IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 3, June 2023

A Review on Current Applications of Artificial Intelligence in Medical Field

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Abstract: *Artificial Intelligence is a powerful and revolutionary discipline of computer science that has the potential to radically transform medical practise and healthcare delivery. Artificial intelligence (AI) is the intelligence displayed by machines that can aid in the performance of various tasks via sentiment analysis and natural language processing (NLP). Using past data and information, this technology allows machines to learn on their own. When it comes to equipping computers, AI is a subset of machine learning and deep learning, each of which has its own set of tasks. In medical research, artificially intelligent computer systems are commonly used. Patient diagnosis, end-to-end drug discovery and development, enhancing physician-patient communication, transcribing medical documents such as prescriptions, and remotely treating patients are all common applications. We outline current developments in the application of AI in healthcare in this review paper, applications of AI in different medical specialization, and assess the probable future direction of AI-augmented healthcare systems.*

Keywords: Artificial Intelligence, Medical, Healthcare, machine learning, deep learning, Natural Language processing (NLP)

I. INTRODUCTION

AI promises to completely transform patient care in the coming years with the aim of optimizing personalized medicine and tailoring it to the use of individual patients. AI is expected to help precision medicine and health care. Clinical and scientific research groups are quickly adopting this method to develop diagnostic and prognostication tools and improve healthcare delivery efficiency. AI may find numerous applications, ranging from Image collecting and processing to aided reporting, follow-up planning, data storage, data mining, and many more.

Artificial intelligence is widely used in many healthcare facilities around the world because it has simplified the lives of patients and doctors by doing complex and crucial jobs in less time and at a fraction of the cost. AI has numerous uses in healthcare, ranging from discovering correlations between genetic codes to controlling surgical robots.

AI assists doctors in making correct diagnoses. Artificial intelligence (AI) is used extensively in scanning technologies such as X-rays, computed tomography, magnetic resonance imaging, and three-dimensional scanners. These are useful in making a better decision about the patient. It effectively organises patient scheduling and reminds patients of doctor's appointments.

AI is useful in a range of medical jobs, including automated measurement tasks such as carina angle assessment, aortic valve analysis, and pulmonary artery diameter. It can be used in the medical diagnostic support system to diagnose congenital cardiac disorders. It is currently utilised to detect the amount of fracture and trauma in orthopaedics patients. With the help of several breakthrough technologies, AI has had a tremendous impact on the medical industry. It facilitates the work of nurses, doctors, and surgeons. These technologies aid in the development of patient-specific treatment programmes. It is crucial in the computerised storage of health records. It can improve diagnostic accuracy, speed, and consistency. These technologies reliably forecast patient outcomes and are useful in acquiring additional information that doctors miss. These are employed in large-scale medical organisations to manage the health system properly by monitoring cost recovery, health expenditure, and treatment responses.

Will discuss different AI applications and implementation in medical field.

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AI in Radiology

In radiology, artificial intelligence is improving diagnostic imaging accuracy. Because patient images may be instantly recorded in digital form for central archival and soft copy viewing, radiology practises have simply incorporated artificial intelligence (AI) into clinical practise. AI integration into the radiology process is now possible thanks to advances in digital imaging technology. Large amounts of data can be evaluated and sent in minutes. Deep learning AI can be used to precisely identify regions of interest and diagnose patients images produced by various imaging modalities, such as X-ray, MRI imaging for brain malignancies, CT scans for lung nodules, and mammography for breast abnormalities. Radiology eliminated film, chemicals, developers, and film storage by transitioning to digital imaging. It also addressed the issue of film loss, providing transportation to locations such as intensive care units (ICUs), operating rooms (ORs), and emergency rooms. These images have intrinsic value for improving radiologists' quality, security, and efficacy through computer-assisted learning.

AI in Oncology

For cancer risk assessment and disease diagnosis, prognostic staging, treatment, and surveillance monitoring, oncology relies significantly on evidence-based medicine scoring systems. Artificial intelligence and machine learning techniques are making inroads into biomedical research and health care, most notably cancer research and oncology, cancer detection and diagnosis, subtype classification, cancer treatment optimisation, and identification of new therapeutic targets in drug discovery. Deep learning, a subset of AI that is very versatile and allows for automatic feature extraction, is rapidly being used in scientific and clinical cancer research. AI applications are increasing to encompass innovative approaches for cancer detection, screening, diagnosis, and classification, characterisation of cancer genetics, investigation of tumour microenvironment, and evaluation of biomarkers with prognostic and predictive value.

AI in Surgical Pathology

Oncology heavily relies on evidence-based medicine scoring systems for cancer risk assessment and disease diagnosis, prognostic staging, treatment, and surveillance monitoring. Machine learning and artificial intelligence pathologists are vital in modern medicine. Pathology's role in tumour diagnosis and beyond has developed throughout time, from disease entity identification to prognosis evaluation to precision therapy prediction. Pathology is one of the important disciplines in medicine with high expectations for the application of artificial intelligence (AI) or machine learning approaches due to their ability to analyse complex data in a quantitative and standardised manner to further improve diagnostic scope and precision. Artificial intelligence is predicted to minimise the workload of human experts, increase the impartiality and consistency of pathology reports, and have a clinical impact by retrieving hidden information. While the analysis of histological images is an obvious application of artificial intelligence and machine learning from routinely available data, recent applications for the analysis of molecular profiling data from various sources and clinical data support the notion that AI will improve both histopathology and molecular pathology in the future. Pathologist tools could scan slides to count elements such as lymph node metastases, mitoses, inflammatory cells, or pathologic organisms, giving data at sign-out and marking examples for evaluation. AI/ML tools could also identify regions of interest on a slide or prioritise cases based on slide content.

AI in Endoscopy

In terms of AI in endoscopy, with AI technology augmentation, there have been significant breakthroughs in endoscopic detection that have transformed the traditional model and enhanced efficiency. According to certain specialists, utilising endoscopy, AI technology can successfully increase the detection of lesions, colorectal polyps, as well as stomach and oesophageal cancer. By lowering detection time and boosting diagnostic accuracy, AI systems can considerably improve the diagnosis of stomach and intestine disorders such as Barrett's oesophagus, squamous carcinoma, and gastric cancer. Endoscopy paired with the new AI algorithm demonstrated a higher sensitivity and more accurate localisation of the intestinal lesions than the conventional model. With more and more research demonstrating the potential of AI + endoscopy in the detection and classification of many diseases, this new technology clearly has a future.

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AI in Ultrasonography and Biochemical Examinations

Ultrasound (US), a versatile green imaging modality, is being more widely used as a first-line imaging method in a variety of clinical settings around the world. The reflection of an ultrasonic beam reveals tissue structure in ultrasound. It is one of the most extensively utilised imaging modalities in clinical practise. It is widely used by obstetricians, cardiologists, for interventional therapy recommendations, and for post-treatment surveillance. Although doctors have already used image-based computer-aided diagnosis (CAD) systems to diagnose through ultrasound, the performance is mostly dependent on the detection and classification methods. Methods have altered dramatically when combined with AI technology. AI excels at automatically recognising complicated patterns and offering quantitative assessment for imaging data, indicating a significant potential to assist clinicians in obtaining more accurate and reproducible outcomes. AI has been shown to improve the efficiency and accuracy of traditional ultrasonographic identification of tumours in the thyroid, breast, bronchia, puborectalis muscle, and urogenital hiatus, as well as various obstetric and gynaecological disorders. Medical photos are transformed into high-throughput mineable data using artificial intelligence (AI). Machine learning techniques, which can be used to model lesion detection, target segmentation, illness diagnosis, and prognosis prediction, have significantly advanced precision medicine for clinical decision support.

AI in Medical Treatment

AI in Surgery: The surgical AI system is the most spectacular achievement and application of AI in the surgical area. With the advancement of AI technology, the idea of an AI-enhanced surgical system has emerged. AI-based surgical systems make surgical treatment less invasive, with the benefits of a sharper image, more precise and convenient operation, and even remote operation. This inventive idea enables previously difficult minimally invasive surgical procedures to be done. The surgical AI system is made up of three parts: the surgeon console, the manipulator operating system, and the surgical AI system. The surgeon console, manipulator operating system, and imaging system are all part of the system. Thyroid surgery, for example, was improved in terms of postoperative cosmesis and voice outcomes, maxillary surgery was improved in terms of accuracy and safety, gastric, nephritic, and prostatic surgery was improved as evidenced by a high surgical success rate but a low complication rate, and lung cancer surgery was beneficial to patients in terms of postoperative recovery. Aside from the aforementioned elements of surgical operation enhancement when compared to traditional surgical systems, the greatest distinguishing feature of AI surgical systems is "AI," which means that the surgical systems evolved from a non-intelligent to an intelligent form. Using deep learning, the AI algorithm can also self-deduce based on numerous experiments from clinical surgeons and reconstruct clinical digitised data by uploading the surgical programme to an AI surgical system to assist with surgery insurance and prediction of lymph nodes with potentially positive metastasis. Clinical surgeons reconstruct clinical digitised data by uploading the surgical programme to an AI surgical system to assist with surgery insurance and prediction of lymph nodes with potentially positive metastasis.

Anesthesiology Assistance

AI technology has also been widely used in anesthesiology during the perioperative phase. Anaesthesia is a crucial aspect of the surgical procedure that helps ensure a smooth surgery; nonetheless, there are numerous dangers and consequences during anaesthesia. Six characteristics have been heavily promoted and attracted substantial attention when combined with the deployment of AI technology: (1) anaesthesia depth monitoring; (2) anaesthesia control; (3) adverse event prediction; (4) ultrasonography aid; (5) pain control; and (6) operating room management.

AI in Drug Production

According to the old approach, drug manufacture takes a long time, including functional target studies, drug ingredient design studies, performance tests, clinical trials, testing, and promotion; consequently, even after a long period of study, new pharmaceuticals may not necessarily work as well as planned. However, with the growth of AI in recent years, the new technology has revolutionised the old drug industry in healthcare and facilitated new drug research and assembly. Furthermore, as AI-generation medications have matured, their uniqueness and quality have reached new heights. For example, the combination of AI prediction models with vaccine design has effectively accelerated clinical trial

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processes while reducing research and development costs and time. Deep learning technology-guided drug discovery can target proteins exactly as designed, which was previously impossible. AI technology's excellent logical deduction and automatic learning abilities aided in the design and production of cancer medications, resulting in improved therapeutic performance. Furthermore, research into AI-assisted bioinformatics tools and approaches has presented a promising future for small molecule medicinal therapy. As a result, using AI to reconstruct sections of the drug discovery process will be less expensive, faster, and safer. However, it is probable that AI technology will not be able to be used in all drug discovery processes. Rather, it aids in stages such as the discovery of novel Artificial intelligence technology was utilised to search for available medications that could be altered to combat the disease.

AI in Medical Management and Education

In the traditional model, medical management in hospitals is based on the general planning of the hospital administrative department, and there are always some management omissions and disadvantages, such as the unequal distribution of medical resources. Procedures have altered significantly as a result of AI technology regulation. Some researchers used long-short-term memory neural network AI technology to build a prediction model and analyse a database of patient hospital-stay time, successfully predicting accurate waiting times in their hospital's emergency department, which effectively enhanced medical efficiency and patients' subjective experience and promoted medical resource redistribution. AI algorithms were utilised to cut average hospitalisation duration by 7%, determine the optimal number of hospital beds, and optimise hospital resources and required inputs. A real-time prediction model based on artificial neuron networks forecasted the readmission rate competitively and precisely, assisting in patient preparation and enhancing hospital management. AI technology has aided in patient counselling, hospital administration, medical resource allocation, and, ultimately, individualised clinical care. Medical student education represents the future and promise in medical progress; nevertheless, due to the huge and complicated professional knowledge necessary, medical student training is lengthy and demanding.

The learning pattern of medical students has become deeper and more colourful as a result of the diverse application of AI technology. AI-based problem-based learning has increased student learning and comprehension, increasing their understanding of clinical disorders. The combination of learning surgery with an AI system has also yielded encouraging outcomes in terms of improved performance and confidence among medical students. Furthermore, the AI simulation-based surgical training system, which combines AI and simulation to study surgical techniques, has established a new educational tool with objective feedback that is useful to student learning.

AI in Cardiology

Cardiology AI is also utilised in cardiology to lower the risk of sudden cardiac death. It combines evidence-based information on heart disorders. This technology detects a blockage in the heart valve, reducing the risk of a heart attack. Furthermore, it delivers accurate data on blood flow. AI implementation aids with all aspects of a patient's hospitalisation, treatment, and recovery.

AI in the Perioperative Period

The perioperative period encompasses the time between the patient getting surgical treatment and completing basic recovery; it is divided into three parts: preoperative preparation, surgical phase, and postoperative recovery period. Rehabilitation following a surgical procedure. postoperative rehabilitation, AI technology is very important in the rehabilitation process. For example, in the intensive care unit (ICU), the use of AI wireless sensors can effectively collect patient information, eliminate false alarms, and alleviate ICU problems. The use of AI robots has also sped limb rehabilitation in sophisticated anthropopathic action guiding, allowing patients to recover more quickly. AI technology has also been used to track progress and monitor health, which may be useful for managing discharged patients. There are numerous breakthroughs with the deployment of AI technologies throughout the entire perioperative period.

AI in the Medical field

For difficult surgeries, AI delivers accurate and timely communication. It automatically schedules, checks, and develops follow-up processes while clinicians are on the go. It increases treatment efficiency while lowering diagnostic

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risk. AI technology is capable of scanning a patient's test results and updating/reminding the patient at the appropriate moment. Automatic ECG, cardiac monitoring, clinical laboratory analysis, medical imaging, electroencephalography, respiratory monitoring, and anaesthesia are some of the successful application areas. This new technology can instantly assess blood tests, glucose levels, medical imaging, and a variety of other duties. When patient data is embedded in algorithms, AI can extract the knowledge needed to remedy a medical condition. The computer can interpret human speech and writing by applying AI to manage and evaluate the patient using various technologies. It instructs doctors, surgeons, and physicians on how to enhance outcomes and learn in real time. AI assists the surgeon step by step and does additional analyses to improve outcomes. It also suggests what forms of medical innovation are possible. It assesses doctors' adherence and aids in the treatment of a variety of new ailments. In everyday medical applications, AI can boost efficiency while posing minimal danger. It is extremely capable of acquiring information through neural networking, sophisticated imaging, and natural language processing. Neural networking, sophisticated imagery, and natural language processing are all being used.

AI in Treatment Plan

Adoption of AI technology has resulted in advanced treatment in healthcare, which has enhanced treatment tactics and aided the analysis process that gives a fulfilling treatment strategy as well as monitoring therapies. Furthermore, Artificial Intelligence can analyse and precisely recognise indications and symptoms in medical pictures such as X-rays, CT scans, MRIs, and ultrasounds. This allows for speedier diagnostics, lowering the time a patient spends waiting for a diagnosis from months to hours. Furthermore, AI has aided in the development of medical assistant systems such as Modernising Medicine, which uses cloud computing to gather information about a patient, record diagnoses, assist in the testing process, and organise billing information. Furthermore, the strategy of using a public database that contains information from many patient and doctor cases helps physicians arrive at more personalised treatments or uncover similar situations by using AI technology to extract data.

AI in Managing Medical Data and Records

Data management is a critical job of Artificial Intelligence in healthcare, where it is responsible for collecting or acquiring data, storing it, normalising it, and tracking its origin. Because compiling and evaluating data are critical tasks in healthcare, data management is a widely employed technique in Artificial Intelligence. Furthermore, significant amounts of healthcare data are generated every day, necessitating the implementation of new data analytic technologies. These tools have assisted healthcare organisations in collaborating with patients and making informed decisions on enormous amounts of data, as well as archiving it to reduce waste. Artificial intelligence allows for the simulation of intelligent activity in a computer and human contact of clinicians with the power of AI.

Future of Artificial Intelligence

AI has a favourable impact on doctors and patients in healthcare because of its ability to collect and analyse vast amounts of medical data, resulting in faster and more accurate diagnoses for a significant portion of the population. As a result, if certain people are unable to get specialised healthcare, they may gain an advantage through Artificial Intelligence. Another major expectation is that healthcare costs will continue to reduce as diagnostic accuracy improves. As AI technology becomes more widely employed in healthcare, doctors' approaches to patients will shift, expanding the possibilities for predicting and treating diseases. This will minimise healthcare costs, and it will now be easier to advance medical care. AI technology is a high-tech product that adapts to the evolution of the modern period; so, it is an unavoidable result of scientific and technological advancement and follows the trend of time. Human society has seen two industrial revolutions: the steam revolution and the electrical revolution, both of which radically altered human life and advanced human civilisation. Now, the scientific and technological revolution, including AI technology, has demonstrated an unstoppable trend that has developed as quickly as a blazing fire. With the help of new AI technologies, the old medical environment has altered dramatically, and patient diagnosis employing radiographic, pathological, endoscopic, ultrasonographic, and biochemical methods has become much more accurate. Medical therapies during the perioperative phase, including preoperative preparation, surgery, and postoperative recovery, were dramatically improved, resulting in superior surgical outcomes. Furthermore, AI technology has played an important

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role in medical drug development, medical administration, and medical education, propelling them in a new path. The future of AI has arrived, and we believe that the new revolution will be as rapid as the wind, ushering in an unparalleled new era in our medical profession.

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