

Appliance of Artificial Intelligence (AI) in Medical Field

Zixi Zhong *

Guangzhou Foreign Language School, Guangzhou, 510000, China

* Corresponding Author Email: 1910831120@mail.sit.edu.cn

Abstract. This essay is targeted to provide a summary about the basic mechanism of Artificial Intelligence (AI), appliance of AI in the medical field, and the issues in applying AI to the medical field. In the first part of the article, the mechanism of AI like machine learning, natural language processing, neural network, deep learning and machine vision/computer vision are briefly introduced. At present, AI could be applied in drug development, medical imaging, clinical trials, and diagnosis. Then, the issues of applying AI to the medical field are summarized in the article. The issues contain social acceptance issues, ethical issues, and legislation issues. In conclusion, if these issues could be solved, AI could unleash its potentials in the medical field and have positive effects like increased efficiency, lowered costs, and more accurate results in medical research and healthcare.

Keywords: AI; medicine; social issues; legislation issues; ethics of AI.

1. Introduction

With the introduction of ChatGPT to the public, AI is becoming a more and more intriguing topic for the scholars and researchers. One of the new fields of AI appliance is the medical field. It is a well-known fact that medical research is a troublesome, expensive, and time-consuming task, so researchers are trying to introduce AI to the medical field to solve some of its existing issues. This article introduces the appliance of AI in drugs, clinical trials, medical imaging and diagnosis. Applying AI in the medical field have advantages like strong calculation abilities, reduced human involvement, and access to a larger database with an easier way. However, with these merits come the issues of applying AI to the medical field. These issues include social acceptance issues, ethical issues and legislation problems of applying AI to the medical field. Remain unsolved, these issues could severely impact the prevalence of AI appliance to the medical field, which could fail to accelerate the breakthroughs in the medical field, the initial goal of applying AI to healthcare and medicine.

Therefore, this article summarizes the many ways of applying AI to the medical field from several articles as well as the several problems that applying AI to the medical field will cause. This summarization will provide a guide for developing medical AI and point out the problems for researchers to solve.

2. Mechanism of Artificial Intelligence in Medical Field

The AI developed especially designed for the medical field is based on these methods and mechanisms: machine learning, natural language processing, neural network, deep learning and machine vision/computer vision. Fig. 1 categorizes the basic method and mechanism of AI and the functions of the methods.

Machine learning is a is a method of presenting adaptive AI solutions with inputs and outputs. It could be classified into three subfields-supervised learning, unsupervised learning and reinforcement learning. Natural language processing (NLP) enables computers to read, understand and draw interpretations from the human language [1]. NLP is an essential tool for the communication between human and computers. With NLP computers could draw information through text data, vocal data, which is written or spoken by human. Another important subarea of artificial intelligence is neural network, a model which simulates the neurons of the human brain. It consists of several hidden layers of connected artificial neurons that takes images or speech as input, and uses these layers to provide

an output. Based on neural networks, deep learning, a subarea of machine learning, enables computers to perform tasks based on the present data relationship [1]. Machine vision is also known as computer vision. It is capable of carrying out tasks including image processing and acquisition, as well as the identification of an item or set of objects [2]. Machine vision's capability to process images enables AI to be a powerful assistant in medical imaging.

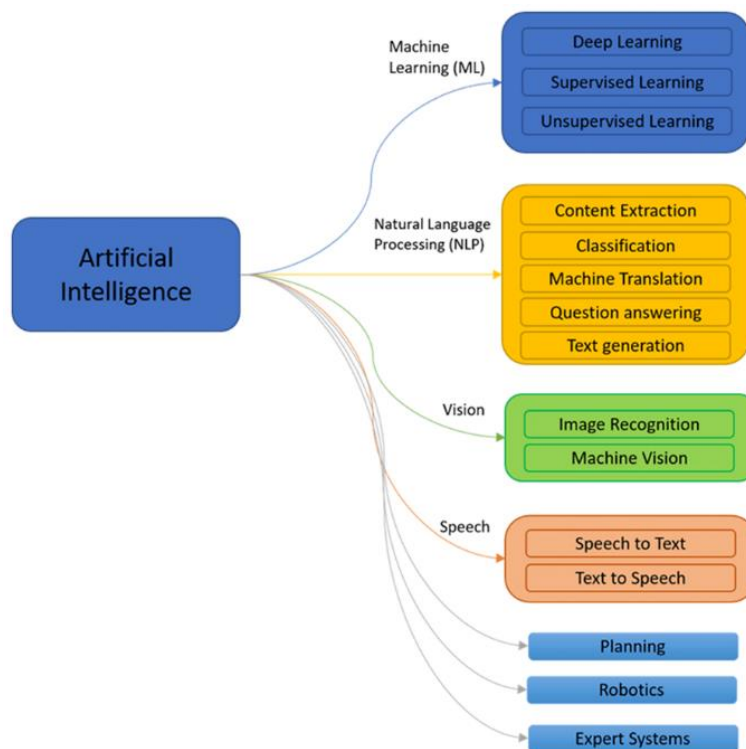


Fig 1. Basic methods of AI. <https://www.semanticscholar.org/paper/AI-in-healthcare%3A-A-narrative-review-V%C3%A4%C3%A4n%C3%A4nen-Haataja/8b8232818cdc31c677b40521052b7461f4a991c1>

3. Application of AI in Medical Field

AI has already been applied in many different domains in the medical field, including drug development, medical imaging, clinical trials and autonomous diagnosis.

3.1. Drug Development

One of the functions of AI technology in the medicine domain is that AI could boost the speed of drug discoveries [3]. There are two main ways that AI technology could aid drug development. The first way of accelerating drug development is improving the drug treatment for the patient, which meaning optimizing the amount and combination of the medicine according to each patient's features. The era of customized medicine has arrived [4]. Recent use of AI technology demonstrates its significant potential to be a powerful tool in the era of personalized medicine. Based on the existing genomic and transcriptomic data relating to diseases, healthy tissues, animals, and cell lines and the mathematic models calculated by Artificial intelligence, in order to enhance chances of success treatment and patients' quality of life, researchers could forecast the best medication treatments, dosages, and regimens for each individual patient [4]. Drug combinations is also an indispensable factor to consider in personalized treatment because at times patients would take several drugs at the same time. Statistical data shows that as the age of the patient grows, the likelihood of a patient taking several medications at once rises, because they are more likely to encounter many diseases at the same time [4]. The drugs they take at the same time could interact with each other to create adverse effects on the human health as well as decreased dosage efficiency, it is essential to use AI models

base on deep learning to calculate the result of taking the medicines at the same time to prevent damage on patients' health. These features of personalized medicine with the involvement of AI demonstrates that AI play a significant role in making treatments more effective. Another way of boosting the drug development is including artificial intelligence in drug designs. Developing a novel drug is both time consuming and expensive. Moreover, there is a high possibility that the drug will fail. The projected clinical approval success rate of new small molecules during the therapeutic discovery and development process is about 13%, even if the mean pretax expenditure is over 2.558 billion USD and it takes between 10-15 years [5]. However, with the development of deep learning methods and the collection of pharmacological data, the properties of the drug molecules could be predicted and the targeted molecules could be generated using the present Artificial intelligence technologies. Therefore, AI could help reduce the time and expenditure for drug development.

3.2. Clinical Trials

AI technology and deep learning could also be applied in clinical trials for novel medicine by searching for appropriate patients for the test and collecting and analyzing data from the patients during the experiment. The inability to successfully choose and recruit patients, as well as the challenges of tracking and guiding individuals during clinical trials, are the main causes of high trial failure rates [6]. This high failure rate not only leads to low efficiency in drug innovations and development, but also contributes to the high expenditure in drug development. Therefore, with the maturity of the AI technology and machine learning method, scientist have tried to apply this novel technology to clinical trials. Artificial intelligence could access to electronic health records (EHRs), medical literature, and trial databases to find out the optimal patient for the trial before it starts, and it could also help patients in their trial eligibility assessment to let the patient themselves to know whether they are fit for the experiment. In monitoring patient, AI and wearable technology might be paired to use their sensors to instruct patients and track their progress during continuous trials. More detailed data regarding the patients can be collected in this way, reducing the pressure for both the patients involved and the researchers. This reduces the high drop-out rate of the patient due to the cumbersome task during the trials [6].

3.3. Medical Imaging

The role of AI technology and machine learning method in medical imaging and radiology is a tool of increasing efficiency and accuracy of imaging. One of the most troublesome issues in medical imaging is the conflict between the efficiency of imaging and its accuracy. In many scenarios each imaging machine and radiologist have to examine hundreds of patients per day, so current models of practice will be negatively impacted by increased efficiencies [7]. This problem in medical imaging is prominent in prevailing medical imaging technologies-CTs and MRs, so this conflict will not only increase the amount of work for the doctors, but also drive up the rate of medical errors. Computers, unlike human radiologist who will be more likely to make errors when experiencing fatigue, are better at dealing with complex data from different domains and quantitative data. With AI's machine vision ability, when they are welly trained, they will treat all data as essentially equivalent, and are agnostic to the format or nature of the underlying content [7]. Another function of AI in medical imagine is that it could use algorism to select the optimum method for the targeted patient; this function avoids technical errors and improves the quality of the images, both of which contributes to the accuracy of radiology. When the conflict between accuracy and efficiency is alleviated by AI, it will be welcomed by physicians, hospital administrators, insurers and patients alike [7].

3.4. Diagnosis

In recent years, development and research on explainable AI (XAI), which is a new type of AI that have the ability to explain, give new possibilities to apply AI in diagnosis. XAI, apart from traditional AI using deep learning methods, provides both the decision made and the reasons for making the decision [8]. The greatest difficulty in applying traditional AI to clinical diagnosis is caused by AI's

black-box nature, which means that the process of judging the patient's disease through its hidden layers of connected artificial neurons is opaque to the doctors. Therefore, doctors distrust the results due to the difficulty in finding out the reliability of AI's diagnosis [8]. However, provided with XAI, doctors and researchers are more likely to trust the results of diagnosis since the reliability of the diagnosis could be found out by checking the explanations of XAI. Even if the results are wrong, the explanation provided by AI still has reference value to the doctors and trainers of the AI, because doctors could know which part of the explanation is wrong and fix the mistake to get the correct diagnosis, while developers of AI could increase the accuracy of the AI from the correcting the data.

4. Issues of AI Application in Medical field

Although the appliance of AI in the medical field has already come into a larger extent in recent years, there is still some issues regarding the appliance of Artificial intelligence in healthcare. The primary problems are, legislation and management problems, social problems, and ethical problems.

4.1. Social Acceptance Problems

Discussing the social acceptance of medical AI, despite the fact that most patient would trust AI diagnosis, they prefer to trust human doctors more when the doctors and computers give different diagnosis. This is caused by the black-box effect of AI, which means that AI could not explain the reason for their diagnosis while human doctors can, so even if they do not understand the doctor's explanation, they still tend to trust the doctors more. Another factor contributing to the low social acceptance is that healthcare professionals in less developed regions are very concerned about being substituted by AI in the future.

4.2. Ethical Problems

The most complex and salient issues in applying artificial intelligence to the medical field is the ethical problem. Ethical issues caused by AI appliance is regarded as the central problem of AI in any field. These issues are caused by the limitation of giving AI moral criterions. The prevailing AI is based on machine learning methods, which means that they are just consisted of algorisms and data. Thus, they do not have self-consciousness or the concept of ethics. Ethics are used for decision making by human; it is at present impossible to let AI interpretate human ethics. This limitation in AI lead to a series of problems. To begin with, fairness is one of the problems caused by using AI in healthcare. Fairness is an important but abstract concept in human ethics. According to research, gender bias may be introduced into a machine learning model by simply selecting biased data for the model's training, so it is essential to ensure that fairness to be integrated into AI used in healthcare and medicine so that patients could have equal access to healthcare and medicine despite their gender, race, and nationality. However, the present technology and training method of AI could not add the notion of fairness to it, so medical AI still require further development. Another ethical problem of applying AI to the medical field is privacy issues. Regarding the privacy issues, the present AI requires a huge data base to do calculations for medical research and diagnosis, yet some of these data that AI requires includes patient data. Thus, concerns raise regarding the security of the patients' personal data. Due to the present prevalence of EHRs in medical practice and the requirement for sensitive patient data to be uploaded in digital form to networked systems with varied levels of security protocols in place, these worries have grown more pressing [9]. Furthermore, due to the reason that some of the IT companies involve in the development of medical AI, the risk of the patients' private data being evaded increases. Researchers have consequently argued that it is unfair to permit large corporations to operate in the healthcare sector because they have limited medical knowledge [10].

4.3. Legislation and Management Issues

To apply AI to the medical field in the future, legislation is a central step that must be taken by the government to ensure patients' safety. One of the problems in AI legislation is finding out the main responsible person for AI products in healthcare. This means that it is still unclear who should be held accountable for AI-related infringement—the AI maker, user, or maintenance. Additionally, it is unclear where each stakeholder's jurisdiction ends. What portion of the burden should be shared when a complex situation emerges rather than expecting clinicians to shoulder all the dangers associated with AI medical treatment? [9]. Privacy protection should be another center in legislation activities to protect the private information of patients when they are used by doctors and the companies responsible for developing AI. Although hospitals are unlikely to invade their patients' privacy rights, the IT corporations might. However, they require the data for the sake of further medical AI development, so it is critical for the government to make laws to add constraints to the corporations.

5. Conclusion

In conclusion, AI could be applied to drug development, medical imaging, clinical trials, and diagnosis. Applying AI to these fields can not only increase the efficiency of medical research and healthcare, but also improve the accuracy of it. However, problems regarding medical AI still remains. These problems are mostly in the social field and technological field. The social problems include, public acceptance problems, ethical problems, and legislation problems. On the other hand, the main technological problems are the problems, which is the most basic problem in AI appliance. In the author's opinion, there are several reasonable ways to reduce the effect of these problems. The first way is to let the corporations invest more money in AI development to develop explainable AI and increase the general accuracy of AI to reduce the users' concerns regarding AI. Moreover, schools and academies should teach more medical students to use AI and to develop AI. With more skillful users AI could further unleash its potentials in the medical field. Most importantly, the government should have better management on AI. Laws should be set immediately regarding the appliance and development of medical AI to protect the patients' and the users' rights. With firm laws, public concerns regarding medical AI should be alleviated, which could aid in solving the social problems caused by medical AI appliance. Regarding the prospect of applying AI to the medical field, AI is still not a mature technology yet, so it still has many more potentials to be discovered. When they are discovered, AI could be applied to other fields apart from those mentioned in the article. If the issues could be solved in some way, there is a great possibility that medical AI could be seen and used in people's daily lives. Therefore, the future of AI appliance in the medical field is promising.

References

- [1] Väänänen A., Haataja K., Vehviläinen-Julkunen K., Toivanen P., AI in healthcare: A narrative review. *F1000 Research*, 2021, 10: 6.
- [2] Golnabi H., Asadpour A., Design and application of industrial machine vision systems. *Robotics and Computer-Integrated Manufacturing*, 2007, 23(6): 630-637.
- [3] Shaheen M.Y., Applications of Artificial Intelligence (AI) in healthcare: A review. *ScienceOpen Preprints*. 2021.
- [4] Romm E.L., Tsigelny I.F., Artificial Intelligence in Drug Treatment. *Annual review of pharmacology and toxicology*, 2020, 60: 353–369.
- [5] Zhong F., Xing J., Li X., et al., Artificial intelligence in drug design. *Science China. Life sciences*, 2018, 61(10): 1191–1204.
- [6] Harrer S., Shah P., Antony B., Hu J., Artificial intelligence for clinical trial design. *Trends in pharmacological sciences*, 2019, 40(8): 577-591.
- [7] Gore J.C., Artificial intelligence in medical imaging. *Magnetic resonance imaging*, 2020, 68: A1–A4.

- [8] Zhang Y., Weng Y., Lund J., Applications of Explainable Artificial Intelligence in Diagnosis and Surgery. *Diagnostics*, 2022, 12(2): 237.
- [9] Vellido A., Societal issues concerning the application of artificial intelligence in medicine. *Kidney Diseases*, 2019, 5(1): 11-17.
- [10] Martinho A., Kroesen M., Chorus C., A healthy debate: Exploring the views of medical doctors on the ethics of artificial intelligence. *Artificial intelligence in medicine*, 2021, 121: 102190.