

# An investigation in to AI applications in Clinical Medicine diagnosis and treatment

Shujian Gao \*

School of Computer and Information Technology, Beijing Jiaotong University, Beijing 100044, China

\* Corresponding Author Email: 20722005@bjtu.edu.cn

**Abstract.** Since the Industrial Revolution, productivity has risen rapidly and the global population has entered a stage of rapid growth. At the same time, the number of people suffering from the disease has increased by itself. Nowadays, the imbalance of medical resources is a serious problem. In some regions, the life expectancy of the population is much lower than the world average due to the serious lack of medical resources. And because diagnosis and treatment are subjective, there can be potential problems, further raising the risk of malpractice. Therefore, the application of advanced technology in the medical field is necessary and urgent. In this article, we examine the application of artificial intelligence in the medical field, especially in diagnosis and treatment. Furthermore, the advantages and disadvantages of the technology are further evaluated. Finally, we summarize the full text.

**Keywords:** Artificial intelligence, medical usage, Treatment and diagnosis.

## 1. Introduction

The global artificial intelligence in healthcare market size was estimated at USD 10.4 billion in 2021 and is anticipated to expand at a compound annual growth rate of 38.4% from 2022 to 2030 (GMI, 2020). Today, artificial intelligence technology has been extensively applied to clinical medicine, particularly in diagnosis and treatment, which could be deemed as the core of clinical medicine. Additionally, due to misdiagnosis and surgical errors in conventional medicine, medical intelligence will continue to expand and further capture the traditional healthcare market as technology develops and awareness increases. In order to investigate how AI can break through existing medical limitations and enhance clinical medical treatment, this essay will discuss the applicability of AI in diagnosis and treatment, as well as how it compares with traditional therapeutic techniques, particularly the advantages and disadvantages of the new technology, together with the associated ethical issues. Firstly, the application of AI in medical diagnosis will be presented, combined with an assessment of the advantages and disadvantages given. Next, this article will further examine the therapeutic use of AI, focusing on the impact in the context of surgery and patient health management, which will then be evaluated in turn. Finally, the above will be summarized.

## 2. Artificial Intelligence in Diagnosis

Artificial intelligence has been widely used in medical diagnosis, and its specific application and evaluation will be introduced next.

### 2.1. Solution

Identifying and diagnosing diseases have always been at the forefront of medical research. There is no doubt that artificial intelligence technology has contributed to the rapid development of this field in the short term. As Webb (2018) noted, biologists need to collaborate with computer experts. This collaboration is a bi-directional street, fostering both innovations in computer algorithms and significant improvements in medical technology so that the rapid development of this cross-information discipline will progressively change the established global healthcare system. It can be noticed that the existing cross-application has been effective. For instance, the area and volume of

disease in patients with hydrocephalus can be accurately surveyed by the technique. Hydrocephalus, most often seen after various cranial traumas or intracranial masses, allows impaired absorption and circulation of cerebrospinal fluid, which can be mentally impaired in mild cases and even life-threatening in severe cases.

Recently, Imperial College, in collaboration with the Soochow University Medical Research Unit, utilizing artificial intelligence and supervised learning techniques to build a high-performing model based on 143 patient brain CT and MRI images as a training set, applying image segmentation techniques and acquiring relevant data (Zhou et al., 2022). The experiment mentioned above showcased that the treatment paradigm for this disease was altered by the intervention of artificial intelligence. Firstly, an efficient and accurate automatic measurement of the ventricular volume of NPH patients is achieved, which helps clinicians quickly understand the patient's symptoms. To a certain extent, this improves the success rate of diagnosis and thus indirectly improves the survival rate of patients. Secondly, it is difficult to diagnose in conventional medicine by a single technique, necessitating a detailed history, radiographs, and a consolidated assessment of the CSF release fluid (Siregar et al., 2019).

Being diagnosed this way is a complex and time-consuming process. In the case of acute patients-with acute symptoms, delayed treatment can result in irreversible brain damage and a lifetime of pain for the patient and family. The newly developed application is efficient in comparison to conventional technology. Furthermore, the similarities of hydrocephalus with dysplasia and atrophy increase the difficulty of diagnosis (Weerakkody and Gaillard, 2022). Nevertheless, this barrier has been overcome by this technology, and the diagnostic accuracy has been improved as a result. Next, this essay will discuss about the limitations of the application.

## 2.2. Evaluation

However, there are also drawbacks to this application. Firstly, artificial intelligence is not completely reliable. Benner et al. (2008) reveal that "clinical medicine is extremely complicated; in order to make the conclusion, doctors often need to consider various factors, such as the patient's family situation and past medical history". In this experiment, the correlation coefficient between the machine segmented images and the manual-segmented results was 0.95, which did not achieve complete compliance (Zhou et al., 2022). As is evident, if diagnosed by a machine solely, the results are not completely reliable and can even lead to catastrophic consequences. Besides, It is estimated that in the United States only, there are approximately seven hundred thousand diagnosed hydrocephalus patients each year (William and Malm, 2016), and assuming only one per cent of misdiagnoses occur, with a large denomination, it is still a very large group of people potentially at risk of being misdiagnosed and mistreated. Secondly, advanced computing power is currently only available in developed countries and regions, whereas places such as Africa lack the financial resources to purchase such equipment. Moreover, to some extent, this could further exacerbate the imbalance of medical resources and makes social conflicts more prominent. Finally, the machine's diagnosis is based on past patient data, but people are all different, and no two people are exactly alike. Hence, it is difficult to ensure individualized diagnosis and treatment even with massive data. In summary, AI diagnosis has dramatically improved efficiency but also has limitations. In the following, this paper will illustrate the utilization of AI in clinical medical treatment.

## 3. Artificial Intelligence in Treatment

Artificial intelligence has been widely used in medical treatment, and its specific application and evaluation will be introduced next.

### 3.1. Solution

During the epidemic, AI-related technologies were further applied to medical treatment, significantly improving the efficiency of the healthcare system. The next section will first describe

the applications for clinical surgery. Research carried out by Feizi et al. (2021), several hospitals across the United States used the corpath robotic arm during the pandemic to perform coronary interventions. This is a minimally invasive procedure, and the technology is widely used to allow physicians to operate the robotic arm remotely in a physician-safe environment, not only dramatically eliminating radiation exposure for the operator and potentially reducing fatigue and stress but also protecting the physician from infected patients and reducing the risk of a shortened career (Feizi et al., 2021). According to statistics, as of April 2021, there are approximately 4 million infected health care workers worldwide, which directly affects the functioning of the health care system. The application of this technology has changed the situation to a certain extent, as the safety of health care workers is guaranteed, allowing more health care workers to be involved in medical work and improving the efficiency of the health care system to some extent.

Artificial intelligence in therapy also involves patient health management, a field in which AI technology plays an important role. A study conducted by Henderson (2021) suggested that artificial intelligence could be used to predict the oxygen needs of infected patients. This application could be used to treat patients with precision, thereby increasing treatment efficiency and reducing the wastage of healthcare resources. In addition, it could reduce work as well as both work and psychological stress for caregivers, which could result in enhanced productivity. Another study conducted by Johns Hopkins University (McNemar, 2022) developed a whole-heart computational model to understand sinus arrhythmias better. This computational model monitors patients' vital signs in real-time. Consequently, the best treatment plan can be developed through calculations. The model can also be used to predict and analyse the risk of sudden death and the outcome of cardiac surgery. Compared to traditional treatments, this new approach to treating patients renders repeated testing of patients unnecessary, which improves efficiency and enhances patients' well-being, thereby leading to better treatment outcomes. After all, a study by Ownby et al. (2014) indicated that patients maintaining a good mood state would contribute to the success of the treatment to a certain extent. Overall, AI has been extensively applied in patient health management, enhancing medical care and achieving favourable treatment outcomes.

### 3.2. Evaluation

However, there are some limitations to the robotic arm. Firstly, the psychological conflicts of patients have to be taken into account. As this is a new technology, the patient's awareness is poor. Besides, the patient is vulnerable during the treatment (Angel and Vatne, 2017). It makes it difficult for patients' reactions to operations to be promptly and fully taken into account by robot arm and doctors who control them remotely, which in turn affects the surgical operation. Secondly, since this is a remote operation, problems such as delayed communication and feedback lags are present during the procedure (Sharoky et al., 2017). Existing technology makes it difficult to guarantee the procedure's safety. Therefore, point out that AI technology cannot be applied in real-time hospitals on a broad scale yet. As Hashimoto et al. (2020) points out, the application of AI cannot be widespread at the moment, and it should be treated with caution and tested in its entirety before it can be applied in hospitals. Regardless, the convenience it brings to the healthcare system is apparent, while drawbacks are also.

Even though AI has dramatically advanced the field of health management, it is still faced with many challenges and problems. Firstly, data security issues. AI applications are connected to the internet, and the relevant data are stored in the cloud. Moreover, these data are private data of patients and involve a variety of sensitive information such as family information, medical history, etc. Malik et al. (2021) argue that insurance companies benefit from such data, which can easily be marketed and traded for profits. For instance, these companies can make high profits by using personal health information to increase insurance rates for people who may have certain illnesses and their families (Li et al., 2021). More importantly, char et al. (2018) point out that the consequences would be catastrophic once stolen by hackers. Criminals with anti-social personalities could even create biochemical viruses based on this information, directly threatening the safety of humans. Therefore,

further research on how to strengthen information security is necessary. The advent of artificial intelligence has to some extent, taken the place of the nurse practitioner. However, the nurse practitioner has a communicative advantage that AI does not have. It is a skill that brings the doctor and patient closer together and makes it easier to gain their trust to be reassured, which is an integral part of the doctor-patient relationship. Finally, personal discrimination by AI designers may affect applications. Char et al. (2018) suggests that because medical data involves information about race, gender, religious beliefs, etc., medical AI designed to treat certain groups differently will be treated differently if the developers themselves personally discriminate against those groups. As a result, certain groups may be treated unfairly.

#### 4. Conclusion

In conclusion, despite the fact that the applications of artificial intelligence are still at an nascent stage, it is clear that it has transformed the healthcare industry. In other words, traditional techniques have been revolutionized and even replaced, the efficiency of the healthcare system has increased dramatically and more patients' lives have been saved. Despite some shortcomings, it has somewhat alleviated the pressure on the healthcare system and provided a more advanced model for the global healthcare system. As far as diagnosis is concerned, advanced image recognition algorithms are being applied not only to reduce the pressure of work on doctors but also to improve diagnostic and treatment accuracy. However, the issue of robustness still needs to be addressed, and improving machine and human interaction is necessary, which requires more sophisticated AI algorithms. In terms of treatment, the use of AI during epidemics has safeguarded healthcare workers and improved the utilization of healthcare resources, resulting in more patients being cured and therefore improving the efficiency of the healthcare system operation. However, the issue of fear in the minds of patients and the integration of supporting technology still needs to be addressed. In addition, with both areas involving privacy and ethical issues, ensuring data security is necessary and the subsequent introduction of more detailed laws and regulations to restrict the development of AI is also urgent. Overall, at this stage AI can only assist doctors and cannot completely replace humans, and a cautious attitude should be maintained towards the adoption of AI. Despite the limitations of AI in both diagnostic and therapeutic applications, the use of AI in diagnosis is more mature. In the future, it is essential to delve into AI technology and explore how it can be more closely integrated with the healthcare system, while the issue of uneven regional development needs to be addressed by the government.

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