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The applications and prospects of intelligent services robots in medicine

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Abstract. With the rapid growth of the ageing population and the increasing demand for medical services, the medical market is facing great challenges and opportunities. Intelligent service robots can provide various medical services, such as patient monitoring, drug distribution, medical record management, etc., which can improve medical efficiency, reduce the burden of medical staff, and have the advantage of 24-hour uninterrupted service. However, the application of intelligent service robots in the medical field still faces some challenges, such as technical limitations, legal and ethical issues. In addition, there are also differences in patient acceptance and demand for intelligent service robots. Based on the summary of intelligent medical treatment, this paper will introduce the application of intelligent service robots, study the application and prospect of intelligent service robots in medical treatment and the innovation of intelligent service robots in business models. Through literature review, SWOT analysis and data, the paper explains the wide application of intelligent service robots and their future opportunities and challenges.

Keywords: artificial intelligence, robotics, medical services, smart medicine.

1. Introduction

Due to the arrival of the aging era, the relative lack of medical manpower and other problems, in order to cope with the growth of high-quality medical demand, medical intelligent service robots came into being and have considerable development potential. The appearance of intelligent service robots has liberated the hands of nursing staff to a certain extent, improved the work efficiency of the hospital, and is a highly intelligent robot. It can be used for surgery, medical imaging, medical information query, drug delivery, etc. Intelligent service robots can partially make up for the shortage of medical resources and provide more medical services. Since 2015, the state has issued a series of important policy documents to promote the transformation and upgrading of Chinese manufacturing, and the medical field, as an important area of people's livelihood, has also been the focus of major policy documents to support the research and development and production of medical robots [1]. The introduction of a series of supportive policies can show that China's medical system is transitioning from the traditional mode to the intelligent medical mode with modern service as the concept. At present, China has a large number of medical robot emerging enterprises, but most of them are foundries, and their innovation ability is relatively lacking. China's Shanghai Jiao Tong University leads the world in the development of single-hole robots and is expected to become an emerging subdivision of China's medical robot industry to

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achieve cornered overtaking. The theme of this paper is the application and prospect of intelligent service robots in medical treatment. It will analyze the application and prospect of intelligent medical treatment and medical service robots by citing a literature review and exploring the ethical and legal issues of robots. The SWOT analysis method is used to analyze the opportunities and challenges of Cobos service robot in its business model innovation. The research on the application and prospect of intelligent service robots in medical treatment provides reference and guidance for the reasonable application of intelligent service robots in medical treatment, which is helpful to further optimize the medical process, improve medical service quality, help to cope with the challenges brought by the aging population, improve the coverage and accessibility of intelligent medical services, and contribute to the exploration of the business model of medical robots. The application of robots in the medical field will bring a subversive change to the entire medical industry. However, due to the "technical black box" in the algorithm, the application of intelligent medical robots is accompanied by greater technical risks and uncertainties, which will cause great harm to the life and health of patients once it is out of control [2]. How to formulate the regulations and ethical guidelines related to the application of intelligent service robots in medical treatment, to ensure the legal and ethical use of robots in the medical environment is a problem that needs attention.

2. Application direction of service robot in the context of intelligent medical treatment

2.1. Background of smart healthcare

Data from the National Bureau of Statistics (NBS) show that by the end of 2021, the elderly population aged 65 years and above will reach 2005.6 million, accounting for 14.2% of the total population. the dependency ratio of the elderly population aged 65 years and above will be 20.8% [3]. China's population is aging very rapidly, mainly due to the long-term low fertility rate and the longevity of the population structure. Due to China's large population base, the elderly populations are also very large. According to surveys, the prevalence of chronic diseases among the elderly is on the rise. However, such patients have relatively high demands on medical services, requiring more accurate medication data records and body function monitoring data. In addition, the elderly with chronic diseases need to receive long-term medical services [4]. The demand for healthcare resources for the elderly is far greater than the supply, and smart medical technology can provide more convenient, efficient and personalized healthcare services for the elderly, helping to meet the healthcare challenges posed by an aging population.

2.2. The development status of intelligent medical treatment at home and abroad

Medical treatment is one of the most deeply applied fields of artificial intelligence, and its application will greatly improve people's healthy living conditions. Nowadays, driven by mobile Internet, big data, brain science and other cutting-edge technologies, medical artificial intelligence is revolutionizing the medical production model. Compared with the domestic, foreign intelligent medical industry developed earlier. In the 1980s, Massachusetts General Hospital began to develop the DxPlan project, including clinical characterization of most diseases in various specialities of internal medicine and developed a personal computer program IBM. Watson (Watson) is an artificial intelligence system developed by the IBM DeepQA project team in 2007, which can store millions of documents, including encyclopedias, medicine, literature, nutrition, and other reference materials, can build a knowledge base and absorb a large amount of medical knowledge by asking patients about their symptoms, medical history, and medical records. By using artificial intelligence technology for natural language processing and analysis, with the help of information and data collected from various channels quickly become a medical intelligence expert in a short period of time, and quickly give diagnostic hints and treatment suggestions [5]. After a long period of argumentation, artificial intelligence medical treatment has been accepted and gradually promoted by many hospitals and scholars at home and abroad.

Unlike the development of foreign countries, the application of artificial intelligence in the medical field in China started late, but the development speed is no less than that of foreign countries. China has

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a huge population base and rich medical data in the field of artificial intelligence, which provides good conditions for the application of artificial intelligence in the medical field. In recent years, China has actively promoted the transformation of the medical industry from digitalization and informatization to intelligence. From 2015 to 2020, the application scale of China's intelligent medical industry has been developing steadily, with a compound annual growth rate of 12.4% [6]. From 2020 onwards, with the superposition of market demand, favorable policies, technological transformation and other factors, the scale of the future application of intelligent medical care will develop rapidly. From 2017 to 2021, the market size of China's medical robots grew at a rate of more than 20%, and the industry experienced rapid development.In 2021, China's medical robots market size reached 7.93 billion yuan, an increase of 34.01% year-on-year. Preliminary estimates indicate that the market size of China's medical robotics market in 2022 will be 9.71 billion yuan [7]. The Third Hospital of Peking University makes full use of the advantages of new technologies such as big data, artificial intelligence, and the Internet of Things, and combines its own actuality to improve the workflow from four aspects, namely, medical quality management, hospital operation and management, intelligent logistics management, and cross-hospital collaborative management, and builds a smart hospital management system. It has improved the management efficiency, standardization and refinement of the management level [8]. Through the application and development of artificial intelligence in the medical industry at home and abroad, it can be seen that the medical service under the background of artificial intelligence has become a focus of attention, and will play a role in guaranteeing people's health in the future.

3. Medical service robots

Since the birth of Unimate, the first industrial robot, in 1961, the fields of application for robots have begun to expand. As technology advances and innovates, so do the types of robots that are derived. Among them, the application of robots in the medical field is particularly striking. In 1985, researchers completed a neurosurgical biopsy with robot-assisted positioning with the help of the PUMA260 industrial robot platform, which marked the beginning of the development of medical robotics. A medical service robot is a hot research direction in the field of robotics, which has advanced sensing systems, intelligent information devices and extensive image analysis systems. They can be used in hospitals, families, clinics, communities and other environments to provide rescue, rehabilitation, health management, surgery and other services for patients. Medical service robots have a high degree of intelligence, which can improve the diagnosis and treatment technology of the medical system and assist the hospital to improve work efficiency. The development of medical service robots is of great significance for improving people's healthy living conditions, improving medical efficiency and reducing misdiagnosis.

Medical service robots based on computer science, biomedicine, big data computing and mechanics have the following characteristics: 1) Applied to all medical-related environments, with basic mobile obstacle avoidance capabilities, remote operation intelligence and other capabilities. 2) There is interconnection between the medical service robot and the hospital's own information management system, and there is communication information, clinical auxiliary equipment, and an interactive transmission docking interface. 3) It mainly serves people, integrating biology, medicine, artificial intelligence, mechanical technology, computer technology and other fields. 4) The material selection is safe and non-radiation, and if necessary, it is assisted with disinfection and sterilization functions to ensure the safety of use. 5) Have a certain adaptability to the medical environment, help the nursing staff to complete the repetitive work, give patients a certain emotional sustenance, and relieve the pressure generated in the treatment process [9].

A surgical robot is one of the best-developing directions in the entire medical service robot industry. Da Vinci's surgical robot was officially certified and put into use in 2000. It can perform minimally invasive surgery in the abdominal cavity, help doctors operate complex surgical actions and observe pathological structures in the abdominal cavity, and represents the first-class level of surgical robots. It is widely used in pediatric surgery, cardiovascular surgery, thoracic surgery, gynaecology and other departments [10].

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In recent years, nursing assistance robots have increasingly appeared in hospitals. Through the instructions given to the nursing robot by the computer platform, the robot can freely transport items in the indoor environment, sort out medicines, affect communication, record the vital signs of patients and other actions. In addition, the nursing robot also has auxiliary functions such as medical information query and life entertainment, providing hospitals with more efficient and convenient nursing services. These robots can not only reduce the burden on nurses but also improve work efficiency and provide a better care experience for patients. HelpMate, a robot developed in the United States, can help nurses with transport tasks such as picking up bed sheets. In order to facilitate the transport of patients, the Japanese Mechanical Engineering Research Institute developed the "MELKONG" robot, which is specially used to care for and transport the elderly, patients after surgery, patients with physical disabilities and patients who are not convenient to move around [11].

4. The resolution of legal and ethical issues in the future of AI robots in healthcare

On the one hand, through the in-depth discussion of the law, ethics and social issues related to artificial intelligence, draw the legal and ethical boundaries for the intelligent society, so that artificial intelligence can serve human society; On the other hand, establish open and transparent technical standards and management mechanisms, implement a two-tier regulatory structure with equal emphasis on design accountability and application supervision [12], formulate relevant policies to ensure medical safety and service quality, focus on the establishment of traceability and accountability systems, and conduct research on medical ethical issues that may arise from artificial intelligence. Strengthen the assessment of the potential harms and benefits of artificial intelligence in healthcare; On the basis of the comprehensive implementation of the national information security hierarchical protection system, the data security management responsibility system shall be established, the identification code, scientific classification, risk classification, and security review rules shall be formulated, the boundary between data application, information security and privacy protection shall be clarified, the security of artificial intelligence applications shall be evaluated and monitored, information security shall be ensured, and privacy protection shall be strengthened [13].

5. Smart medical business model innovation

Business model innovation in smart healthcare is of great significance, which can improve healthcare efficiency, and good doctor-patient experience, promote technological innovation, address the challenges of an aging population and explore the ethical and legal issues of robotics. The first step is to understand the pain points and needs of the healthcare industry, especially those that can be solved by technology. Conduct in-depth research and conversations with healthcare organizations, doctors and patients to identify market opportunities and potential innovations. Second, develop new technologies and solutions suitable for the healthcare sector by combining the latest technological developments such as artificial intelligence, big data analytics, and the Internet of Things (IoT). For example, develop intelligent assisted diagnosis systems, telemedicine platforms, and medical data analysis tools. Provide better user experience and personalized medical services through technological innovation. For example, developing intelligent medical assistants, providing 24-hour online consulting services, and customizing personalized rehabilitation programs. Also, cooperation with medical organizations is an important part of business model innovation. It is possible to establish partnerships with hospitals, clinics, insurance companies, etc., to provide technical support, data analysis services, telemedicine, and other solutions to achieve a win-win situation. Finally, data security and privacy protection are very important considerations in smart healthcare. Ensuring the safe storage and transmission of medical data and complying with relevant privacy regulations establishes the basis for trust and cooperation.

TiMi Robotics uses medical robots as a carrier to create a medical intelligence system, covering the fields of operating room medicine, instrument management, ward care, and hospital sensory management. It improves the efficiency of hospital decision-making and supervision, enhances the patient's medical experience, reduces medical costs, and minimizes occupational injuries to healthcare workers. As a leading company in the medical robotics industry, TiMi continues to help the construction

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and development of smart hospitals through the deep integration of robotics technology and medical business. It has the following three major advantages. First, technical advantages. Titanium Mee Robotics has advanced robotics technology, which can provide targeted services according to the special needs of the scene, optimize the status quo of the existing medical services, and establish a smart medical service system, including nuclear medicine ward service robots, PET-CT companion/guidance robots, and intelligent guidance and triage robots. Second, is the brand advantage. TiMi Robotics has a good reputation and wide popularity in the field of medical robotics, which is conducive to market promotion and user acceptance. Titanium Meter Robotics is a domestic high-tech enterprise that provides intelligent robot solutions for intelligent medical scenarios. At present, among the hundreds of medical robot products of TiMi, nearly ten medical robot products have been applied to more than 400 large-scale tertiary hospitals in China. Third, leading flexible logistics technology. Titanium Meter robot realizes the full coverage of the key departments in hospitals and establishes a safe, convenient, efficient and intelligent software and hardware system for the transportation and management of materials, which does not need to modify the building structure and does not need to post any auxiliary signs. It improves the distribution efficiency of hospital supplies, realizes the fine management of supplies, reduces medical costs, and enhances the brand image of the hospital [14]. However, it also has disadvantages. The high development and production costs of the TiMi robot led to high product prices, which limits the purchase willingness of some medical organizations and individuals. In addition, due to the relatively new application of medical robots in the healthcare industry, some users have limited acceptance and need to be publicized and educated. Meanwhile, TiMi Robotics has many opportunities ahead. For example, the medical robotics market is expected to continue to grow as the population ages and the need for healthcare increases, which will provide additional business opportunities for TiMi Robotics. As technology continues to advance, TiMi Robotics has the opportunity to further improve its technology and introduce more advanced products to increase its competitiveness in the market and expand its market share. At the same time, there are inevitable threats. The medical robotics market is highly competitive, and Titanium Meter Robotics faces competitive pressure from other medical robotics companies at home and abroad. In addition, medical robotics involves some legal and ethical issues, such as responsibility sharing and privacy protection, which need to be solved by Titanium Meter Robotics in cooperation with relevant authorities.

Titanium Meter Robotics can respond to these challenges and threats through strategies such as continuous improvement of technology, reduction of product costs, and strengthening of marketing and cooperation. At the same time, Titanium Meter Robotics can also pay attention to the changes in market demand and adjust its product and service strategy in time to adapt to market development.

6. Conclusion

Based on the background of intelligent medical care, this paper analyzes the current situation, development trend and application status of existing intelligent medical service robots, analyzes the business model innovation of intelligent medical care, and takes TiMi Robot as an example to illustrate the opportunities and challenges of the business model of intelligent service robots in the medical field. It is pointed out that the future application of intelligent service robots in the medical field still faces legal and ethical challenges, as well as the commercialization of intelligent service robots still has a lot of room for development. There is indeed a long way to go to fully realize the road of medical intelligence. This requires not only scientific and technological progress but also policy support and people's rational treatment. However, with the continuous development of artificial intelligence and robot technology, the prospect of medical robot industrialization is very broad. The government and relevant institutions should actively promote the research and development and application of medical robots, formulate relevant policies and norms, and provide support and guarantee for the healthy development of the medical robot industry. At the same time, people also need to treat the application of medical robots rationally, clarify their role and limitations in the medical process, and ensure the reasonable and safe application of robot technology. It is believed that with the joint efforts of all parties, the medical robot industry will usher in a better future.

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