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Artificial Intelligence in Health: Transforming Health in the Future

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Abstract

Artificial intelligence (AI) is a rapidly developing technology that has the potential to revolutionise healthcare in recent years. AI is known to have various applications that can be used to improve the diagnosis of diseases, treatments and patient care. In addition, by analysing large data sets that will form the basis of diagnosis and treatment, it is aimed to capture details that may escape the human eye and reveal new information. AI enables physicians to make faster, more accurate diagnoses and select the most suitable treatments for patients. Administrative and clinical operations in the healthcare sector are undergoing a radical change under the influence of the digital transformation process. In this context, innovative steps towards process automation are being implemented at an increasing pace. Artificial intelligence technologies, in particular, have demonstrated remarkable adaptation by being integrated into both administrative and medical applications in the healthcare field. These technologies increase the efficiency of patient management systems along with the optimization of diagnosis and treatment processes, thus providing a significant reduction in both operational and clinical costs. Artificial intelligence-supported solutions reshape the organizational structure of healthcare services, optimize resource use and increase service quality. This transformation has a wide range of effects from patient care to institutional operations and contributes to the sustainability of healthcare systems.

Keyword: Health , artificial intelligence, future

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INTRODUCTION

Artificial Intelligence in Health

Medical imaging techniques are one of the most important tools that reveal the clinical findings of the patient. Artificial intelligence, together with medical imaging methods, supports the doctor by providing information on detecting lesions, deciding on the diagnosis and prescribing the treatment procedure. The success of the treatment procedure applied to the patient is with the correct diagnosis. Evolved neural networks are successfully used in the medical field, especially in image processing and disease prediction to determine the correct diagnosis. For example, it has been reported that artificial intelligence-supported systems perform at least as well as radiologists in mammography and breast cancer screening, have lower diagnostic error rates than radiologists, and significantly reduce the workload of radiologists (1). An artificial intelligence-assisted diagnosis system has been developed to classify malignant and benign lung nodules based on computed tomography (CT) data and has been shown to accurately differentiate lung nodules (2). One of these is computer-aided diagnosis system. Today, computer-aided diagnosis (CAD) has become one of the most important research topics in diagnostic radiology and medical imaging. CAD methods offer tremendous advantages to physicians in diagnosing disease more effectively and avoiding unnecessary biopsy procedures, while reducing test time and cost. CAD acts as an intermediate layer between medical imaging and radiologists. It is important to note here that the CAD product is not considered a medical record or report. Only the results should be considered as a support reference for the relevant examination and diagnosis (3). AI models often require large amounts of data, so you first need to collect relevant data. For example, if you want to train an image recognition model, it's important to collect thousands of images. It is important to clean and organize the data and reveal important features.

Another area where artificial intelligence plays a role is dermatology. In recent years, artificial intelligence and technological developments have become a component of health. Artificial intelligence is achieving better results in object recognition day by day. According to studies conducted in 2019 and 2020, artificial intelligence achieved better results than humans for the first time with an error rate of less than 5%. Skin Cancer is a disease that patients or doctors usually notice as a lesion during physical examination, but experts try to make a diagnosis by performing biopsy and histopathological examinations after dermatoscopy and examination. The initial detection of disease foci creates a disease classification algorithm and artificial

intelligence plays a guiding role in diagnosis and treatment (4,5).

Diabetic Retinopathy (DR) is one of the major reasons behind the overall increase in the number of people experiencing vision loss. This is due to the worldwide spread of diabetes and the increasing incidence of DR among people with diabetes. People diagnosed with DR have about a 90 per cent chance of avoiding permanent vision loss if early detection is done correctly and effectively. AI algorithms have been shown to be more accurate than the human eye in the early diagnosis of diabetic retinopathy. For example, in one study, AI algorithms achieved an accuracy of 90% in the early diagnosis of diabetic retinopathy, while the accuracy of the human eye was 80%. This suggests that AI can help prevent vision loss from diabetic retinopathy (6). There are several reasons why AI algorithms are more accurate than the human eye in the early diagnosis of diabetic retinopathy. Using image processing and machine learning techniques, AI algorithms can detect details that the human eye cannot see. In addition, AI algorithms can be trained on very large amounts of data, an advantage that doctors do not have.

Cancer is the unpredictable growth of cells that have the potential to invade other parts of the body or spread. Cancer remains one of the world's most common causes of death. AI algorithms have been used to predict how cancerous cells spread. This suggests that it could help develop more effective treatments for cancer patients. For example, in one study, AI algorithms were able to determine the most effective treatment for patients 10% more accurately by predicting how cancerous cells spread (7). The place of AI in pathology is one of the most promising areas in medicine; it can improve the quality and efficiency of detecting lesions, determining their spread, classification (e.g. tumour subtype), prognosis (in terms of combining clinical and genomic information) and other predictions. Integration of digital pathology with other imaging modalities and clinical data is thought to increase efficiency in terms of diagnosis and prognosis (8). AI algorithms enable early diagnosis by quickly and precisely detecting cancerous areas. This is especially important for cancer types where treatment success largely depends on early diagnosis. This developing technology also offers great potential in the diagnosis of various urological cancers such as prostate cancer, bladder cancer and kidney cancer.

Heart disease is also one of the world's most common causes of death. Artificial intelligence algorithms have started to be used to predict the risk of heart disease. This can help identify people at high risk of heart disease and develop prevention strategies for them. For example, in one study, AI algorithms were able to identify people at high risk of heart disease 20% more accurately by predicting the risk of heart disease . There are several reasons why AI

algorithms predict the risk of heart disease. AI algorithms can predict the risk of heart disease by using demographic information, lifestyle and health history of patients. In addition, AI algorithms can be trained on very large amounts of data, which is an advantage that tissues do not have.

AI applications that are actively available and under development are also used to support specialists. DeepRhythmAI (DRAI) software is used to detect arrhythmias and automatically analyse electrocardiograms (ECG). DRAI is a cloud-based artificial intelligence algorithm that analyses all heartbeats in the processed ECG signal and classifies them as correct or arrhythmic based on this . In addition, the Rothman Index (RI) is used to monitor and visualise patients in a hospital setting. The RI uses the sum of vital signs, laboratory values and nursing assessments to produce a single score reflecting the patient's risk of death (9). In another study, all incoming patients including patients without murmurs, patients with innocent murmurs and patients with pathological murmurs (106 patients) were followed up. These patients who underwent ECHO, the gold standard for diagnosis, were compared with the new algorithm. The computerised algorithm tested showed 87% sensitivity and 100% specificity, 100% positive predictive value, 90% negative predictive value and 94% accuracy. The computerised algorithm has been shown to detect pathological murmurs with high sensitivity, specificity and accuracy comparable to the published results of paediatric cardiologists and neonatologists (10).

AI algorithms have been used to predict the success of surgery. This has been shown to help us better understand the risks and benefits of surgery and help patients make better decisions. For example, in one study, AI algorithms were able to identify patients at high risk of surgery failure 15% more accurately by predicting the success of the surgery (11). Significant progress has been made with the use of artificial intelligence-based technologies in the perioperative process, which covers the stages before, during and after surgical intervention. Artificial intelligence learns by using the data obtained from surgical operations and makes the surgical programme compatible with the artificial intelligence system by using this information. In this way, it is said that it is possible to determine the limits of surgical intervention, preserve the remaining organ volume after surgery and predict possible metastasised lymph nodes (12). Accurate measurement of intraoperative blood loss is an important clinical variable in managing fluid resuscitation and preventing unnecessary transfusion of blood products. In this study, the blood lost in laparotomy sponges in surgical cases is an example of an application programmed with a unique algorithm modelled on face recognition technology(13) . However,

it is thought that studies should continue to make these algorithms more appropriate.

Research on the combined use of AI and endoscopy in the diagnosis and classification of different diseases is increasing day by day and the future is promising in this field (14). It is thought that AI can help to obtain more accurate and faster results in the diagnosis of diseases in organs such as oesophagus, stomach and colon (15). For example, in a study in which small intestinal capsule endoscopy images were analysed with the AI neural network algorithm, diseased tissues and their locations could be determined more precisely and accurately than traditional methods (16,17).

Medical education is a field that requires intensive and complex professional knowledge. Therefore, only reading medical books and notes may limit the development of medical students. Diversified applications of artificial intelligence (AI) technology have contributed to the solution of this problem by making the learning model of medical students richer and more colourful (18). AI offers medical students a more immersive and interactive learning experience through tools such as virtual reality, augmented reality and interactive simulations. In this way, students have the opportunity to concretise theoretical knowledge and improve their practical skills. By analysing the individual learning style and needs of each student, AI is able to provide the most appropriate learning materials and resources. In this way, students will be able to learn more efficiently and effectively. AI can help medical students develop their clinical skills through tools such as virtual patients and robotic mannequins. In this way, students will be able to practice in a risk-free environment before intervening in real patients (19). However, some ethical and legal regulations are required for the widespread use of AI technology in medical education.

As is known, the drug development process is a long and labourious process. In this process, which includes target identification, drug design, tests, clinical trials and approval stages, there is also the risk that the expected result may not always be achieved. With the development of artificial intelligence, the pharmaceutical industry is also transforming. New drug discovery and design are becoming easier, and the quality of drugs is also increasing. AI enables us to better understand diseases and the functioning of drugs by analysing medical data. In this way, it becomes possible to develop more accurate and effective drugs. The role of AI in the drug development process is said to have the potential to offer new treatment options to patients faster and safer by saving time and cost . The role of artificial intelligence (AI) in drug development is increasing day by day. Especially deep learning technology enables the discovery of drugs targeting proteins that were once impossible to reach. It has also been observed that cancer

drugs designed and produced thanks to the powerful logical inference and automatic learning capabilities of AI show better therapeutic performance compared to drugs developed by traditional methods. These developments indicate that AI will radically change the drug development paradigm in the near future (20).

CONCLUSION

Artificial intelligence has begun to revolutionise the healthcare sector, offering innovations in every field from diagnosis and treatment to patient care and drug development. By analysing medical images and patient data, it helps doctors make faster and more accurate diagnoses and can be used to create personalised treatment plans. AI plays an important role in remote patient monitoring and chronic disease management. It also accelerates the development of new drugs and treatments. Faster and more accurate diagnoses and treatments, personalised medicine, improved patient care, new drugs and treatments, and lower healthcare costs are expected in the future with the use of AI. The use of AI in healthcare has many benefits. It will provide better patient outcomes, fewer medical errors, lower healthcare costs and greater access. However, there are also some ethical and legal concerns about the use of AI in healthcare. Addressing concerns such as the privacy and security of patient data, the freedom of AI algorithms from bias, and who will be responsible for the mistakes of AI is important for the widespread adoption of AI in healthcare. In conclusion, AI has great potential for the future of healthcare. When utilised properly, the quality of healthcare services, patient satisfaction and overall health status can be significantly improved.

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