Frontiers in Computing and Intelligent Systems
ISSN: 2832-6024 | Vol. 8, No. 1, 2024

The Application of Artificial Intelligence in Healthcare

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Abstract: Science and technology have been deeply developing in the direction of data processing, deep learning, artificial intelligence, etc. The speed of technological change is profoundly affecting people's way of life, causing a strong impact and challenge to the traditional philosophy of science and technology. With the advancement of artificial intelligence strategies and capital markets in various countries, artificial intelligence companies, artificial intelligence products and artificial intelligence services continue to emerge. Humans have also made great progress in developing various AI applications, especially in the field of medicine. Ai technology has fundamentally changed the healthcare sector, exponentially increasing doctors' ability to deliver better and faster results than ever before.

Keywords: Medical Artificial Intelligence; Ethical Challenges; Medical Health Field.

1. Introduction

It can be seen from the density of documents released by the state that China attaches great importance to the application and development of artificial intelligence in the medical and health field. Medical artificial intelligence not only brings us more high-quality and efficient medical services, but also brings a series of ethical risks and challenges. Only by actively responding to the ethical challenges brought by medical artificial intelligence can medical artificial intelligence technology develop in a direction conducive to human health [1-2]. The research and development of medical artificial intelligence and its application involve medical institutions, medical personnel, patients, designers and producers of medical artificial intelligence, etc., which determines that the ethical issues brought by the application of artificial intelligence in the medical field are very complex. Therefore, reflecting on and actively responding to the ethical challenges brought by medical artificial intelligence are of great significance to increasing human health and welfare [3]. Mathieu Komorowski [4] believes that the concerns surrounding AI replacing doctors' jobs can be dispelled. Awareness, multitasking, flexibility, and communication skills are human abilities that AI has not yet achieved and are unlikely to do so anytime soon. Instead, AI will continue to occupy the co-pilot's seat, improving the way we work and injecting more rationality into our practices. Bertelan Mesko, Gregory Hertney, and Zusana Jelfi [5] argue that while there are still more problems to be solved, AI is not meant to replace medical professionals, and that those who use AI may replace those who do not.

Loredana Mark, Chris Boyd, and Eva Bezak [6] see a need to think about how biomedical engineers, physicists, and IT specialists can work with clinicians and healthcare providers to ensure the safe adoption and implementation of these new technologies. Mark Henderson Arnold [7] believes that since medical artificial intelligence will affect the role and nature of the work of doctors, doctors should neither uncritically accept nor unreasonably resist the development of artificial intelligence, and that it is not enough for future doctors to have simple technologies, they also need to learn new concepts, namely how to benefit patients through artificial intelligence. And the doctor-patient relationship needs to be reconsidered. Jason Borenstein and Daniel Schiff [8] recommend that companies provide detailed information about AI systems, which can help ensure that doctors and their patients are adequately informed. By explaining to patients the specific roles of healthcare professionals, AI, and robotic systems, as well as the potential risks and benefits of these new systems, physicians can help improve informed consent processes and begin to address major sources of uncertainty in AI. The hope is that the healthcare community will encourage an open and robust dialogue about evaluating new AI technologies and integrating them into training and patient care. Michael J. Rigby [9] argues that the most pressing issue is to parse the boundaries between the role of physicians and machines in patient care, and to adapt the education of future physicians to proactively confront the coming changes in the practice of medicine.

2. Main Applications of Artificial Intelligence in the Medical Field

2.1. Medical Robot

Medical robot mainly refers to the intelligent service robot used for clinical surgery or auxiliary medical treatment. The rapid development of medical robots is driven by a combination of technological advances (motors, materials, and control theory), advances in medical imaging (higher resolution, magnetic resonance imaging, and 3D ultrasound), and increased acceptance of laparoscopic surgery and robotic assistance by surgeons and patients. The greatest impact of medical robots is in surgery, whether it is radiosurgery or tissue manipulation in the operating room, which is improved by the precise movement of the necessary tools [10]. With robotic assistance, surgical outcomes can be improved, patient trauma reduced, and hospital stays shortened. The most widely available surgical robot, the Intuitive Surgical Da Vinci System, has been discussed in more than 4,000 peer-reviewed publications, the system has been approved by the U.S. Food and Drug Administration, and the procedure was used in 80 percent of radical prostate cancer surgeries performed in the United States in 2008, just nine years after the system came on the market. In China, although the research of medical robots started late, it has developed very rapidly. Beijing University of Aeronautics and Astronautics' Institute of Robotics has collaborated with the PLA Navy

General Hospital to develop a medical brain surgery robot, and has made major breakthroughs in key technologies such as human-machine synthesis and optimization, medical image processing, navigation and positioning, and surgical scheduling.

In addition, the medical brain surgery robot can also be operated remotely via the Internet. At present, Tianzhihang is the largest orthopedic medical robot company in China. The first generation orthopaedic surgical robot (GD-A) was officially registered as a medical device in February 2010, filling the gap in domestic orthopaedic medical technology research.

2.2. Image Recognition

Image recognition is a technology that uses computer to process and analyze images. It is an important technology in the field of artificial intelligence deep learning. On the basis of training various medical images and obtaining input images, it converts the sequence of input information and images into flat direction vectors through operations such as convolution and aggregation, and every element of these output vectors can be used to calculate and represent the probability of the existence of these diseases. At present, image recognition technology has been applied in many clinical fields. Cervical cancer is one of the four leading causes of death in women, and although there are many treatments available for cervical cancer patients, such as surgery, radiation, and chemotherapy, a patient's prognosis largely depends on whether the cancer is diagnosed at an early stage. Intelligent image recognition of cervical cancer based on deep learning can assist doctors in early diagnosis of cervical cancer with an accuracy rate of about 90%. The traditional chest image recognition system for patients with pneumonia virus is mainly a mode of detection and viewing by two doctors at the same time. In the outbreak stage, image recognition technology has greatly alleviated the dilemma of insufficient medical personnel in the fight against the new coronavirus.

2.3. Auxiliary Diagnosis

Artificial intelligence in medicine can greatly improve the degree of automation of medical data measurement and analysis, thus greatly improving work efficiency and reducing the intensity of work of medical personnel. As computing power continues to improve, AI systems can analyze personal characteristics, medical records, large amounts of literature, and other medical data with high accuracy and with little time and cost to perform the same tasks as humans. The increase in cases can not only enrich and train the knowledge of artificial intelligence systems, but also accumulate and analyze knowledge through automatic or manual intervention to improve the overall level of medical care. Ai-based software has demonstrated high performance in visual tasks, such as large intestine polyp detection. The technology will play an auxiliary role in improving human cognitive pattern recognition and will be a valuable educational tool, especially for non-expert operators. In summary, the application of AI to medicine provides decision support for disease prevention and control, increasing the access and quality of healthcare due to the reduction of time, cost, and medical errors.

2.4. Health Management

With the booming development of big data and artificial intelligence, the health management model is undergoing fundamental changes. One of the most important changes in modern healthcare delivery is the evolution of paper records to electronic health records (EHRs). The EHR contains the patient's vital signs and generates a list of questions about the patient's symptoms and medical conditions. As a result, the EHR has shifted the focus of the physician's physical examination from the actual patient's body to a set of indicators about the patient's body, so that the physician spends more time on the computer than at the patient's bedside. The current novel coronavirus is widespread around the world, and although some patients meet the discharge criteria and are no longer infectious, their lung function, immune function, psychological and social adaptability are generally reduced. The provision of dynamic, comprehensive and continuous health services for patients returning to their communities and families has become a prominent issue in the global public health field. Based on artificial intelligence cloud database, a TCM health management platform was built. Through the information processing of patients' health assessment data, this model can provide them with professional diagnosis and personalized TCM health management projects. This hospital-community-family interaction and cooperation model accurately connects the diversified and multi-level service objects, breaking through the limitations of traditional health management in time and space.

3. Advantages of Artificial Intelligence in Medical Applications

3.1. Ease the Crisis of Medical Human Resources

People need the highest quality health care, but it cannot be provided without a workforce. 400 million people lack access to one or more essential health services, and 5 billion people lack access to safe, affordable surgical and anaesthetic care when they need it. The current healthcare workforce crisis is attributed to at least three major issues: a global physician shortage, physician aging and burnout, and an increased demand for chronic care [11]. With one in three doctors over 55 and one in three doctors expected to retire in the next decade, there is a growing shortage of doctors in the future. With the number of people over the age of 65 expected to double by 2030 and the number of chronic diseases on the rise, the demand on the healthcare system is also growing. The increase in the number of diseases means that the per capita workload of doctors will continue to increase, and doctors will suffer from increasing burnout due to far overload. It can be seen that the crisis of medical human resources is expanding globally, and it takes a long time to train an excellent doctor, which cannot be completely solved in a short period of time. The participation of medical artificial intelligence can make up for the lack of high-quality medical human resources, reduce the work pressure of doctors, and alleviate the tension of medical human resources.

3.2. Improving the Medical Service Model

Big data technology has changed the way patients interact with healthcare providers, and new modes of interaction are easier and more effective than in the past. Under the current model, when a patient comes to the hospital for a medical procedure, only data such as last name and social security number is required and the hospital administrator can find and pull the patient's past medical records, which may include medical history, medications, allergies, blood type, and so on.

Once treatment is complete, most hospitals offer patients a variety of payment methods, such as downloading a hospital app on their mobile phones, and patients only need to enter a guarantor number or social security number to pay. On the one hand, this model greatly improves the work efficiency of medical institutions and doctors, on the other hand, it also reduces unnecessary trouble for patients and provides convenience for patients. The transformation of the healthcare delivery model is also reflected in elderly care, where the digital transformation of elderly care is a huge opportunity, with many applications and systems where elderly patients can actively participate in the collection and processing of data. Patients can measure their own blood pressure or blood sugar levels, read data from wearable sensors, and then communicate symptoms to care professionals and doctors through various channels. The data collected by patients is not only a valuable input for clinical decision-making, but also gives patients the opportunity and power to manage their own health and mobilize their enthusiasm.

3.3. Improve the Efficiency of Diagnosis and Treatment

It's no secret that a well-trained professional can make mistakes, after all, doctors are human. And AI has better decision-making abilities, more accurate and faster than doctors. Ai has now proven to be effective in the precise diagnosis of various medical conditions. In ophthalmology, for example, an AI-based grading algorithm is used to screen fundus photographs obtained from people with diabetes and identify them with high reliability (94% and 98% sensitivity and specificity) to determine which cases should be referred to eye specialists for further evaluation and treatment. In another study, the researchers showed that an AI agent, using deep learning and neural networks, accurately diagnosed congenital cataracts and provided treatment decisions in a multi-hospital clinical trial, performing as well as individual ophthalmologists. For skin cancer, the researchers trained a neural network on a dataset of 129,450 clinical images and performed performance tests on biopsie-confirmed clinical images with 21 board-certified dermatologists. In another study using routine clinical data from more than 350,000 patients, machine learning significantly enhanced the precision and accuracy of cardiovascular disease risk predictions, correctly predicting 355 more patients (another 7.6 percent) with cardiovascular disease compared to established algorithms. Clinical neuroscience is also benefiting from AI. A deep learning algorithm used brain MRI of individuals aged 6 to 12 months to predict an autism diagnosis in individual at-risk children aged 24 months, with a positive predictive value of 81 percent. Similarly, in another study, a machine learning approach designed to assess dementia progression over a 24-month period based on a single amyloid PET scan achieved 84 percent accuracy, outperforming existing algorithms using the same biomarker measure as well as previous studies using multiple biomarker approaches.

References

[1] Xu Yingjin. Mind, Language and Machine: Wittgenstein's Philosophy and the dialogue of artificial Intelligence Science [M]. Beijing: People's Publishing House,2013.

[2] Komorowski M.Artificial Intelligence in Intensive Care:Are We There Yet?[J]. Intensive Care Medicine,2019,45(9):1298-1300.

[3] Meskó B,Hetényi G,Zsuzsanna G.Will Artificial Intelligence Solve the Human Resource Crisis in Healthcare?[J].Bmc Health Services Research,2018,18(1):545-54 8.

[4] Biot J.How Will Clinical Practice be Impacted by Artificial Intelligence?[J]. European Journal of Dermatology,2019, 29 (1): 8-10.

[5] Baker-Brunnbauer J.Management Perspective of Ethics in Artificial Intelligence[J].AI and Ethics,2020.

[6] Marcu L G,Boyd C,Bezak E.Current Issues Regarding Artificial Intelligence in Cancer and Health Care[J].Health and Technology,2019(9):375-381.

[7] Arnold M H.Teasing out Artificial Intelligence in Medicine:An Ethical Critique of Artificial Intelligence and Machine Learning in Medicine[J].Journal of Bioethical Inquiry,2020.

[8] Schiff D,Borenstein J.How should Clinicians Communicate with Patients about the Roles of Artificially Intelligent Team Members?[J].AMA Journal of Ethics,2019,21(2):138-145.

[9] Rigby M J.Ethical Dimensions of Using Artificial Intelligence in Health Care J].2019,21(2):121-124.

[10] Puppe F.Introduction to Knowledge Systems[J].Artificial Intelligence in Medicine,1997,9(2):201-203.

[11] Shen T L,Fu X L.Application and Prospect of Artificial Intelligence in Cancer Diagnosis and Treatment[J].Zhonghua zhong liu za zhi Chinese journal of oncology,2018,40(12):881-884.