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Review Article

The Current State and Future of Artificial Intelligence in Health

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Abstract

An overview of the current situation of AI applications in the health field is presented from several aspects, such as whole-cycle health management and infectious disease prevention and control, and an analysis of the prospects for the integration of AI with the health field and the challenges faced in terms of data and technology.

Keywords: Artificial intelligence; Healthcare; Review.

Introduction

Artificial Intelligence (AI) is an intelligent system capable of understanding complex situations, simulating human thought processes, acquiring learning capabilities and knowledge to solve problems, including expert systems, machine learning, natural language processing, automatic planning, image processing and many other technologies [1]. AI is increasingly being used in the health sector, thus creating a new model for the health A new model for the health industry chain. China's State Council's "Development Plan for a New Generation of Artificial Intelligence" clearly states the need to promote the development of intelligent healthcare, establish a precise and intelligent service system, explore the construction of smart hospitals, develop human-machine collaborative medical robots, intelligent treatment assistants and strengthen intelligent health and group intelligent health management [2]. This paper provides an overview of the current status of AI applications in the health sector at home and abroad and provides an outlook on its future development and challenges, so as to promote the in-depth exploration and application of AI in the health sector.

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Current status of AI applications in the health sector

Full cycle health management

Disease risk prediction Individual patient differences and disease instability can lead to errors in traditional disease risk prediction, and disease risk prediction is an early application of AI in health. 2008 Google flu prediction software predicted flu changes in the US 1 to 2 weeks in advance by analysing user search data [3]. Chinese scholars use Baidu search engine data to predict seasonal influenza [4]. AI algorithms combined with electronic medical records can be used to predict the risk of hospitalisation and prevent readmission in patients with heart disease and diabetes [5]. Some studies have shown that AI-based remote risk prediction for COPD and asthma is between 40% and 90% accurate. The feasibility of AI for disease risk prediction has thus been demonstrated, but there is still room for improvement in accuracy.

Disease diagnosis over the past decade, there has been a growing number of reports on AI in clinical medicine, with the most common applications including disease diagnosis, health monitoring and digital patient consultation, clinical training, patient data management, drug development and personalised medicine [6]. Rahman, et. al [7] looked at the effectiveness of adopting artificial intelligence (AI) in response to the dire effects of the COVID-19 pandemic. Their applications in response to COVID-19 are highlighted, such as detection and diagnosis, data analysis and treatment procedures, drug research and development, social control and services, outbreak prediction, etc. Rahman, et. al [8] looked at the use of AI and computer-aided diagnosis (CAD) systems in gastrointestinal disorders such as endoscopy, GERD, eosinophilic esophagitis and motility disorders etc. Cheung, et. al [9] provide an overview of the role of artificial intelligence in oncology imaging, diagnosis and detection of cancer, determining clinical management, assessing treatment response and complications of treatment or disease, screening and detection of cancer, diagnosis and risk stratification, tumour segmentation, precision oncology, predicting prognosis and assessing treatment response.

Surgical robots high-resolution imaging with the aid of minimally invasive robotic arms can enable surgical robots to perform precision surgery. The da Vinci laparoscopic surgical robot is currently the most advanced surgical robot in the world and has been used in more than 3,000 hospitals worldwide. It can switch the surgical viewpoint at will through the imaging device and the robotic arm can memorise and imitate the operation of the attending surgeon [10]. The Remebot neurosurgery robot, developed in China and approved by the State Drug Administration in 2018, can operate with an accuracy of <1mm and can also synthesize a 3D model of the patient's skull to allow the surgeon to observe the lesion and plan the operation [11].

Health care

Nursing robots

Nursing robots assist nurses in completing treatment, reducing their workload, and improving the quality of care. Material transport robots can avoid obstacles based on built-in sensors and carry materials such as

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medicines and instruments [11]. Eating care robots assist paralysed patients to eat through human-computer interaction [12]. Mobility assistance robots are aimed at visually impaired patients and can effectively monitor obstacles and build real-time maps to guide patients to their destination [13]. The supervisory robot automatically measures and records patient vital signs and output, as well as detecting urine quality, automatically alerting when indicators hit critical values, and navigating to the ward where the alert is signalled [14]. The intelligent intravenous drug dispensing robot enables nurses to dispense drugs without contact with them throughout the process, making the process precise, efficient, and traceable, effectively avoiding occupational exposure [15].

Nursing decision aids

Helping nurses to reduce the pressure of decision making and improve the efficiency and accuracy of decision making, but not completely replacing them. The clinical care system includes intelligent knowledge decision-making, record quality control and human-computer interaction modules, effectively reducing the incidence of nursing adverse events and quality control problems in medical records [16].

Rehabilitation robots Rehabilitation robots can help restore motor function to patients and help reduce the workload of health care workers [17]. The rehabilitation robot can perform repetitive and complex movements for long periods of time and can monitor and adjust movement and force parameters precisely in real time [18]. The exoskeletal finger rehabilitation robot designed by Calafiore, et. al for patients with severe stroke and hemiplegia allows the rehabilitation programme to be set up in advance and the degree of finger flexion to be monitored in real time [19]. The exoskeletal finger rehabilitation robot designed by Serrezuela, et. al The gait rehabilitation robot designed by Serrezuela, et. al is aimed at patients with hemiplegia and allows the use of the residual motor capacity of the affected limb and systematic training based on the motor capacity of the healthy limb [20].

Home health management includes physiological indicator testing, healthy lifestyle promotion, medication reminders, nutrition management and mental health management. AI physiological indicator testing is mainly based on smart wearable devices, such as smart wristbands that can monitor users' blood pressure, heart rate, respiration, and body temperature 24 hours a day [21]. Through analysis of user health data AI health management software can plan exercise routines for patients and monitor sleep quality and medication adherence [22]. For nutrition management, AI can help users develop and maintain healthy dietary habits through food recognition and provide more accurate nutritional advice [23]. AI can also analyse users' facial expressions through face recognition to determine their emotions and assist in emotion management through interactive methods such as chat, music or video to promote mental health [24].

Infectious disease control

AI has also been applied in the prevention and control of infectious diseases. The new generation of information technology, represented by big data and artificial intelligence technologies, has been widely

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used as an important basic support for the prevention, diagnosis, treatment and management of NCCID. The prevention and control of sudden-onset infectious diseases often relies on controlling the source of infection, blocking transmission routes and developing vaccines [25]. Big data and artificial intelligence are effective technologies for identifying the source of infection and have an irreplaceable role in distinguishing between close contacts and suspected populations. Advanced computational analytics can help speed up vaccine development and improve vaccine quality [26]. AI-based deep learning time series prediction models are important for predicting the onset of hepatitis, helping decision makers to make effective decisions, detecting disease events early and contributing significantly to the control and management of hepatitis disease [27].

Reflections and Insights

Leveraging AI to solve problems in China's health sector

Alleviating the strain and uneven distribution of healthcare resources: The number of patients with chronic diseases has increased dramatically and the public demand for quality healthcare resources is on the rise. However, the tight and uneven distribution of healthcare resources and the inadequate grading and triage system have led to many patients flocking directly to tertiary hospitals, which not only wastes valuable healthcare resources, but also makes it increasingly difficult and expensive to see a doctor. The development of various AI robots will expand the field of telemedicine applications and reduce the uneven distribution of medical and nursing resources, resulting in patients travelling long distances to seek medical treatment. In addition, AI-assisted health management will enable efficient and quality continuity of care, and patients will be able to ask frequently asked questions through a health management app to reduce the need to travel to and from hospitals and wait for medical appointments [28].

Shorten the waiting time and improve the efficiency of consultation. Poor waiting environment and poor attitude of healthcare providers are the main reasons for patients' dissatisfaction in seeking medical treatment. AI intelligent consultation during patient waiting time can efficiently collect patient's medical history and disease information related to this visit, which can help alleviate patients' discontent caused by long waiting time. Meanwhile, the system will compare and deeply learn the collected information with the medical information database, and the diagnosis and treatment suggestions will be transmitted to the doctor's end in advance, improving the efficiency of doctor's diagnosis and doctor-patient communication [29].

High quality, standardized data acquisition is central

Health care big data is an important basic strategic resource for the country, which will regulate and promote the integration, sharing and open application of health care big data [30]. At present, there is a low level of information sharing and many information silos among Chinese hospitals, and there are problems of duplication, scattered construction and multiple systems standing side by side. A number of big data companies are working together to actively promote the

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construction of national health care big data infrastructure. With the establishment of a systematic and standardized system for medical data, which is strongly promoted by the state, data sharing and flow will be promoted, and AI is expected to break through the data bottleneck, accelerate its implementation and develop in a long run [31].

Multiple challenges remain at the technical level

AI is a disruptive technology that faces multiple challenges in its application in the health sector. Ensuring data security is one of the key technical challenges. The current way of storing data under a centralized structure does not guarantee data security well and may result in patient data leakage. Therefore, more secure data storage methods, such as the use of blockchain technology to develop a medical ecosystem with a personal health information repository as the core, so that technology and healthcare can be combined to maximize benefits is a direction worth exploring. At present, the lack of health behavior and life data is relatively serious, wearable device technology is still in its infancy, the market penetration is low, and an intelligent health management system that includes health behavior and life data and long-term tracking has not yet been established. AI is currently facing data and technical bottlenecks, and the existing AI implementation level is not high enough to meet people's needs for high-quality smart health [32].

Conclusion

This paper provides a review of typical applications of AI in health and an outlook on the future development and challenges of AI in health, with a view to improving healthcare professionals' knowledge of AI and providing new ideas for healthcare professionals to participate in AI research, thereby promoting the further integration and development of AI and healthcare.

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