the feet) that indicated the relative position of an image. Considering that the target variable were continuous, two ML methods including linear regression and artificial neural network (multilayer perceptron: MLP) were used to build the prediction model. Prediction models were evaluated by 10-fold cross validation and are implemented in MatLab environment.

Results: The results showed that MLP with Lunberg-Marquardt training algorithm with R2 and RMSE values equal to 0.9947 and 2.261 have better performance compared to the linear regression method with R2 and RMSE values 0.9286 and 8.291 respectively.

Conclusion: The results revealed that the neural network prediction model achieved to better performance compared to the linear regression method for predicting the relative location and the same areas in the CT slices.

Keywords: image registration, CT scan, machine learning, artificial neural network, linear regression

Analysis of COVID-19 Distribution in Countries Using Unsupervised Machine Learning

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ABSTRACT:

Background and aims: Although more than two years have passed since the spearing of COVID-19, a global pandemic, there are still major peaks in the number of confirmed cases and deaths. Although governments are trying to overcome this disease with different policies, it is not entirely controlled yet. Therefore, many researches have been conducted to address this issue. However, most of them considered individuals' features such as disease symptoms. The current study aims to analyze data at the country level and use health, economic, and social information in order to cluster countries affected by COVID-19 employing machine learning. Thus, countries with similar factors can take proactive steps to control the pandemic.

Method: In this study, two methods of unsupervised learning, K-Means and Hierarchical algorithms, were used to cluster 207 countries based on factors such as the number of confirmed COVID-19 cases, deaths, vaccinated people, handwashing facilities, and other socio-economic indicators like GDP per capita, smoking prevalence, and life expectancy. The optimal number of clusters was considered k=6 based on the elbow method. To obtain the most associated features, the correlation between selected variables and confirmed COVID-19 cases, deaths, and vaccination rates were analyzed.

Results: The results revealed that countries in the same clusters have behaved similarly in dealing with this pandemic. For example, Russia, Argentina, South Korea, and Italy are in the same cluster with a relatively low stringency index and as a result, a low number of vaccinations. Countries such as Canada, Sweden, and Egypt where the human development index, life expectancy, and the amount of GDP per capita were the highest placed in the same cluster. In this cluster, relatively more people were vaccinated and the mortality was low.

Conclusion: The government stringency index showed a strong correlation with the number of vaccinations, whereas environmental health indicators were weakly correlated with mortality from COVID-19. Politicians can make better decisions by considering these indicators and therefore, manage the negative consequences of COVID-19.

Keywords: COVID-19, Clustering methods, Unsupervised learning, K-Means, Hierarchical clustering

Title: Development and Implementation of Wearable Sensors for Early Detection and Monitoring of Neurological Disorders

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Introduction: Movement, balance, and coordination can be impaired by neurological illnesses, including Parkinson's disease and multiple sclerosis, creating obstacles to daily life. These conditions can be detected and monitored earlier with the help of wearable sensors. The purpose of this literature review was to assess the present status of studies examining the feasibility of using wearable sensors to detect and monitor neurological illnesses at an early stage.

Methods:We used online databases, including PubMed, Embase, and Scopus, to conduct a comprehensive literature search. Inclusion criteria included research on the effectiveness of wearable sensors for the diagnosis and monitoring of neurological diseases in people. Sensor type, system accuracy, and clinical applicability were the major measures of success.

Results:32 studies were included in the analysis. Some studies used electromyography (EMG) sensors to detect muscle activity and electroencephalography (EEG) sensors to assess brain activity, although inertial measurement units (IMUs) were the most common method of capturing movement data. These sensors were incorporated into a wide variety of wearables, including watches, bracelets, and even some articles of clothing. System accuracy was seen to be between 70% and 99%, with some systems demonstrating higher accuracy than standard clinical evaluations. Monitoring illness progression, evaluating therapy efficacy, and providing real-time feedback to patients were all used to prove the systems' therapeutic usefulness.

Conclusion: Data gathered from wearable sensors may prove useful in the diagnosis and tracking of neurological illnesses. Inertial measurement units (IMUs), electromyography (EMG), and electroencephalography (EEG) sensors all collect information about movement. Wearable devices that incorporate these sensors can be discrete, portable, and simple to operate. The precision and reliability of illness monitoring can be increased with the help of wearable sensors, since they can give objective measures unaffected by human influences. More extensive clinical trials are required, however, to prove the systems' clinical efficacy and cost-efficiency.

Keywords:wearable sensors, neurological disorders, early detection, monitoring.

Prediction of Nanoparticle Toxicity Using Machine Learning

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ABSTRACT

Background and aims: Nanoparticles have attracted considerable attention in biomedical applications due to their unique characteristics. However, the toxicity of nanoparticles remains a concern, especially for use in biological systems. The biological toxicity of nanoparticles can lead to various responses such as apoptosis, inflammation, allergies, neurotoxicity, fibrosis, hematological toxicity, pulmonary toxicity, carcinogenicity, and genotoxicity. Since the experimental analysis of toxicity is time-consuming and costly, an alternative approach, such as artificial intelligence techniques, could be useful to predict the toxicity of nanoparticles.

Methods: A dataset containing 246 records of nanoparticle properties, along with the effect on various cell lines, was retrieved from the NanoHub repository in 2022. After preprocessing the dataset using K-Nearest Neighbors for imputing missing values, Gini Index was used to analyze the effects of different factors on nanoparticle toxicity. The 10-Fold cross-validation was used to build and evaluate a Random Forest model for the classification of nanoparticles. Hyperparameters of the Random Forest model were optimized by a grid search of parameters using the train data in each fold. The model's performance was evaluated in terms of accuracy, sensitivity, specificity, F-measure, and area under the receiver operating characteristic curve.

Results: Based on Gini Index, the cell type was the most correlated factor with toxicity, followed by exposure dose, tissue, nanoparticle type, specific surface area, and surface coatings. The Random Forest model predicted the toxicity of nanoparticles with a 93.45% (±3.39%) accuracy, 92.70% (±8.20%) sensitivity, and 94.18% (±5.67%) specificity. Also, the F-measure of the Random Forest Model was equal to 92.44% (±3.85%), and the AUC of the ROC was equal to 0.966 (±0.027).

Conclusion: Compared to similar studies, the findings obtained in this study have provided satisfactory results, indicating this momodel'sigh performance. Artificial intelligence techniques could be useful in the prediction of nanoparticle toxicity that results in omitting excessive laboratory work. However, more data is required to create robust models for predicting nanoparticle toxicity.

Keywords: artificial intelligence, nanoparticle, toxicity, data mining, random forest

Computational Hematoxylin-and-Eosin staining of fluorescence confocal microscopy for basal cell carcinoma tissue based on unsupervised deep learning approach

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Background: In the clinical practice of pathology, Hematoxylin-and-Eosin (H&E) staining is the gold standard for basal cell carcinoma (BCC) diagnosis. However, standard H&E staining of high-quality tissue sections requires lengthy and laborious tissue preparation. Fluorescence confocal microscopy (FCM) of fresh or frozen tissue enables fluorescence detection, rapid and high-resolution imaging, with minimal tissue preparation. Despite these advantages, gray-level FCM images are not easy to read for pathologists due to the lack of diagnosis specificity compared with H&E-stained images. To correlate the color of the FCM images with H&E images, this work proposes a deep learning model for the computational staining of FCM images based on an unsupervised approach.

Methods: In this study, we investigated the utility of FCM on BCC tumor sections, stained with Acridine Orange and computationally colored to simulate H&E dyes. We adopted an unsupervised CycleGAN framework to computationally stain FCM images. The dataset consists of unpaired and unannotated thousands of FCM and H&E patches from whole slide images (WSI) of BCC tissue sections. CycleGAN includes two forward and backward GANs which complete a cycle to ensure a reliable transformation between the two domains. The network was trained under adversarial, cycle-consistency, and saliency constraint learning scheme mapping between FCM and H&E images while avoiding distortions of the image content. The coupling of forward and backward mapping together ensures that a generated image is close to its original. The structural similarity index (SSIM) scores were computed between source and reconstructed images to show information preservation for each cycle. We evaluate the quality of the generated images compared to the original images using similarity measures.

Results: We assessed the quality of the images with subtyping BCC and skin tissue characteristics qualitatively. The generated H&E-like images from FCM through this CycleGAN model were qualitatively and quantitatively similar to real H&E images. We also achieved a high cycle consistency for the generator networks by obtaining similarity indices greater than 0.92. Highly resembling H&E staining allow the pathologist's easy adaptation. The application of the Fréchet Inception Distance (FID) was used to measure the quality of generated H&E images and indicated that the similarity improves up to 0.73 after the transformation of images from source to target.

Conclusion: Our results suggest that combining the FCM and computational staining using the CycleGAN model can eliminate the need for BCC tissue preparation steps (except staining). The proposed method has the potential to expand the application of rapid analysis of tissue which is comparable to the standard histopathology images. Thus, using the CycleGAN model for computational staining is beneficial for diagnostic applications with simplifying laboratory staining procedures. We believe that our approach has significant potential in clinical computational staining and advances the progress of computer-aided histology image analysis. Keywords: Basal cell carcinoma (BCC), Fluorescence confocal microscopy, pathology, hematoxylin-and-eosin (H&E), cycle-consistent generative adversarial network (CycleGAN), deep learning

Survival Prediction in Traumatic Brain Injury Patients Using Machine Learning Algorithms

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Background: The prediction of treatment outcomes in traumatic brain injury (TBI) patients is challenging worldwide. The present study aimed to achieve the most accurate machine learning algorithms to predict the outcomes of TBI treatment by evaluating demographic features, laboratory data, imaging indices, and clinical features.

Methods: We used data from 3347 patients admitted at a tertiary trauma centre in Iran from 2016 to 2021. After exclusion of incomplete data, 1653 patients remained. We used 10-fold-cross validation and applied some of the best classification algorithms such as Random Forest and Decision Trees to generate machine learning algorithms. The generated models were tested to determine the best prediction model.

Results: Our findings revealed that among different variables included in this study, motor component of Glasgow Coma Scale, condition of pupils, and condition of cisterns were the most reliable features for predicting in-hospital mortality, while the patients' age takes place of cisterns condition when considering the long-term survival of TBI patients. Also, we found that the random forest algorithm is the best model to predict the short-term mortality of TBI patients. To predict the long-term survival of patients, the generalized linear model had the best performance.

Conclusion: Our results showed that using appropriate markers, machine learning algorithms can provide a reliable prediction of TBI patients' survival in the short- and long-term with reliable and easily accessible features of patients.

Artificial Intelligence Model for Cardiovascular Incidence Prediction: A Practical Deep Learning Approach Based on Isfahan Cohort Study

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Background: Over the last decade, the dramatic improvements in Artificial Intelligence (AI) and Machine Learning (ML) approaches have had remarkable achievements in Cardiovascular Disease (CVD) predictions. However, Studies have indicated that recent Artificial Intelligence developments such as Deep Learning strategies could be more effective than both classic ML and classic statistical models in estimating the risk of CVD incidence in large-scale cohort studies. In fact, Deep Learning approaches are much more efficient in dealing with high dimensional large datasets. Thus, this cutting-edge technology is capable of considering various factors including parameters with indirect impacts on development of cardiovascular diseases.

Method: By utilizing of Deep Learning algorithm and a Deep Neural Network (DNN), we developed a risk prediction model for the incidence of cardiovascular diseases based on a 13-year dataset garnered from Isfahan Cohort Study (ICS). ICS is an ongoing population-based longitudinal cohort study performed in central areas of Iran, starting from 2001. The primary aim of ICS was to evaluate the risk factors of CVD including myocardial infarction, stroke, unstable angina and sudden cardiac death in a large Iranian population. The learning data frame current model includes 58 diverse variables containing information about clinical, laboratory, socio-economic, demographic and lifestyle components of each participant.

Results: Among 6504 participants at the baseline, 4370 individuals were chosen with no history of CVD background. The target population and had was completely followed up data up until the end of ICS's first phase and of the ICS. during the period, 413 CVD events were recorded. The ANN proposed model fully connected neural network demonstrated considerable precision in predicting 13 years CVD incidences with accuracy classification score of 90.52% (the accuracy score has been used as a metric and it is calculated by dividing the number of correct predictions by the total prediction number).

Conclusion: In this study we developed a practical risk assessment model for predicting the incidence of CVD in Iranian population using Deep Learning and AI algorithms.

Keywords: Deep learning, CVD incidence, Fully Connected Neural Network, AI

Predicting pain score in different doses of ondansetron using a powerful machine learning method in upper limb orthopedic patients

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ABSTRACT

Predicting pain scores in patients can help identify the appropriate analgesic dose. In this research, two different doses of ondansetron (2 and 4 mg) in combination with lidocaine were compared with the lidocaine group alone. In addition to comparing the three groups, different input parameters were used to model the pain score using new machine-learning methods. The two conventional training algorithms, Levenberg-Marquardt (LM) and Scaled Conjugate Gradient (SCG) were coded in MATLAB software to model the pain score. After comparing the pain scores in the three groups, the third group with a dose of 4 mg had a lower pain score at different times. The linear regression results between the output of the developed artificial neural network and the corresponding targets show a high correlation coefficient.

Background and aims: Simple and inexpensive methods of intravenous regional anesthesia are used in many orthopedic surgeries. Predicting the pain score at different times helps to estimate the appropriate analgesic doses. The purpose of this article is to predict the pain score using different doses of ondansetron.

Method: 90 patients with upper limb injuries underwent intravenous regional anesthesia. Patients were divided into three different groups of 30 people, including group 1 of lidocaine alone, group 2 of lidocaine with 2 mg of ondansetron, and group 3 of lidocaine with 4 mg of ondansetron. Then, the pain score was evaluated before injection, 5 and 10 minutes after injection, when draining the tourniquet, and 5 to 60 minutes after draining the tourniquet in 5-minute intervals using a visual analog scale that was taught to the patient before the operation. In order to model, an artificial neural network with LM and SCG optimizers was used. The variables of age, sex, systolic and diastolic blood pressure, heart rate, and pain at the mentioned times were used as inputs of the artificial neural network. 70%, 15%, and 15% of the input data were used for training, testing, and validation, respectively. The number of layers and hidden neurons in each layer for the LM optimizer are 2 and 8, respectively. For the SCG optimizer, these values are 1 and 10.

Results: In the third group, the results showed less pain score than the other two groups. The correlation coefficient (R-value) of the model developed using machine learning in all 3 groups of data is higher than 80%. To check the developed model more accurately, one person from each group of 30 patients was used to estimate the pain score. The root mean square error value for all 3 patients was below 2% and the results show the accuracy of the SCG training method for higher doses of ondansetron.

Conclusion: The statistical results of modeling and estimating the pain score of orthopedic patients using machine learning show the high accuracy of this method, which can help to predict the appropriate doses of medication in the next few minutes. The pain score estimated at different times, in addition to showing the effectiveness of ondansetron, indicates the need to prescribe painkillers.

Keywords: Machine learning, Ondansetron, Orthopedic Patients, Artificial Intelligence, Pain.

Brain tumor segmentation using morphological operation and threshold in PET images

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ABSTRACT

Background and aims: This study aimed to propose a model based on a mathematical operation on each slice of PET image to segment the tumors in three-dimensional (3D) images of patients' brains

Method: Our experiments were done on the relevant data obtained from the public dataset of the HECKTOR challenge. In our study, only PET images with careful reference to the CT images were used. Hence, PET images of 408 patients with brain tumors were used to test the model. We used Non-Local Means (NLM) noise reduction algorithm to minimize the loss of the essential image information and remove its noise. After pre-processing, morphological operations measured the similarity of the intensity and edge information in the image after setting areas with the same sized label located. Then, the images were filtered in three steps based on the location field filters, including Gaussian, median, and mean filters. The Dice score and accuracy are used to compare the manual and predicted segmentation.

Results: The Dice score is applied to calculate overlap among segmented outcomes of the proposed model with ground truth annotations. Our proposed method achieved an average Dice score of 81.47 ± 3.15 and an accuracy of 94.03 ± 4.44.

Conclusion: The presented algorithm makes it feasible to produce a patient-specific segmentation of the tumor region without manual interaction. In summary, this model may be highly effective for segmenting other organs from small amounts of annotated medical images.

Keywords: brain tumor, segmentation, morphological operation, PET images

Predicting the cognitive ability of young women using a new feature selection algorithm

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ABSTRACT

Background and aims: Cognitive abilities are the mental capabilities to perform several processes that include: executive function, comprehension, decision-making, work performance, and educational attainment. This study aimed to investigate the relationship between several biomarkers and individuals' cognitive ability using various machine learning methods and a new feature selection algorithm.

Method: A total of 144 young women aged between 18 to 24 years old were recruited into the study. Cognitive performance was assessed using a standard questionnaire. A panel of biochemical, hematological, inflammatory, and oxidative stress biomarkers in serum and urine was measured for all participants. A novel combination of feature selection and feature scoring methods in a hierarchical ensemble structure has been proposed to find the most effective features to recognize the importance of various biomarker signatures in predicting cognitive abilities in young women. Feature selection with different classifiers was used to construct models. In this manner, using three filter methods, the scores of each feature were considered. The union of high-scoring features for each filter method was stored as the primary feature subset. Moreover, the high-accuracy feature subset was selected by a wrapper method. 10-fold cross-validation was applied and repeated ten times to avoid random events in searching the feature subset. Afterward, the most repetitive features were chosen using the relative frequency of each feature in ten folds that were higher than a defined threshold. Ultimately, if a high-scoring feature provided a high relative frequency, it could be nominated as a significant feature. This step gives the best feature subset to reduce feature dimensions while preserving accuracy.

Results: Among the 47 extracted factors, the serum level of nitric oxide (NO), alkaline phosphatase (ALP), phosphate as well as blood platelet count (PLT), were entered into the model of cognitive abilities with the highest accuracy using a decision tree classifier.

Conclusion: The serum levels of NO, ALP, phosphate, and blood PLT count, may be important markers of cognitive abilities in apparently healthy young women. These factors may provide a simple procedure to identify mental abilities and earlier cognitive decline in healthy adults.

Keywords: Algorithms, Biomarkers, Cognitive Performance, Feature Selection Methods, Machin Learning

T2-Weighted (T2W) synthesis from brain Fluid-Attenuated-Inversion-Recovery (FLAIR) images and vice versa based on deep learning methods

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ABSTRACT

Background and aims: In this study, considering the importance of T2-Weighted (T2W) and Fluid-Attenuated-Inversion-Recovery (FLAIR) scans, we focus on generating FLAIR from T2W MRI scans, and vice versa, based on the CycleGAN.

Method: The data utilized in our study were obtained from the public data collection 'ACRIN-DSC-MR-Brain'. We extracted 510 T2W/FLAIR paired slices from 102 patients, which were further divided into 410 pairs from 81 patients for training and 100 pairs from 21 patients to evaluate synthesis results. Each pair include the axial paired T2W/FLAIR slices for the same patient and at the same axial depth. Of note, the testing data are held out of the training process at all times. Our networks take 2D axial-plane slices of the volumes as inputs. The Cycle Generative Adversarial Network (CycleGAN) model was applied for the synthesis task. The proposed CycleGAN operates with two generators (GT2W, GFLAIR) and two discriminators (DT2W, DFLAIR). Given a T2W image, GT2W learns to generate the respective FLAIR image of the same anatomy that is indistinguishable from real FLAIR images, whereas DT2W learns to discriminate between synthetic and real FLAIR images. Similarly, given a FLAIR image, GFLAIR learns to generate the respective T2W image of the same anatomy that is indistinguishable from real T2W images, whereas DFLAIR learns to discriminate between synthetic and real T2W images. To generate a T2W MRI from a FLAIR, and vice versa, the T2W and FLAIR values are converted to [0, 1] tensor. The resolutions of the FLAIR and T2W images in our dataset are 256× 256 and 512× 512 respectively. Therefore, in the first preprocessing step, FLAIR images are registered to T2W images using rigid registration to ensure that all images have a 256 × 256 resolution. Then, the axial T2W/FLAIR pairs were the input of the network with 256×256 pixels. Performance evaluation is conducted based on the Mean Absolute Error (MAE), Mean Squared Error (MSE), and Peak Signal-to-Noise Ratio (PSNR) metrics.

Results: It has been shown, via a perceptual study and in terms of quantitative assessments based on MAE, MSE, and PSNR metrics, that CycleGAN can be used to generate visually realistic MR images.

Conclusion: The CycleGAN method can be used to generate realistic synthetic T2W and FLAIR brain scans, supported by both experimental qualitative and quantitative results.

Keywords: T2W, synthesis, FLAIR, deep learning

Design at home Sperm Test Medical Device (SPOO) based on Machine Vision

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Background and aims: Unfortunately, one in six couples is affected by infertility in the world. It is interesting to know that men and women have an equal share of this problem. Diagnosis is the first step in solving this problem. Usually, couples go to the laboratory to take a test but this process can be very embarrassing, expensive, time-consuming, and stressful. Among couples presenting for infertility assessment, 18% to 27% of men will not be tested. We designed a self-test medical device (SPOO) enabling men to test, analyze, and improve their sperm quality from the comfort of their own homes. SPOO is a smartphone-based home sperm test application that evaluates sperm count, motility, and morphology and gives a complete fertility report that can be shared with a doctor. The aim of this paper is to introduce a smartphone-based Home Sperm Test accurately and precisely measure sperm total motility, morphology and count versus the CASA, an automated laboratory semen analyzer.

Method: 350 human semen samples were tested by professionals at two sites utilizing the SPOO Home Sperm test kit. In parallel, the same samples were tested on the CASA automated semen analyzer (VIDEO TEST SPERM 3.1). Samples were collected, liquefied, split and run in a blinded fashion. Professionals ran the SPOO test using the SPOO device on either a Galaxy Smartphone following the SPOO app. SPOO uses the smartphone's camera and light source and the SPOO Clip (a mini-microscope) to capture a moving sperm video. Using proprietary algorithms, the app analyzes the video and translates these movements into sperm count, motility and morphology.

Results: The SPOO device demonstrated good correlation and good to moderate agreement with the CASA for count and total motility parameters.

Conclusion: The smartphone based device (SPOO) is affordable and convenient option for men wanting an answer about their fertility as soon as possible. The smartphone-based device has a high level of accuracy and precision when compared with the CASA. In the absence of a clear-cut evaluation and diagnosis of the male partner, the female partner may undergo unnecessary and unsuccessful medical interventions. This highlights the need for an at-home semen screening test that is relevant, accurate, easy to use, and affordable. Thus, the SPOO can improve patient satisfaction and empowerment.

Keywords: artificial intelligence, infertility, sperm, analyze

Using deep learning networks for classification of lung cancer nodules in CT images

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Abstract

Purpose: One of the foremost common cancers around the world is Lung Cancer (LC) which evaluation of its incidence very important for more robust planning. Computerized Tomography (CT) is important for the diagnosis of lung nodules in carcinoma. The aim of this article is to create an expert system to help doctors reduce human errors. In each CT scan, a considerable amount of image is generated and sent to the doctor. Studying these images with maximum accuracy in a short time is not possible and therefore problems arise. Small cancerous nodules may not be detected in the early stages, leading to lower survival rates. Therefore, developing an algorithm for image analysis is necessary and leads to increased accuracy in diagnosis. The assistive diagnostic system marks suspicious areas and doctors can have a faster and more accurate assessment of the patient's condition by re-analyzing them. The main problem that this project seeks to solve is human errors caused by current clinical methods for lung cancer detection, which are characterized by low accuracy and speed. The current project seeks to answer the fundamental question of whether the analysis of CT scan images from Iranian patient samples using a computer and artificial intelligence methods can reduce human errors or not.

Method: The location and size of the cancerous gland are among the practical information provided by CT scan images. Medical images of lung cancer patients will be valued as input to the data algorithm so that machine learning is completed In this paper, open-source datasets, and multicenter datasets are used. Three CNN architectures (VGG16, VGG19, and InceptionV3) were designed to detect lung nodules and classified them into two malignant or benign groups based on their pathological and laboratory results.

Results: The output of this study is automated diagnostic software, which is used by customers of clinics and hospitals involved in the diagnosis of cancer, and will be used in other centers for lung cancer screening. By developing such algorithms, it is possible to prevent patient deaths due to incorrect and delayed diagnoses and the financial damages that Iranian families suffer at individual, economic, and national levels. In addition to self-sufficiency in issuing practical knowledge, it should be noted that the accuracy of these three architectures (VGG16, VGG19, and InceptionV3) was 98.3%, 99.6%, and 99.5%, respectively, and there was no difference in sensitivity and specificity between larger and smaller nodes.

Conclusion: The model's credibility was evaluated by manual CT evaluation by physicians, and the performance of the CNN model was found to be better and more accurate than the manual method. The results showed that among the CNN architectures, VGG19 had the best performance with an accuracy of 99.6% among the three networks.

Keywords: Deep learning, Lung Cancer, early diagnosis, Computed Tomography

Deep Learning-Based Pediatric Bone Age Estimation Using Enhanced Images and Pretrained Models

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Background and aims: Pediatric specialists usually apply radiography images to evaluate the maturity of bones where a large discrepancy between the evaluated age and chronological age suggests a growth disorder. This procedure usually takes time and is subject to intra-observer and inter-observer variability. This procedure usually takes time and is subject to intra-observer and inter-observer variability. Therefore, using artificial intelligence, especially deep learning methods, is vital for automated bone age assessment.

Methods: In this study, a convolutional neural network is used for pediatric bone age estimation, where pre-trained models are used for transfer learning. Prior to fine-tuning the pre-trained model, the input images are preprocessed to enhance the poor quality of images.

Results: The presented method in this study is evaluated on the RSNA pediatric bone age dataset. The results show that fine-tuned DensNet-121 pre-trained model satisfactorily outperforms other pre-trained models with a mean absolute error (MAE) of 9.8 months, which is comparable to cutting-edge techniques.

Conclusion: These results show that preprocessing and transfer learning can effectively enhance the predictive power of the proposed method.

Keywords: Artificial Intelligence, Bone Age, Deep Learning, Transfer Learning

An Adaptive Neuro-Fuzzy Inference System to predict Acute Lymphocytic Leukemia prognosis in children

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Background and aims: Leukemia is the most common cancer in children, and the most common leukemia is Acute Lymphocytic Leukemia (ALL). Prognosis can play an important role in timely treatment and reduction of subsequent complications. Therefore, the aim of this study was to develop an Adaptive Neuro-Fuzzy Inference System to predict Acute Lymphocytic Leukemia prognosis in children.

Method: This study was conducted in 2022 and consisted of two main phases. In the first phase, the prognostic parameters were determined based on the literature review and by investigating specialists' perspectives by using a questionnaire. The face and content validity of the questionnaire was approved by the experts in the field of medicine. The reliability of the questionnaire was calculated by using the test-retest method. In the second phase, this system was designed and implemented by using ANFIS toolbox in MATLAB. Then, system performance was evaluated. An online dataset was used to test the sensitivity, specificity, and accuracy of the system.

Results: According to the physicians, the most important parameters were age, sex, white blood cell count at diagnosis, rate of decrease in cancer blood cell count after initial treatment, whether the source of cancer blood cells is B lymphocytes or T lymphocytes, specific changes in lymphocyte chromosomes, Leukemia was found in the brain and spinal cord, the child had Down syndrome, the duration of the cancer, and the type of treatment. The system was designed and the evaluation results showed that the values of sensitivity (87%), specificity (91%), accuracy (85%) were in good condition.

Conclusion: The results of the system were largely similar to the patients' records and showed that the designed system can be used to help physicians to predict prognosis of ALL patients and to improve the quality of care services and life for these patients.

Keywords: Adaptive Neuro-Fuzzy Inference System, Artificial Intelligence, ANFIS, Prognosis, Acute Lymphocytic Leukemia

Robust Deep Stack Auto-encoder Approach for Image Classification: A Novel Fuzzy Attitude

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Background and Objectives: Deep learning has been recently integrated with fuzzy logic to learn efficient models against uncertainty factors. Due to the daily spread of imaging equipment, different types of uncertainty appear in image analysis tasks. In general image analysis applications, uncertainty management is a challenging issue. Furthermore, image analysis issues involve uncertainty in low-level and high-level features, which are not evaluated in related research works already. Developing a novel image classification approach to evaluate the uncertainty in several feature levels is the main motivation of this study. The main purpose in this paper, a robust deep stack auto-encoder model is proposed for image classification while uncertainty is evaluated in several levels of features.

Methods: Deep learning-based models have demonstrated outperformance in different image classification tasks in recent years. To address uncertainty issues, we employ a fuzzy attitude to deep learning that decrease the effects of uncertainty in image data. A deep stack auto-encoder model is proposed in this paper in which fuzzy membership degrees are applied to the activation function of the neurons in the deep model. More adaptability and especially higher degrees of freedom in fuzzy parameters contribute to better manage the inherent uncertainties in complex data to a large extent.

Results: The experiment is performed on three imbalanced image datasets, including CIFAR-10, Caltexh101, and Caltech256. The experimental results of the proposed classification method applied to these datasets demonstrate that the deep stack auto-encoder model with fuzzy attitude can adequately minimize the negative effects of uncertainty in input images.

Conclusion: Comprehensive comparisons between the proposed model and some other state-of-the-art classification methods are performed. The performance results show the outperformance of the proposed model compared to other recent strategies. Additionally, the evaluation results indicate the robustness and efficiency of this model in uncertainty management.

Keywords: Deep auto-encoder, Image classification, Fuzzy logic, Uncertainty, Activation function.

A deep learning framework for Segmentation of acute ischemic stroke lesions on multimodal MRI images

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Background: Accurate segmentation of stroke lesions on MRI images is very important for neurologists in planning of post stroke care. Segmentation helps clinicians to better diagnosis and evaluation of the any treatment risks. However, manual segmentation of brain lesions relies on the experience of neurologists and is also a very tedious and time-consuming process. So, in this study, we proposed a deep convolutional neural network (CNN-Res) that automatically performs segmentation of ischemic stroke lesions from multimodal MRIs.

Methods: CNN-Res used a U-shaped structure, so the network has encryption and decryption paths. The remaining units are embedded in the encoder path. In this model, to reduce gradient descent, the remaining units were used and to extract more complex information in images, multimodal MRI data were applied. In the link between the encryption and decryption subnets, the bottleneck strategy was used, which has reduced the number of parameters and training time compared to similar research.

Results: CNN-Res was evaluated on two distinct datasets. First, it was examined on a dataset collected from the Neuroscience Center of Tabriz University of Medical Sciences, where the average Dice coefficient was equal to 85.43%. Then, to compare the efficiency and performance of the model with other similar works, CNN-Res was evaluated on the popular SPES 2015 competition dataset where the average Dice coefficient was 79.23%.

Conclusion: This study presented a new and accurate method for segmentation of MRI medical images using deep convolutional neural networks called CNN-Res, which directly predicts segment maps from raw input pixels.

Keywords: ischemic stroke, Convolutional network, Lesion segmentation, MRI, Informatics, Deep learning

An efficient approach to deal with the lack of data in medical image segmentation applications using Capsule Networks

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Backgrounds/Aims: Gathering huge dataset is the first step towards successful implementation of the AI-based medical applications. Availability, prevalence and the hardness of annotating a large amount of data is the main obstacle for training Deep Convolutional Neural networks (DCNN). In another point-of-view the tradeoff between the model complexity and the intrinsic complexity in the feeding input is the vital point as it could lead to over-fitting and under-fitting problems and made a model with less convergence and generalizability. Many methods have been developed to handle the lack-of-data based on some data processing and multi-stage training in standard CNNs. Capsule networks are robust and efficient techniques to handle this problem in medical applications . The goal of this research is to evaluate the outcome of the SegCaps network by employing a limited amount of data rather than the state-of-the-art segmentation methods. We committed with the principles of the capsule networks and tried to converge the network utilizing less than 1.2 million of training parameters.

Method: In this research almost 20 percent of the entire of two public datasets, the BRATS2020 and LIDC-IDRI CT, selected in which slices extracted randomly then be applied Capsule networks. Capsule networks besides having dynamic routing, gain vector encoding to extract more informative features even in shallower levels of the model structure. We removed the reconstruction loss and proposed a prediction layer based on one-dimensional convolution filters. Using this technique the texture features inside the target regions could be utilized to regularize the network toward extracting output capsules with similar orientation. Finally Disc score was evaluated for every dataset and compare with previous results that gotten by U-Net architecture.

Results: The results showed that the proposed architecture and the proposed loss function has enough capability to train on a limited dataset with fewer parameters than U-Net. We achieved the Dice score of 88.1 and 95.71 in BRATS2020 and LIDC-IDRI CT dataset respectively. The results are comparable with state-of-the-are U-Net using the smaller training dataset and less than 1.2 million of parameters compare to the 31 million parameters of the U-net network.

Conclusion: SegCaps is the first development of the basic capsule network into the segmentation applications. Utilizing limited spatial window and routing inside these kernels between capsule types, the network could effectively route the capsules to the next level. The study implied reasonable result can be obtained by following principles of the capsule networks and tried to converge the network utilizing less than 1.2 million of training parameters. In fact SegCaps is able to manage lack of data and reduce the number of parameters of U-Net architecture.

Keywords: Capsule Network, Deep Learning, CNN, Medical image, lack of data

Management of Thyroid Nodules Based on ACR-TIRADS in Ultrasound Images by Deep Learning

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Background and aims: Interpreting thyroid ultrasound images is time-consuming and has inter-observer variability. This study develops a computer-aided diagnosis system for thyroid nodules risk stratification and management recommendations based on the American College of Radiology (ACR) Thyroid Imaging Reporting and Data System (TIRADS) by deep learning to improve diagnosis accuracy and reliability.

Methods: In this retrospective analysis, 2450 thyroid ultrasound images with 3250 nodules were acquired from 1037 patients from 2018 to 2020 at a single institution. Our proposed automated method had four main steps: preprocessing and image augmentation, nodule detection, nodule classification based on ACR-TIRADS, and risk-level stratification and treatment management. We trained different state-of-the-art pre-trained convolutional neural networks (CNN) to choose the best architecture in the detection and classification stage. We compared the performance of our method and three experienced radiologists.

Results: Comparison results show that the Faster R-CNN ResNet-101 has a better performance in the detection stage and fine-tuned Xception model with attaining 0.98% accuracy, 0.99% AUC, 0.967% precision, and 0.912% recall selected as the backbone of the classification stage. the result demonstrated that the performance of our algorithm was better than three radiologists by achieving a mean kappa value of 0.85% in five ACR-TIRADS categories compared with the gold standard.

Conclusions: This study, in addition to generating a valuable database of thyroid US images, demonstrates that our method can effectively improve the performance of thyroid nodule assessment and can assist the radiologist as an adjunct clinical tool to improve efficiency, reliability, and diagnosis performance in clinical practice.

Keywords: Deep learning, thyroid nodule, nodules risk stratification, ultrasound

Analysis of Lung Scan Imaging Using Combination of Image Processing Algorithms and Deep Multi-Task Learning Structure for Covid-19 Disease

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Background and aims: COVID-19 is a global health challenge with over 458 million confirmed cases and 6.1 million deaths worldwide as of March 2023. Accurate diagnosis of lung infections through computed tomography (CT) scans is crucial for effective treatment. However, manual diagnosis is time-consuming and subjective. Therefore, this study proposes an automated multi-task deep learning model for the segmentation and classification of CT scans to detect infected areas. To increase the efficiency of the model, CT scan images were enhanced using image processing algorithms before entering the network.

Method: In this study, an encoder-decoder model based on the U-net architecture was used. In the pre-processing phase, a median filter and mathematical morphology operation were applied to the input images to improve their quality. The encoder was responsible for feature extraction, and the number of filters increased from 64 to 1024 in the encoder. Skip connections were used following each convolutional block to preserve information. Then, the decoder level began with a sampling layer, followed by a convolution to decrease the number of features by a factor of 2 in the segmentation task to detect areas affected by COVID-19 and other infections, as well as healthy regions. In the classification task, a multilayer perceptron was used, and 4 neurons were considered for each class of the task in the last dense: COVID-19, normal, other infections, and combined infections. Since both classification and segmentation tasks used the same dataset, it was necessary to use a dataset that had both masks and labels. The proposed model was trained using two-dimensional CT scans with allocated masks and labels obtained from the Italian Society of Medical and Interventional Radiology, and by applying data augmentation techniques to the dataset, the number of slices increased to 1311 images. Images were segmented by a radiologist. However, in the segmentation task of the proposed model, infected areas infections and healthy regions were considered as segmentation labels.

Results: The model achieved an accuracy of 97.16%, MSE of 0.02, and mean dice of 88.89±0.02 in the segmentation task. In the classification task, the model used a combination of median filter and morphology operation to achieve an accuracy of 97.75% and AUC of 0.97. The median filter alone achieved an accuracy of 0.96 and mean dice of 88.78 ± 0.06 in the segmentation task and an accuracy of 0.97 and AUC of 0.97 in the classification task. Similarly, the morphology operation achieved an accuracy of 0.96 and mean dice of 88.79 ± 0.04 in the segmentation task and an accuracy of 0.96 and AUC of 0.97 in the classification task. The model successfully identified infected areas in lung CT scans and segmented them accurately.

Conclusion: This paper proposes an efficient deep multi-task learning structure for Covid-19 disease, which uses image processing algorithms in the pre-processing phase. The model showed the highest results among previous studies. The proposed model could be applied as a primary screening tool to help primary service staff better refer suspected patients to specialists.

Keywords: COVID-19, Lung infections, Computed Tomography scan, Automated diagnosis, Multi-task structure

A MobileNetV2-based Android Application for Acute lymphoblastic Leukemia diagnoses and classification of its subtypes

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Background and aims: B-cell acute lymphoblastic leukemia (ALL) is a common type of cancer, and a conclusive diagnosis involves intrusive, expensive, and potentially harmful diagnostic procedures. However, in many locations, access to accurate ALL diagnostic tools is restricted. Blood microscopic analysis has long been the main ALL screening and diagnosis method. However, there are inherent limits to the microscopic analysis of blood performed by laboratory staff and hematologists. In contrast, image analysis of blood microscopy data using artificial intelligence (AI) approaches has demonstrated encouraging outcomes. This study's goal was to create and use a well-optimized deep convolutional neural network (CNN) to identify the subtype of ALL by first detecting ALL instances in hematogenous.

Method: A mobile application was developed with the objective of accurately differentiating between instances of ALL and hematogone cases, utilizing a well-designed and optimized model. The segmentation of images was carried out during the modeling stage using a specialized technique based on unique segmentation. The K-means clustering algorithm was applied to segment the images and remove irrelevant components, followed by the addition of a mask to the clustered images. After evaluating the performance of six popular lightweight CNN architectures (MobileNetV2, ResNet50, DenseNet121, MobileViT, ShuffleNetV2, and NASNetMobile), the most effective model was chosen. The proposed model was then configured and fine-tuned based on this selected architecture.

Results: The proposed model exhibited a remarkable accuracy rate of 99.98%. Based on this state-of-the-art model, a mobile application was developed. The mobile application, built upon the suggested model, effectively differentiated ALL cases from other classes in a real laboratory setting, demonstrating a 99.88% sensitivity and specificity. This successful implementation establishes the mobile application as a reliable screening tool for ALL.

Conclusion: The mobile application, which incorporates preprocessing and deep learning (DL) algorithms, can be employed by hematologists and clinical specialists as a powerful screening tool to potentially reduce unnecessary bone marrow biopsy cases and expedite the diagnosis of ALL. This application has the potential to significantly shorten the time required for ALL detection and diagnosis, thereby improving clinical efficiency and patient care.

Keywords: Mobile Application, Acute Lymphoblastic Leukemia, MobileNetV2, ResNet50, DenseNet121, MobileViT, ShuffleNetV2, NASNetMobile

Mortality risk assessment of COVID-19 Patients using Cause-specific hazard regression models: The Khorshid COVID-19 Cohort study

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Background and aims: Simple tools are needed so that clinicians can identify high-risk from low-risk patients during hospitalization. Predicting the clinical course of COVID-19 patients helps manage patients in the hospital and make correct and timely clinician decisions. It has been proven that Machine learning and survival analysis methods effectively predict the mortality of COVID-19 patients.

Method: Using Cause-specific hazard regression models on the Khorshid Cohort COVID-19 (KCC) data set, a color risk chart was presented using the following variables at hospital admission: age, gender, oxygen saturation, Charlson comorbidity index, Blood Urea Nitrogen, Creatinine, Bicarbonate (HCO3), Partial Pressure of Carbon Dioxide (PCO2), Lymphocyte, and blood platelet count. The evaluation of the model was performed on the validation data, and the area under the receiver operator curve (AU-ROC) and the calibration curve with the related parameters, including calibration-in-the-Large, calibration in Slope, and R-Square, was provided.

Results: Age over 75 years (HR=3.10 [CI95%: 0.59-16.21]) was the most effective variable in the mortality of COVID-19 patients. The risk analysis method in the validation set had excellent diagnostic accuracy and suitable coverage for the entire risk values regarding the calibration curve (Calibration in the Large =0, Calibration on Slope =1). In the validation data, $\hat{\sigma}$ = 0.72 and AUC = 0.97 [CI95%: 0.86-0.91] were reported.

Conclusion: The proposed risk chart can help with resource allocation and management of medical centers during the pandemic as part of the pandemic preparedness. The external validation of the proposed model is the focus of our future activity.

Keywords: Machine Learning, COVID-19, Mortality, Prognosis, Risk assessment, Risk chart, Calibration.

Designing a multi-Epitope Vaccine against Parkinson's Disease: An Immunoinformatics and AI approach

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Background and aims: Parkinson's disease (PD) is caused by significant loss of nigral cells and the proliferation of α-synuclein in distinct regions of the cortex, spinal cord, and brain stem. It is estimated that between 5 to 20 cases of PD occur per 100,000 people in years. While some cases of PD can be linked to genetic inheritance patterns, some cases could be related to environmental elements or a combination of genetical and environmental aspects. There is controversy surrounding the potential role of infections in causing PD. A neurovirulent strain of influenza type A virus has been displayed to particularly target the substantia nigra. However, some infections, such as chickenpox, mumps, measles, and Helicobacter pylori, are inversely related to PD. Additionally, proteins such as glucocerebrosidase (GBA), leucine-rich repeat kinase 2 (LRRK-2), and α-synuclein could play a vital function in susceptibility to PD. In this article, we designed a multi-epitope vaccine against human proteins, bacteria, and viruses that are predisposing factors for PD. We used computational reverse vaccinology to deviate immune response and Th1/Th2 balance via the introduction of a novel immunogenetic chimera protein.

Method: Epitopes from proteins, bacteria, and viruses were identified. Predicting MHC-1, MHC-2, and CTL epitopes using bioinformatics online tools. Then these epitopes were linked together with a TAT peptide, adjuvant, and IL-10 inducer sequence to form a chimeric vaccine. The vaccine sequence was created using MODELLER, and the 3D structure was refined using a Ramachandran plot. The vaccine and TLR-4 were docked, and a molecular dynamics (MD) simulation of the vaccine-TLR4 complex was performed using GROMACS. The C-ImmSim server was used to stimulate the immune response to the chimeric vaccine. We predicted the solubility, antigenicity, and allergenicity of the structure.

Results: The developed model was confirmed to be stable with an enhanced ERRAT outcome above 80%. The Ramachandran plot exhibited that over 95% of the residues resided in a favorable and permissible location. Molecular dynamics simulations (MDS) demonstrated that the docked vaccine-TLR4 had a stable formation. Moreover, the result related to solubility, antigenicity, and allergenicity were acceptable. GRAAVY evaluation showed the vaccine was mildly hydrophilic. We designed a vaccine against viruses that have a protective role against Parkinson›s as by such pathogenic epitopes the immune system will be stimulated in a similar manner. Ultimately, simulations of the immune response showed a good reaction from both the innate and adaptive immune systems. The memory response and cytokine profiles were favorable. SnapGene cloning and gel simulations showed successful cloning of the vaccine protein in pET-21 b(+) / MEV.

Conclusion: We developed an immunogenic vaccine against PD using Immunoinformatics and corroborated its favorable properties. This vaccine has significant value because it serves multiple purposes, providing immunity against all mentioned risk factors and PD itself. The results obtained through computer simulation can aid researchers in developing a vaccine for PD in real-world preclinical and clinical experiments.

Keywords: Parkinson's disease, chimeric vaccine, Immunoinformatics, bioinformatics

Developing data visualization tools to improve the efficiency and ease of healthcare analysis

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Background and aims: Clinical practice units, teams, and hospitals are increasingly relying on electronic medical records to collect, store, retrieve, and analyze patient-related data. physicians often have to use multiple tools to gather patient status from heterogeneous databases to get a complete health assessment. Therefore, this research was carried out by developing a dashboard based on augmented reality for efficient visualization of data in the nephrology department of Imam Khomeini Hospital in Urmia.

Method: The current research is in three stages: 1. Determination of data elements using the Delphi method. 2. Nephrology dashboard design and AR interface using PHP and Java. 3. The implementation of the dashboard system in the nephrology department and its evaluation was done using the questionnaire of effectiveness, applicability and interview.

Results: Data elements in 4 classes of demographic information, historical information, clinical information and discharge recommendations for kidney disease dashboard were identified as necessary from the experts' point of view. The results of the evaluation showed that the dashboard has gained the satisfaction of users and is acceptable.

Conclusion: The clinical dashboard of the nephrology department was effective in providing quick access to patient information, in accordance with the user's needs, and maintaining comprehensive patient information to review the treatment process. Also, the designed dashboard facilitated the ability to personalize information to improve patient safety. Therefore, according to the evaluation results, it is necessary to implement such systems to the needs of the target society.

Keywords: dashboard, visualization, augmented reality, kidney disease

Telepharmacy Research Trends; Current Situation and Future Perspective

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Background and aims: Revelation of the Internet and common pharmaceutical care methods limitations have caused the invention of the telepharmacy concept, defined as "providing pharmaceutical services to patients through communication technologies". So far, telepharmacy has made significant achievements in patient telecare in rural areas and providing pharmaceutical services during the Covid-19 pandemic. Studying this field trend can be a valuable basis for determining future perspectives of this field. In the current research, the bibliometric maps of telepharmacy studies and their prospects are reviewed and analyzed.

Method: Considering Aidi Ahmi standards for bibliometric studies, TITLE-ABS-KEY("Telepharmacy"OR"Telepharmacy") search formula was used to extract all Scopus-indexed studies until 2022-09-5 (n=270). Published articles data were included in VOS viewer software (version.6.1.180) and checked with various analysis types, including co-authorship, co-occurrence, and citation, and analysis units including authors, countries, sources, documents, and keywords. Finally, various maps and bibliometric tables were designed, and related quantitative and qualitative analyses were reported.

Results: Our study showed that the first article in this field was published in 1998. The most active author in this field has contributed to only eight articles. International collaborations in this research showed weak relationships. The USA and Spain, with the most articles, were the most focused countries (n=107, 15). Some countries, such as Iran and Australia, had only national research productions. In the case of Iran, only three articles have been published and a leading author has contributed to all of them. The recently published articles used "medication adherence", "virtual pharmacy", "medication dispensing", "emergency medicine", and "hospital disturbing system" keywords more than before.USA, Italy, Spain, and Australia had the most cited articles, all of which were published in American journals. These articles were often prepared with an interdisciplinary approach, especially in collaboration with medical profession researchers.

Conclusion: This study showed that telepharmacy is still a novel research topic. The Covid-19 pandemic was a driving force for it, and our research revealed telepharmacy trends, importance, and future perspectives for scientific communities. The international cooperation of authors needs much more development. We found that authors often consider telepharmacy as an extra field of research. The USA has a critical role in research outputs of telepharmacy research; Iranian researchers need to pay special attention to telepharmacy as their main research field considering future trends. Also, the review of published articles shows that conducting interdisciplinary studies, especially in medicine, provides more opportunities. All in all, we believe that focused, interdisciplinary, international teams should study telepharmacy technology and administration to flourish in this field of research.

Keywords: Telehealth, Telepharmacy, Bibliometrics analysis, VOS viewer

Self-care software for early diagnosis of preeclampsia syndrome

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Background and aims: Preeclampsia is one of the main warning factors for fetomaternal complications. High risk patients need to be carefully monitored for signs and symptoms of preeclampsia to make an early diagnosis and prevent cosmplications. Progress in digital communication and medical technologies has led to the digitization of health care to increase the quality of care and reduce costs, emphasizing the importance of self-care in all medical fields, including fetomaternal medicine.

Method: In the design of this software that was done at obstetrics and gynecology department of Isfahan university of medical sciences between June and September of 2022, minimal data set (MDS) which obtained by preliminary review of guidelines, was finalized by a survey of experienced prinatologists. At first, the most effective risk factors of preeclampsia and diagnostic signs and symptoms of preeclampsia were extracted by preliminary review of guidelines. Then, in 2-round based on expert`s opinions, risk factors in predicting preeclampsia and important diagnostic signs and symptoms, were finalized.

Results: MDS for risk factors of preeclampsia considered as maternal age, nulliparity, multiple pregnancy, BMI, previous history of PIH and underlying maternal diseases. MDS for diagnostic signs and symptoms was obtained as blood pressure measured digitally, epigastric pain and neurological symptoms. If the mother has at least 2 of the 6 final effective risk factors, it is considered high risk and it will be recommended to use this software during the pregnancy. In the case of diagnostic criteria, patients were categorized in three groups including routine care, refer to the health care provider as soon as possible and the urgent need to refer to the health care provider; based on systolic blood pressure, diastolic blood pressure and sever signs.

Conclusion: This software can reduce fetomaternal complications caused by preeclampsia in high-risk pregnant women.

Keywords: artificial intelligence, pregnancy, hypertension

The Impact of Using the Electronic Disease Process Form in Improving the Performance of Diagnosis, Prescribing the Type and Dose of Medicine by the Health Care Providers and the Patient's Response to Treatment in the Electronic Hospital of Mashhad Velayat in 2022

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Background and aims: In health care organizations such as hospitals, medical record forms such as the disease course form are the most important tools for storing and retrieving information and analyzing health care. Their incomplete registration, besides threatening the patient's health, creates many problems for the patient in pursuing treatment and legal issues, such as referring cases to legal medicine, supplementary insurance, occupational accidents, and disability, on the other hand, it also causes problems for hospitals such as increasing hospital deductions and medical errors. As a result, hospitals turned to innovative models based on advanced medical technologies such as electronic health, intelligentization of processes, and smart hospitals. Data and a huge amount of information in these forms can be very useful for physicians' better decision-making. This study aimed to investigate the impact of using the electronic disease course form on improving the performance of diagnosis, prescribing the type and dose of medicine by the health care providers, and the patient's response to treatment in Mashhad Velayat hospital in 2022.

Method: The disease process form is the documentation of the patient's response to the treatment, including the notes of the patient's admission in the form of subjective information, all the treatments provided and the patient's response to the treatment, the final notes of the patient's condition at the time of discharge, recommendations at the time of discharge such as the patient's physical activity and diet, notes related to the progress of the disease at the time of death, which should all be recorded. On the other hand, recording general and vague things to show the patient's condition, such as "the general condition of the patient is good", should be avoided. In the electronic Velayat hospital of Mashhad, the disease process form was prepared and designed according to the promulgated instructions by the Ministry of Health, Treatment, and Medical Education. To implement it, an expert system has been used, which is one of the branches of artificial intelligence and is being greatly expanded. One of the ways that knowledge can be presented in an expert system is through a rule-based system that follows an if/then structure. The information that appears in the 'If' section is logically related to the information that appears in the 'Then' section. By choosing each item (if) different decisions (then) are obtained. Finally, by displaying the response of the patient to the treatment in the section of the patient's condition, which includes surgery and medication, the clinicians are helped in determining the type and dosage of the medication.

Results: In other hospitals, the process of recording disease process form is paper-based without any intelligence or warning alarm. In this study, in the process of electronic recording by displaying the tests of the patient that are outside the normal range ("If" in the rule of an expert system), how the response of the patient to the treatment is determined ("Then" in the rule of an expert system), which leads to the improvement of the performance of diagnosis and prescription, systematic recording of the disease by the physician. It is possible to check the effect of the medicine and the recovery process of the patient by displaying the status of the vital signs of the patient and changes in paraclinical tests, such as blood tests during patient visits.

Conclusion: In this study, based on the electronic prescribing approach, by displaying the patient's paraclinical tests and vital signs in the form of the disease process, the performance of diagnosis and prescribing of the type and dosage of the medication by the physicians was improved.

Keywords: Artificial Intelligence, Expert Systems, Disease Process Form, Electronic Health, Smart Hospital

An Intelligent e-clinic for Computer-aided Diagnosis and Prognosis

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Background and aims: Digitalization influences every individual's everyday private and professional activities. Integrating health information technologies (HITs) significantly improves diagnostics and therapy. The application of machine learning and biostatistical methods could improve public health. We hypothesized and implemented computer-aided diagnosis and prognosis methods for e-clinics.

Method: Cardiovascular diseases, cancer, diabetes, chronic kidney diseases, and Alzheimer's diseases remain the top Years of life lost from mortality (YLLs) and deaths attributed risk factors in the Iranian population by 2040, based on the Global Burden of Diseases (GBD) Foresight Visualization. Over the last 13 years, we have worked on computer-aided diagnosis and prognosis methods in various medical fields. Some of our preliminary web-based programs and Android Apps were provided at http://www.prognosis.ir/. They are based on our international publications on various Cohort studies. One of which, a 10-year non-laboratory-based risk prediction chart developed for fatal and non-fatal CVD using Cox Proportional Hazard (PH) regression, is presented in this work.

Results: Age, smoking status, Systolic blood pressure (SBP), self-reporting history of diabetes, and waist-to-hip ratio (WHR) were used as predictors. The implemented model showed acceptable discrimination and proper calibration. For a 52-year-old smoking diabetic female with a WHR of 1.1 and an SBP of 160 mmHg, the estimated CVD risk is 19%. For a person of the same age and sex but without the risk factors, the risk is 2%, while for the risk factors related to the general Iranian population, it is 3% (Figure 1).

Conclusion: The digital clinic offers a unique design to improve treatment outcomes and public health. We are now working on a broad e-clinic implementation of the diseases with high burden in the Iranian population.

Keywords: e-clinic, intelligent systems, machine learning, digital health, medical diagnosis, and prognosis.

RayaTabib, a new Persian medical advisor application based on artificial intelligence

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Background and aims: In recent years, the use of self-service healthcare systems, that allow people to manage their medical concerns, has become a global trend. Mobile applications are widely used and play an important role in this regard.

Method: We have developed an innovative artificial intelligence-based symptom-checker application, called "RayaTabib". First, a team of 10 medical students, extracted background scientific data, including symptom-disorder lists, as well as epidemiologic data, common clinical findings and risk factors of disorders from several medical textbooks and online databases in the field of differential diagnosis. We revised the collected data according to Iranian population epidemiology, unified the terminology and translated the entire textual material into Farsi. Then, a team of 3 software engineers organized the server database, designed the graphic materials and developed both server and client sides of the system. The output product is a web application that can be used on any device regardless of its operating system type.

Results: The current version is beta version in Farsi language, and covers more than 200 symptoms and 3000 disorders in all medical fields. RayaTabib, is a decision-support system based on artificial intelligence. The user enters age, gender and one symptom, then the system asks specific questions about other symptoms and underlying risk factors, and then analyzes the answers on the server and displays the result within seconds. Database on the server, includes all lists and correlations between symptoms, disorders and risk factors. A software on the server extracts the list of disorders common between all selected symptoms, and computes an index for each disorder according to the information entered by the user. The final list of possible disorders is being sorted according to indices and is completely unique for each patient. RayaTabib, also provides recommendations about whether the patient needs urgent hospital care, family physician visit or specialist visit. This feature is rule-based and is compatible with Iranian healthcare referral system. We have not presented RayaTabib for public use and we first need to evaluate its usability and accuracy, and define our business model.

Conclusion: RayaTabib as a virtual primary care provider, can facilitate access to various healthcare services, reduce unnecessary visits or costs, and ultimately improve Iranian society health. We have conducted several steps of systematic test and user experience test and early results are promising. According to the experience of similar projects in developed countries, RayaTabib seems to be usable in Iran as the first Iranian symptom-checker and medical advisor application. We will conduct a study to evaluate the accuracy of the application regarding its clinical diagnosis and recommendations.

Keywords: artificial intelligence, RayaTabib, symptom-checker, medical application

Designing and evaluating a nutrition recommender system for improving food security in a developing country

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Background: Due to the increased price of foods in recent years and the diminished food security in Iran, nutrition recommender systems as a novel nutrition informatics technology can suggest the most suitable and affordable foods and diets to users based on their health status and food preferences to ensure their food security.

Objective: The present study aimed to design and evaluate a recommender system to suggest healthy and affordable meals and provide a tele-nutrition consulting system.

Methods: This applied three-phase study was conducted in 2019-2020. In the first stage, the food items' daily prices were extracted from credible sources, and accordingly, meals were determined in three price categories. After conducting a systematic review of similar systems, the requirements and data elements were specified and confirmed by experts. In the second stage, the software was designed and developed based on the findings. In the third stage, system usability was evaluated by four experts based on Nielsen's heuristic evaluation.

Results: Initially, 72 meals complying with nutritional principles were determined in three price categories. Following a literature review and expert survey, 31 data elements were specified for the system, and the experts confirmed system requirements. Based on the information collected in the previous stage, the Web-based software TanSa in the Persian language was designed, developed, and presented on a unique domain. During the evaluation, the mean severity of the problems associated with Nielsen's 10 principles was 1.2, which is regarded as minor.

Conclusions: To promote food security, the designed system recommends healthy, nutritional, and affordable meals to individuals and households based on user characteristics. To improve access to nutritionists and enhance the nutritional status of society, this system also allows users to receive a tele-nutrition consulting system. Regarding the current conditions of Iran, nutritionists and researchers are recommended to use this system.

Keywords: Nutrition informatics; recommender systems; food security; mealss

Introducing a deep neural network structure with practical implementation capability for polyp detection in endoscopic and colonoscopy videos

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In recent years, deep learning has gained much attention in computer assisted minimally invasive surgery. Researches have shown that the use of deep learning models in colonoscopy can be divided into four main categories: analysis of surgical images, analysis of surgical operations, evaluation of surgical skills, and surgical automation. Analysis of surgical images can be one of the main solutions for early detection of gastrointestinal lesions and taking appropriate actions for treatment of cancer, which deep learning has shown exceptional performance in this area. Recent studies show that the high accuracy of lesion detection by these models significantly improves colonoscopy efficiency. Therefore, in this study, a simple and accurate structure of deep neural networks for polyp detection is introduce. This model can be implemented with low-cost hardware and provides high-precision polyp detection in real-time. For this purpose, due to the shortage of labeled colonoscopy images, transfer learning was implemented to extract appropriate features from the input images. In addition, multi-task learning with two goals of classifying the images and detecting the bounding boxes of existing polyps in the images. Considering the appropriate weight for each task in the total cost function is crucial in achieving to the best results. Due to the lack of datasets with non-polyp images and the need for them to evaluate the performance of the proposed structure on both polyp and non-polyp images, data collection was carried out. The proposed deep neural network structure was trained on KVASIR-SEG and CVC-CLINIC datasets and tested using cross-validation. Experimental results verify that the proposed structure classifies the images into polyp and non-polyp ones with 100% accuracy. Moreover, it detects the bounding boxes of the polyps with an accuracy rate of 86%, and processing time of 0.01 seconds.

Keywords: Automatic polyp detection, Deep learning, Transfer learning, Image processing.

T2-Weighted (T2W) synthesis from brain Fluid-Attenuated-Inversion-Recovery (FLAIR) images and vice versa based on deep learning methods

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ABSTRACT

Background and aims: In this study, considering the importance of T2-Weighted (T2W) and Fluid-Attenuated-Inversion-Recovery (FLAIR) scans, we focus on generating FLAIR from T2W MRI scans, and vice versa, based on the CycleGAN.

Method: The data utilized in our study were obtained from the public data collection 'ACRIN-DSC-MR-Brain'. We extracted 510 T2W/FLAIR paired slices from 102 patients, which were further divided into 410 pairs from 81 patients for training and 100 pairs from 21 patients to evaluate synthesis results. Each pair include the axial paired T2W/FLAIR slices for the same patient and at the same axial depth. Of note, the testing data are held out of the training process at all times. Our networks take 2D axial-plane slices of the volumes as inputs. The Cycle Generative Adversarial Network (CycleGAN) model was applied for the synthesis task. The proposed CycleGAN operates with two generators (GT2W, GFLAIR) and two discriminators (DT2W, DFLAIR). Given a T2W image, GT2W learns to generate the respective FLAIR image of the same anatomy that is indistinguishable from real FLAIR images, whereas DT2W learns to discriminate between synthetic and real FLAIR images. Similarly, given a FLAIR image, GFLAIR learns to generate the respective T2W image of the same anatomy that is indistinguishable from real T2W images, whereas DFLAIR learns to discriminate between synthetic and real T2W images. To generate a T2W MRI from a FLAIR, and vice versa, the T2W and FLAIR values are converted to [0, 1] tensor. The resolutions of the FLAIR and T2W images in our dataset are 256× 256 and 512× 512 respectively. Therefore, in the first preprocessing step, FLAIR images are registered to T2W images using rigid registration to ensure that all images have a 256 × 256 resolution. Then, the axial T2W/FLAIR pairs were the input of the network with 256×256 pixels. Performance evaluation is conducted based on the Mean Absolute Error (MAE), Mean Squared Error (MSE), and Peak Signal-to-Noise Ratio (PSNR) metrics

.**Results:** It has been shown, via a perceptual study and in terms of quantitative assessments based on MAE, MSE, and PSNR metrics, that CycleGAN can be used to generate visually realistic MR images.

Conclusion: The CycleGAN method can be used to generate realistic synthetic T2W and FLAIR brain scans, supported by both experimental qualitative and quantitative results.

Keywords: T2W, synthesis, FLAIR, deep learning