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Applications of Artificial Intelligence in the Healthcare Field

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Abstract. With the development of the Internet and computer technology, the application of artificial intelligence in the medical field has been vigorously promoted. This paper first summarizes the current application status of artificial intelligence in different fields of healthcare, and on this basis, discusses the ethical challenges faced by artificial intelligence medical technology, so as to strengthen technological innovation and ethical norms, drive the intelligent transformation of healthcare, solve medical problems, and improve service efficiency.

Keywords: Artificial Intelligence, Healthcare, Ethical Challenges

1. Introduction

In today's digital era, the rapid development of science and technology is profoundly reshaping the landscape of various industries, and the medical field is also in the tide of this transformation. With the rapid advancement of the Internet and computer technology, artificial intelligence has stood out in many fields by virtue of its excellent data processing capabilities and model construction advantages. This paper discusses that in the healthcare field, massive medical data is accumulating at an unprecedented speed, and the complexity of diseases is also increasing day by day, making the traditional medical model increasingly inadequate in addressing these challenges. The integration of artificial intelligence technology has enabled applications in intelligent image recognition, medical robots, smart healthcare systems, drug research and development, and medical service management in the healthcare field. In-depth exploration of the current application status, potential and challenges of artificial intelligence in the medical field is of crucial significance for promoting the intelligent transformation of the medical industry, protecting patients' rights and interests, and promoting the healthy development of medical science and technology.

2. Research background

With the rapid development of the Internet and computer technology, algorithms have also been continuously improved, and artificial intelligence has achieved considerable development and application in various fields. General Secretary Xi Jinping emphasized during the ninth collective study of the Political Bureau of the Communist Party of China Central Committee that it is necessary to strengthen the in-depth application of artificial intelligence in fields such as medical and health care [1]. Artificial intelligence medical application technologies have been continuously promoted and popularized under the background of big data. A large number of high-tech companies

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and scientific research institutions abroad have laid out related projects and achieved great results. Artificial intelligence algorithms represented by machine learning and deep learning have shown strong advantages in data processing and model construction. The improvement of computer performance and the reduction of storage costs have made the efficient processing of massive medical data a reality; the development of sensor and Internet of Things technologies has enabled the real-time collection of medical data, providing a solid technical foundation for the application of artificial intelligence in the medical field. The massive growth of medical data and the improvement of disease complexity have put forward higher requirements for the accuracy and efficiency of diagnosis; patients' fragmented information reserves have highlighted the importance of personalized medicine, and the traditional medical model is insufficient to meet the new needs of patients; the unbalanced distribution of medical resources and the tight contradiction between supply and demand need to be solved urgently; the long cycle and high cost of medical research and new drug development also need to be improved urgently. In addition, the intensification of population aging, rising medical costs and the improvement of public health awareness have made the development of artificial intelligence medicine an inevitable trend. Technological progress jointly drives the deep integration of artificial intelligence and the medical industry. At present, artificial intelligence medicine in China is mainly effectively invested and applied in the construction of smart healthcare systems, intelligent image recognition, AI medical robots, etc., to respond to the growing medical demand and promote the innovation and transformation of the medical industry.

3. Applications of artificial intelligence in the healthcare field

3.1. Intelligent image recognition

Artificial intelligence-based intelligent medical image diagnosis relies on medical images and uses deep learning technology. With the help of deep learning technology, functions such as image classification, target detection, image segmentation and retrieval are realized, thereby providing strong assistance for doctors' clinical diagnosis and treatment work. In the application scenario of radiological images, work such as disease screening, lesion mapping and three-dimensional organ construction can be carried out; in the field of pathological images, as a branch of the "large image" architecture, it has been gradually applied to preliminary cytological screening, morphological quantitative analysis and histopathological diagnosis, such as assisting prognosis judgment, tissue type differentiation and benign and malignant tumor identification; in the application of endoscopic images, the early esophageal cancer screening project of artificial intelligence medical images is a research direction with high research enthusiasm and relatively mature development at present.

3.2. AI medical robots

AI medical robots mainly have three major functions: surgery, rehabilitation and diagnosis. Among them, surgical robots rely on AI technology and play an important role in the surgical process, with the characteristics of high precision, pressure reduction and stability, which can break through the physiological limitations of doctors in surgical observation and operation. According to Google's research, the accuracy of AI in diagnosing diabetic retinopathy has reached clinical application standards. Compared with traditional open surgery, its incision is only 1-2 cm, the amount of bleeding is reduced by more than 95%, and patients recover faster. Rehabilitation robots integrate rehabilitation or nursing work with traditional robots. Relying on artificial intelligence technology, they can monitor patients' training data in real time, conduct analysis through high-precision sensing

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feedback, and combine artificial intelligence to realize active compliance control of human-computer interaction, timely improve the intensity and efficiency of patients' training, help patients restore normal living ability as soon as possible, and promote the advancement of inclusive medical care. Diagnostic robots have the functions of pre-consultation and auxiliary diagnosis. Pre-consultation uses speech recognition and natural language processing technology to match patients' symptom descriptions with the standard medical knowledge base, so as to complete services such as patient triage and consultation. Artificial intelligence-assisted clinical medical decision-making diagnosis can assist doctors in the clinical diagnosis of diseases such as cancer and heart disease, and improve the accuracy of disease judgment. A number of related products have been put into use and applied in daily clinical practice. The IBM Watson system can analyze medical literature and patient diagnosis and treatment records to provide patients with high-quality evidence-based individualized diagnosis and treatment plans [2]. Microsoft has developed wearable devices for personal health data collection and analysis, providing wearers with targeted medical treatment, exercise and dietary advice.

3.3. Smart healthcare system

In order to continuously improve the equalization, inclusiveness and convenience of public medical services and solve the main contradiction of difficult medical treatment in public hospitals, the smart healthcare system came into being. Relying on App terminals, WeChat official accounts and Alipay service window platforms, an official information portal based on big data is built. The service process covers the entire process of patients' medical treatment. With the help of advanced technologies such as the Internet, artificial intelligence, Internet of Things and big data, it integrates various system resources of hospitals, optimizes service processes, builds systems for smart medical treatment, diagnosis, treatment, wards and management, and promotes resource sharing and collaboration among various business application systems. For example, Alibaba's "Future Hospital" comprehensively uses current scientific and technological methods to develop and build a complete process service of face-scanning medical registration, credit payment and medical insurance settlement, realizing Internet-based, integrated and data-driven smart medical services.

3.4. Drug research and development

Using artificial intelligence technology, a large amount of biomolecular data can be quickly screened, potential drug targets can be predicted, and the process of drug discovery can be accelerated. At the same time, in the process of screening drug active molecules, artificial intelligence algorithms can quickly screen compounds with high activity and low toxicity by simulating the interaction between drugs and targets, improving the success rate of drug research and development. It helps optimize the design of clinical trials, select trial populations more accurately according to patients' characteristics and disease subtypes, and improve the efficiency and accuracy of trials. In addition, it can quickly find patients who meet the clinical trial conditions by analyzing medical data, accelerating the process of patient recruitment [3]. Artificial intelligence plays an important role in all links of drug research and development. For example, by improving the efficiency of target discovery, accelerating the drug screening process, optimizing drug design and clinical trial design, it can shorten the cycle of drug research and development and reduce research and development costs. Traditional drug research and development usually takes 10-15 years from target discovery to new drug launch, with high research and development costs. The application of artificial intelligence technology can shorten this cycle to 5-10 years and reduce

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research and development costs by 30%-50%, which will bring huge economic benefits to pharmaceutical enterprises and at the same time provide patients with effective therapeutic drugs faster to meet clinical needs.

3.5. Medical service management and optimization

Artificial intelligence plays a key role in medical service management and optimization, running through multiple links such as patients' medical treatment processes and hospital resource allocation. Low-intervention medical applications such as smart triage rely on artificial intelligence medical technology to provide more convenient services for patients, simplify processes, and reduce the burden on doctors. Many repetitive tasks are no longer completed manually by doctors, but are improved in efficiency through artificial intelligence. At the same time, artificial intelligence also plays an important role in the field of medical quality monitoring and data management. Real-time monitoring of the medical process by technology can help doctors detect abnormalities and potential risks in a timely manner, and quickly establish an evaluation model through multi-dimensional data, providing effective help for improving medical quality. In addition, in risk process management, artificial intelligence realizes the integration and standardization of data, converts heterogeneous data into usable structured forms, and then conducts in-depth analysis and mining, providing strong support for hospitals' decision-making in department planning, cost control, talent training and other aspects, and comprehensively promoting the optimization and development of medical services.

4. Ethical challenges in the application of artificial intelligence in healthcare

The application of artificial intelligence in the healthcare field has achieved remarkable results, showing great potential in many aspects from image recognition, drug research and development to treatment upgrading, bringing unprecedented opportunities and changes to the medical industry. However, just like other emerging technologies, the prosperous development of artificial intelligence medicine will also bring a series of severe ethical challenges. From the perspective of doctors and patients, doctors will have ethical risks of over-reliance and blind self-confidence when artificial intelligence technology goes deep into the medical field. Most patients can accept and trust artificial intelligence medical applications in medical logistics-related work, such as registration, payment, querying test reports, etc., but when it comes to high-risk core links related to clinical diagnosis and treatment and surgery, patients' acceptance and trust are low, and patients still hold a skeptical attitude towards the safety and ease of use of artificial intelligence diagnosis and treatment [4]. At the same time, artificial intelligence medicine can assist doctors in making more accurate decisions in diagnosis and treatment, but it cannot completely replace doctors' humanistic care. Patients usually need more emotional understanding and support when facing serious diseases or uncertainties. At the value level, artificial intelligence medicine faces value conflicts and responsibility attribution. In the case of decision substitution, the "algorithm black box" makes artificial intelligence medical decisions face interpretation problems, thereby infringing on patients' autonomous rights. With the continuous enhancement of the autonomy of artificial intelligence in medical decision-making, clinical doctors, medical service institutions and developers of artificial intelligence medical decision-making systems have gradually weakened their actual control over it. The traditional culpability determination standards constructed based on agency, control and predictability can effectively define the ownership of responsibility in conventional medical decision-making and traditional technology application scenarios. The autonomy of artificial intelligence makes the decision-making process complex and unpredictable, and the degree of

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control of relevant subjects is reduced, leading to blurred agency relationships, unclear control basis and weak result predictability, making it difficult for traditional culpability determination standards to be effectively applied. When facing such situations, it is also difficult to effectively cover them, which has a direct and profound impact on the implementation of compensation systems such as the identification of medical damage compensation liability of medical personnel, the definition of medical damage compensation vicarious liability of medical service institutions, and the attribution of product quality liability of artificial intelligence medical decision-making developers. At the technical level, AI models should have the ability of simplified functions and attributes so that patients and medical staff can operate them effectively. At the same time, due to unclear risks, medical staff hold a distrustful attitude towards AI-based clinical decision support systems, which is one of the important obstacles to using AI for treatment. Although algorithms such as deep learning have achieved a relatively mature development trend at present, the scale and quality of medical data constitute the core obstacle factor for the expansion of artificial intelligence applications in the medical field [5]. AI medical training requires feeding a large amount of data to support, especially AI rehabilitation robots that need patients' exercise data feedback for analysis and calculation, and AI diagnostic robots that need patients' real-time information to make feedback. AI medical technology requires high-quality medical data for continuous effective training and verification, while the existing medical data is of uneven quality and poor shareability, and the collection, storage and use of data involve privacy and security issues.

5. Conclusion

At present, with the rapid development of artificial intelligence technology, artificial intelligence medicine has gradually become the main driving factor for the continuous transformation of the healthcare field on the basis of its emergence. Countries around the world will fully invest in the further in-depth development of core medical technologies for a long time in the future, and at the same time optimize the relevant machine learning architectures. This will be used to improve the accuracy and efficiency of artificial intelligence medicine in processing cumbersome medical data, deeply explore the innovative achievements of machine learning in subdivided fields such as complex disease diagnosis and postoperative rehabilitation, and enhance the stability and interpretability of artificial intelligence medical models. A strict testing and verification framework will be used to ensure the stable operation of the system, and promote the continuous innovation of artificial intelligence medical technology on the basis of following ethical principles, bringing more breakthroughs and changes to the healthcare industry.

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