Application and Development Prospect of Artificial Intelligence and Big Data in Medical and Health Field

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Abstract. Artificial intelligence and big data technology have broad development prospects in the medical field. This article introduces the development of artificial intelligence and big data process, artificial intelligence and big data technology mainly in the field of medical health development condition, artificial intelligence and big data applications in healthcare, artificial intelligence and big data exist in the field of medical health challenges shows the four aspects of artificial intelligence and big data technology is widely used in the field of medical, think that artificial intelligence and big data promoting and deepening health reform, but also faces some obstacles in the development. In order to develop the supporting ability of intelligent medical treatment, some Suggestions are put forward, such as the combination of technology and products, demand, data exchange acquisition ability, interpretability of results and improvement of laws and regulations.

Keywords. Artificial intelligence; big data; health care; intelligent medical treatment.

1. Introduction
With the rapid development of artificial intelligence technology and big data technology, the application of artificial intelligence and big data in the medical field has become more extensive and deeper. Powerful artificial intelligence technology can help clinical decision-making by unlocking clinic-related information hidden in massive data under the guidance of relevant clinical problems.

The main development process of artificial intelligence can be divided into three stages: the first stage is the early development from 1943 to 1970, the second stage is the second development from 1980 to 2000, and the third stage is represented by deep learning and big data after 2006. The early development of artificial intelligence was represented by the Turing test in 1950, the birth of artificial intelligence in 1956, and later symbolism, reasoning system, connectionism and expert system. The second development was mainly between 1980 and 2000, with the rapid development of typical statistical learning, machine learning, neural networks and pattern recognition. After 2006, artificial intelligence, represented by deep learning and big data, achieved the third great development, and artificial intelligence was rapidly promoted in the vertical field [1-3].

At the same time, big data analysis technology and data mining technology have been widely used in the medical industry. This includes the collection, testing and analysis of partial clinical data, as well as remote monitoring of patients and analysis of patients’ personal medical records. In addition, the patient’s treatment plan, treatment data, clinical records, pathological characteristics, pathological types, medical insurance and other data were analyzed [4].

The combination of big data analysis and mining technology can improve the medical level and productivity of the medical industry. At the same time, the application of big data technology can not
only improve the work efficiency of doctors, but also solve problems such as the high cost of medical treatment for patients and the large damage to the body caused by traditional treatment techniques. In addition, big data technology can also remotely monitor patients, reduce the cost of hospitalization for patients, make full use of medical resources, minimize the accident risk of patients, and create greater social and economic value for our society [5].

In this article, we discuss the current situation of artificial intelligence and big data in the medical field and discuss their future challenges. In addition, it will deeply analyze how artificial intelligence and big data technology empower the medical industry from the aspects of medical information development and intelligent medical application, and finally make an outlook on the future development of “artificial intelligence + medical health”.

2. Main Development Conditions of Artificial Intelligence and Big Data Medical and Health Fields
The main development conditions of artificial intelligence technology in the medical and health industry are data, computing power and algorithm. The data includes structured data and unstructured data. Typical data types include electronic medical records, medical images, genetic data, etc. [6]. After 2006, with the introduction of GPU, CPU, TPU and neural network chips, the computing power of computers has been greatly improved, which has greatly promoted the development of artificial intelligence technology and made great progress in the medical field. In terms of algorithm, the main machine learning includes supervised learning, unsupervised learning, reinforcement learning and transfer learning. Supervised learning has labels, such as medical text classification and image screening [7-9].

On the other hand, unsupervised learning, such as text clustering without labels, is the main application scenario for the medical industry. Due to the shortage of annotated data, potential solutions including transfer learning and reinforcement learning are expected to solve the problem of insufficient annotated data in the medical field [10].

The above paper discusses the development conditions of artificial intelligence + medical health. What are the main data types that artificial intelligence can analyze in the field of medical health? Here, this paper analyzes from three dimensions. In terms of time cycle, the period of medical and health field that can be analyzed by artificial intelligence can cover a variety of medical and health problems from infants to pre-school period, to adolescence, to middle and old age. From the perspective of data type, the data processed includes two categories, one is medical data and the other is health data. The medical data mainly comes from clinical practice, including electronic medical records, medical images and other temporal data [11-12]. The other aspect is health data, including genetic data, exercise data, physical examination data, sleep data, diet and alcohol and tobacco. This part of data is more closely related to us, transforming medical problems into chronic disease management and prevention problems. Artificial intelligence can play a role in health monitoring and personalized treatment plans.

3. Artificial Intelligence and Big Data in the Application of Medical Health

3.1. Artificial Intelligence Technology in the Typical Applications in the Field of Health Care
The first part is natural language processing and speech recognition, the second part is computer vision, the third part is robot technology, and the fourth part is big data technology and intelligent terminal. Finally, literature collection and analysis and reasoning are presented, as shown in figure 1.

(1) Intelligent diagnosis of medical image based on computer vision technology
Medical imaging is an important part of the medical process. Medical imaging data is an important part of medical diagnosis. The application of artificial intelligence technology can help radiologists perform image analysis faster and more accurately and provide reference opinions. It can also help Doctors use computer vision technology to quickly read film information and intelligently diagnose the condition. For radiologists, the improvement of image analysis technology can help them save
more time to analyze and judge the pathological content, and this technology can reduce the need for radiologists in hospitals [13].

(2) Artificial intelligence virtual assistant based on speech recognition technology
With the development of speech recognition technology, speech recognition technology can be applied to electronic medical records to help doctors write medical records. Speech recognition technology is a combination of speech recognition and natural speech processing technology, used to describe the symptoms of patients, patients can provide medical consultation, diagnosis, disease guidance and other services. The technology also saves doctors the time it takes to record data, and automatically generates electronic medical records to make doctors more efficient.

(3) Intelligent medical robot
With regard to the coVID-19 outbreak in 2020, medical robots have played an important supporting role. There are many kinds of medical robots, such as service robot for the disabled, medical teaching robot, nursing robot and surgical robot. At present, hospitals have a high demand for surgical robots. Surgical robots can improve medical technology and reduce the fatigue and tension of doctors due to long operation time. Surgical robots, which can provide more accurate surgical procedures, reduce patients’ blood loss and pain, and allow wounds to heal faster, are promising [14].

(4) Artificial intelligence can collect a lot of literature information for analysis and improve the efficiency of drug research and development
Artificial intelligence technology can help the medical industry in drug research and development, reduce the time for drug research and development, improve drug production efficiency, and reduce research and development costs. At present, Chinese pharmaceutical companies have arranged AI field, Artificial intelligence technology is mainly used in the research and development of new drugs and clinical trials. Artificial intelligence technology can not only save the time and energy of drug research and development personnel, but also can extract information more accurately and conduct experimental verification of new drugs so as to accelerate the speed of drug development [15].
(5) Intelligent health management system

The intelligent health management system mainly contains two technologies, one is data processing technology, the other is chip technology. Health Management Service system is a mobile device for medical assistance, mainly for exercise, sleep, heart rate and other detection. Through the application of artificial intelligence technology, cloud database can be established, which is mainly collected by health data such as body detection, blood pressure detection, ecg detection and fat detection. Therefore, personal health databases can be established and health management schemes can be established by analyzing the data. This kind of device is usually applied to terminal devices such as smart wearables. Through the collection and processing of personal habits through big data, the physical state of users is analyzed and evaluated, so as to provide a set of private health management plan, which enables users to predict risks in advance and formulate countermeasures [16].

3.2. Typical Applications of Artificial Intelligence Technology and Big Data Technology in The Medical and Health Field

In the field of health care, artificial intelligence technology and big data technology have the following main application scenarios: electronic medical record, medical diagnosis, auxiliary diagnosis and treatment, medical robot, personal health, big data analysis and precision medicine. Typical ai technologies combined with applicable scenarios could lead to applications, such as electronic medical records combined with voice recognition, which could produce a voice-based electronic recruitment system, saving doctors a lot of time.

(1) In terms of precision medical, precision medical technology of data management and sharing platform to realize interagency, inter-departmental medical big data gathering and integration, and implementation of the unity of the whole life cycle of large-scale precision medical data management, solve the problem of precision medical key data missing, precision medical in the establishment of the major diseases and biomedical fields such as solid data base, promoting the advancement of medical and health field. Precision medicine can provide personalized health insurance for users by analyzing their daily behaviors related to their health [17]. Finally, the combination of robot technology and diagnosis and treatment can give birth to surgery and guidance robots. Here are some common USES of big data in the medical industry, including business operations and health management:

Sharing electronic medical records: Under the big data analysis, the sharing of electronic medical records is realized. Shared electronic medical records can collect and analyze corresponding data through big data technology, reduce medical costs and reduce the economic burden of patients. Another advantage of sharing electronic medical records is that it records patients’ medical data, which can reduce patients' medical costs and provide convenience for doctors and medical service providers. But the biggest challenge at present is that, considering the security and legality of patient identity information, electronic medical records cannot be shared and universal. Therefore, how to find a safe and effective data mining technology is the key to reducing medical costs, as shown in figure 2.

(2) Analyze the hospital system: consider the benefits we get from analyzing trends in hospitalizations. For example, a meta-analysis of medical equipment in a pediatric ward could identify potential infantile infection trends earlier. Or consider the benefits of reducing postoperative staphylococcal infections. Big data analysis technology can help hospitals understand whether the antibiotics prescribed by doctors after surgery can prevent wound infections in patients.

(3) Management data for public health research: health care workers will be inundated with data. Hospitals can provide patient health records and immunization data that would be meaningless without big data technology to analyze. For public health records, big data analysis technology can make it more substantial, standardized and enriched. Therefore, big data analysis can make our medical industry more legal and provide patients with better medical analysis.
(4) Evidence-based medicine: many medical institutions practice “diet medicine”, in which doctors use the same set of tests to determine the cause of a patient’s illness. Evidence-based medicine, on the other hand, allows doctors to quickly and accurately diagnose patients’ symptoms by comparing them to a vast database of patients. Here, the role of big data technology is to collect information from various places and transform the data into corresponding standards. In this case, a record with “high blood pressure” could be mapped to another record with “elevated blood pressure”.

(5) Lower readmission: one reason costs have risen is that readmission rates remain high within 30 days of patients leaving the hospital. The hospital has corresponding records of the information that patients have visited the hospital. The hospital can analyze the patients through big data, so as to identify which patients are high-risk patients and need to be hospitalized, and which patients are relatively mild and do not need to be hospitalized.

(6) Protect patient’s identity information: Now many insurance companies use big data analysis technology to prevent medical fraud and patient identity theft. For example, UnitedHealthcare insurance company can use voice-to-text method to find scammers. Big data can be used to predict patients’ diseases and help patients find suitable treatment options.

(7) Clinics are more efficient and convenient: with the development of medical technology, there are more clinics, but the biggest difficulty is how many doctors and patients a clinic can accommodate. Westmed Medical Group in Westchester county, New York, for example, has 250 doctors, 250 doctors and $285 million in annual revenue, up from 16 in 1996. As it grows, it must become more efficient to keep its edge. The application of big data technology can help clinics analyze various medical procedures. As a result, it can simplify work processes, reduce the workload of doctors, improve medical procedures, delegate tasks such as clinical examinations to nurses, and improve patient satisfaction with the hospital [18-19].
4. Artificial Intelligence and Big Data in the Field of Health Care Challenges

With the improvement of medical and health technology, there are some challenges in the application of artificial intelligence technology and big data technology in this field. This paper will discuss from the following aspects.

First, in the process of combining technology with products and requirements, the optimization goal should be defined first. For example, you should make clear whether your service target is patients, doctors or hospitals, and use formal language to clearly define the problem and optimization goal. This is the first step. There is a need for multi-disciplinary cooperation, including artificial intelligence experts, information experts and medical staff, as well as government departments.

The second challenge is data exchange. The initial construction of AI system is to conduct statistical analysis of historical clinical data. The deployed AI system will be perfected and improved through the continuous update of data. According to the current analysis of the medical environment, the medical data on the AI system is not available for sharing. In the United States, medical researchers are working to make data sharing possible, leading to a healthcare revolution. Using pay-for-medical schemes to reward doctors for improving health care gives doctors, drug companies and patients a huge incentive to compile and exchange information. With the development of technology, China is also exploring a medical data exchange system suitable for itself.

Third, due to the interpretability of the results, traditional machine learning algorithms, such as decision trees, are highly interpretable, while machine learning algorithms represented by deep learning are black-box and often difficult to explain. When classifying a medical image, machines are often unable to tell why. One solution is to layer the model, visualize the model and features, and show the process of the model to doctors and patients.

Fourthly, with the maturity of artificial intelligence technology and its wide application in the medical field, emerging technologies are facing legal and ethical challenges while creating historic changes. Laws and regulations should protect technological innovation, and technological innovation and development should also abide by the bottom line of value of the law. To ensure orderly and rapid development “artificial intelligence and health”, to strengthen the related legal, ethical and social issues research, establish and perfect the relevant laws, regulations and ethical framework, in addition, still need to carry out related to “artificial intelligence and medical applications” acknowledge the civil and criminal responsibility, privacy and property rights protection, use and study the legal issues, such as information security, build system of traceability and accountability, clear “artificial intelligence and health” legal subject and related rights, obligations and responsibilities, etc. Conduct research on the behavioral science and ethics of “artificial intelligence + medical health”, and establish a multi-level judgment structure of ethics and morality and an ethical framework for human-machine cooperation. We will take an active part in global governance, strengthen research on major international common issues of “artificial intelligence + medical health”, such as robot alienation and safety supervision, deepen international cooperation in “artificial intelligence + medical health” laws and regulations, and formulate corresponding international standards, so that all countries in the world can face the challenges together.

5. Conclusions

Finally, this paper summarizes several typical application scenarios and its hot research directions and fields. In China, medical imaging attracts the most attention, followed by health management and disease risk prediction. In terms of drug mining, China has done little, followed by case analysis, virtual assistant and hospital management. Other countries, such as drug mining, are getting more attention.

In terms of diseases, this paper summarizes the current hot research. At present, diabetes has received more attention in China, which is related to the population base and composition of China, followed by anti-cancer drugs, mental health, psychiatry, breast cancer, genetic testing and so on.

With the rapid development of intelligent medical technology, the combination of artificial intelligence technology and big data technology can not only help doctors get more accurate diagnosis,
but also give doctors treatment advice. At the same time, it can also help us prevent diseases and provide health guidance. Let our life healthier, let our medical treatment level rise substantially.

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