ARTIFICIAL INTELLIGENCE IN MEDICINE

Abstract

Artificial intelligence (AI) is a relatively new field of study that makes use of computer technology to investigate and develop the concepts, approach, technique, and system of application for practising, expanding, and developing human intelligence. The conventional medical setting has undergone significant transformation with the aid of modern AI technology. In 1940's Alan Turing, father of artificial intelligence, first gave the foundation of AI with his "Turing test". It has great role in diagnosis, pathophysiology, therapeutic, drug development, etc. The combination of AI and medicine gives the traditional medical model more revolutionary outlook.

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I. INTRODUCTION

Artificial intelligence (AI) is defined as the new technical field of study which uses computer technology to form various functions which will normally requires human intelligence. In 1950, Alan Turing first gave the idea of AI and stated that it was far more complex than the human brain. One of the main sectors that would benefit greatly from the integration of artificial intelligence is medicine. Artificial intelligence is able to analyze enormous amounts of data and find underlying patterns, whereas humans are constrained to focusing on one or two tasks at once.

The ability to learn from novel settings and machine learning are two more characteristics of artificial intelligence. It also has the capacity to learn from the shortcomings of other artificial intelligence systems and use that knowledge to enhance performance in the future.

The two main applications in AI are the virtual and physical branches. Virtual branch deals with machine learning/Deep learning which uses mathematical algorithms to improve learning through experience while the physical branch focuses into the tangible objects, medical equipment, and increasingly complex robots that facilitate the delivery of healthcare.

AI might successfully introduce the general public to the 4P models of medicine, which are preventative, personalized, participatory, and predictive. Augmented medicine aims to use medical technologies in improving different aspects of clinical practice. Surgical navigation systems for computer assisted surgery, virtuality-reality continuum tools for surgery, pain management and psychiatric disorders are some of the mentioned applications of AI-based technologies.

Despite all of AI's ground-breaking advances to medicine, some medical practitioners still oppose it due to professional identity and self-threat. Self-threat refers to a threat to a person's identity that is independent of context and which involves core self-motivations such as distinctiveness, continuity, generalized self-efficacy, and self-esteem. Threats to professional identity also refer to challenges to the knowledge and prestige of medical professionals as well as threats to professional skills, which refer to the performance of roles associated with performing medical work.

Although the current and popular view in the literature is that AI will complement physician intelligence in the future, there is growing concern about the possibility of AI replacing doctors. The physicians are vulnerable to potential legal results while utilizing AI because there is currently no global legal framework that establishes the idea of accountability in the case of acceptance or decline of algorithm recommendations. However, it is also conceivable that the future technological advancement may be more patient-centered than physician-centered, indicating that the goal of AI will be to help the patient rather than free the doctor of duty.

II. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN MEDICINE

1. **Diagnosis:** With the aid of AI, the duration required for diagnosis is greatly reduced and there is tremendous refinement in diagnostic efficiency. In case of complicated diagnosis, it can augment the results quickly and brings the timely and accurate conclusions. It integrates clinical data from radiology, pathology, endoscopy, ultrasonographic, and biochemical examinations for patient's related conditions to produce highly accurate results and lessen the workload of doctors so that a more intentional and sensible treatment work-up to the patient's condition can be made. More than two thirds of the world's population lacks access to radiologists. There are significant differences both between and within nations. In the US, there is one radiologist for every 10,000 people, compared to about one radiologist for every 100,000 people in India. It is hoped that AI can bridge these gaps.

In May 2022 the FDA granted the authorization of the world's first AI-driven portable and automated 3D breast ultrasound scanner. This technology automatically scans the full breast volume in only 2 minutes and provides a 3D view of the breast tissue. iSono Health system's ATUSA does not require a radiologist or ultrasound technician for picture acquisition, however a doctor with breast ultrasound training is necessary for image interpretation.

Some experts opined that AI technology can successfully advance the detection of lesions, colorectal polyps, as well as gastric and esophageal cancer endoscopy. Wu et al. created WISENSE, a real-time quality improvement system, to lower the blind spot rate of EGD surgery. Blind areas were successfully identified in real EGD recordings with an accuracy of 90.40% after training on 34,513 stomach images.The combined efforts of machine learning(ML), Support Vector Machine (SVN), metabolomics, and lipid metabolites helped in a much more accurate identification of Pancreatic ductal adenocarcinoma. However, these techniques lack the ability to determine prognosis and stages.

Computer aided diagnosis (CAD) tools with machine learning algorithms (supervised and unsupervised learning algorithm utilized a 3D convolutional neural network (3D CNN) to perform Intraductal Papillary Mucinous Neoplasm (IPMN) and lung tumor characterization. This method's drawback was that it relied on humans to label the pre-labeled data needed to train the neural network (supervised learning approach). Hence, there may be significant variation across radiologists unless supported by biopsies.

Abelson's acute myeloid leukaemia (AML) predictive method made use of deep sequencing to examine genes that are frequently mutated in AML and enormous scale analysis of electronic health record databases for AML early diagnosis and monitoring. For the purpose of predicting and diagnosing the early stages of asthma, AI deep learning set up a combination model using data from 556 patients' lung function tests, bronchial experiments, and some biochemical tests.

The coronavirus disease 2019 (Covid-19) pandemic has brought to light the rapidity with which viruses may spread and wreak havoc on the planet. It has also emphasized the critical need for a flexible, swift, and intelligent arsenal of public health measures to combat those consequences. We have seen numerous AI solutions used to fill this function throughout the crisis, some of which have been significantly more effective than others. Artificial neural networks (ANN)-based selector chose the most accurate conventional medical imaging techniques (such as MRI,CT, X-Ray,PET) which has the probability of displaying COVID-19 manifestation. These imaging results are fed into an ANN-based estimator for image processing in order to optimize and categorize the diagnosis. This method has the potential to support a doctor's evaluation in the diagnosis and treatment of COVID-19. However, this suggested technique has not been used in a real-world environment to assess its efficacy and limits. AI-based cough recording analysis may also compensate for the drawbacks of the current gold standard for COVID-19detection, Real time RT-PCR.

Besides AI's valuable approach in overcoming the hurdles, it still has limitations in implementing. First, because AI research is still in its nascent stages, computer-aided design models are frequently confirmed via static images. The majority of these research lack prospective experiments and are retrospective. Second, erroneous results arise from air bubbles, mucus, feces, and exposure which frequently hamper computer-aided endoscopic devices. Third, it may be challenging to expand these systems to different populations because the majority of them were created and constructed by a single institution for use in a specific patient population. However, it is evident that there are promising futures for the supplementary use of AI in GI endoscopy. Endoscopic technology is difficult to ensure in rural or underdeveloped places, and endoscopists' skills develop slowly. The issue of a high percentage of missed diagnoses and incorrect diagnoses can be resolved with the aid of computer-aided examination.

2. **Pharmaceutical:** Computer-aided drug designs have recently supplanted more traditional methods of medication development. A lot of AI is being applied to advance drug design methods and dosage requirements. Additionally, AI makes it simple to identify the target proteins, increasing the likelihood that the proposed medicine will be effective. Each phase of the medication design process uses AI technology, which significantly lowers the cost and lowers the health risks associated with preclinical trials. Based on the vast amount of pharmaceutical data and machine learning process, AI is a useful tool for data mining, de novo drug creation, activity scoring, virtual screening, and in silico evaluation of the characteristics (absorption, distribution, metabolism, excretion, and excretion and toxicity) of a drug molecule.

As many diseases are associated with the protein dysfunctions, it is essential to know the structure of protein to aid in the discovery of active small molecules which targets such protein. However, there is no satisfactory solution to accurately predict de novo 3D structures of such proteins. Deep learning technologies have recently been used to predict the secondary structure (Spencer et al., 2015), backbone torsion angle (Li et al., 2017), and residue interactions of proteins (Wang et al., 2017). To accurately anticipate the 3D structures of proteins is still a long way off, but the deep learning approach has shown considerable promise in advancing this science.

With the goal to evaluate malaria parasite cultures and categorise their developmental stages in accordance with their morphological variety, Ashdown et al. built a semi-supervised machine learning architecture. In an effort to characterise the development of plasmodium falciparum and the effects of antimalarial drugs, various morphologies of the parasite were identified and measured during the asexual life cycle. This strategy also reliably identifies and groups drug-induced morphological outliers according to their mode of action, highlighting the potential of machine learning to hasten the development of new cell-based drugs.

To find differentially expressed (DE) miRNAs in diabetic kidneys, Abedi et al. used a miRNA profile. The quantitative polymerase chain reaction (qPCR) verified the association of DN genes with predicted, recognised, or validated miRNAs. "modified Group Method of Data Handling with Automatic Feature Selection (mGMDH-AFS)" predicted drug targets in the human proteome with the used of biochemical and network topology data. This process had the capabilities of identifying a possible de novo drug related to drug targets. The confinement of experimental data to miRNA profiling is a limitation of this study. In order to produce more precise insights, they intend to incorporate additional phasic layers into the built networks in the future. Notably, the suggested method for predicting therapeutic targets could be applied to other complicated illnesses as well.

3. **Medical Treatments:** AI- technology when combined with anesthesiology have received significant attention regarding: (1) anesthesia depth evaluation; (2) anesthesia control; (3) adverse event prediction; (4) ultrasound aid; (5) pain control; and (6) operating room management. Thus, AI technology improves the safety of delivery, monitoring, and postoperative care, delivering positive improvements for anesthesiology. The use of AI wireless sensors in the intensive care unit (ICU) can efficiently collect patient data, eliminate false alarms, and ease ICU problems.

With the advent of the Da Vinci surgical system, which offers the advantages of a sharper vision, more precise and convenient operation, and even more remote operation, AI plus surgical system makes surgical treatment more minimally invasive. Surgeon console, manipulator operating system, and imaging system are the three main components of this system. The use of the Da Vinci surgical system in clinical surgery received approval from the U.S. Food and Drug Administration in 2000.

The Three dimensional printing is a form of fast prototyping technique that builds objects via layer-by-layer printing using powdered metal or other adhesive biomaterials based on digital model files (produced from CT or MRI data with AI technology). Data from clinical imaging are imported into MIMICS and other intelligent applications. The software may quickly and easily create a main virtual three-dimensional reconstruction for printing after the operator artificially selects the regions of interest. Even though additional human processing may be required at this time, we think it will eventually reach full intelligence. For the next step of organ bioengineering, 3DP technology will soon achieve the objective of printing entire functional-living organs.

III. FUTURE PROSPECTS

In addition to providing students with a foundation in medicine, it is important to undertake ongoing educational initiatives in digital medicine that are geared towards recently graduated physicians. This will enable them to pursue further education in the expanding sector. Fear of a dehumanisation of medicine is one of the main obstacles to doctors using intelligent medical technologies. The main cause of this is the mounting administrative burden placed on doctors. The administrative burden issue will eventually be resolved, and advances in technology like ACI and natural language processing will enable clinicians to devote more attention to the patient. Despite the fact that a significant overhaul of medical education is required to equip future leaders with the necessary skills, healthcare professionals today are in a unique position to embrace the digital revolution and serve as its primary drivers of change.

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V. CONCLUSIONS

A potential area of research and development is the application of artificial intelligence in patient care, which is developing quickly alongside other cutting-edge disciplines like precision medicine, genomics, and teleconsultation. Health policy should now be concentrated on addressing the ethical and financial challenges related with this aspect of the evolution of medicine, while scientific research should continue to be rigorous and transparent in creating new solutions to improve modern healthcare.

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