Application of Artificial Intelligence Technology in Clinical Pharmacy

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Abstract. With the continuous technological development, the application of artificial intelligence (AI) in medical diagnosis and treatment has become increasingly extensive. In this paper, the current technological level and characteristics of AI development are expounded, and the application of AI in clinical pharmacy teaching for medical students is explored preliminarily. The development prospect of AI technology in medical education is discussed.

Keywords: Artificial Intelligence, Clinical Pharmacy, Application

1. Introduction
In general, artificial intelligence (AI) refers to a new technological science for the research and development of theories[1-2], methods, technologies and application systems used to simulate, extend and expand human intelligence [3-4]. First proposed by John McCarthy in the 1950s, it is an interdisciplinary and comprehensive frontier discipline composed of information science [5-6], mathematics, philosophy, psychology, cognitive science, linguistics, information theory, cybernetics, and other disciplines.

2. Application Trend of AI in Medical Education
With the growing maturity of new science and technology, the research and application of AI at home and abroad have been developed rapidly. Scholars and government departments at home and abroad have paid increasing attention to AI. In January 2018, NSFC members set up the research direction of “Education information science and technology”, and strongly supported the cross research of new education and teaching technology and new disciplines represented by AI, to solve the scientific problems in the field of education with innovative thinking and methods. AI is no longer limited to the area of computer technology, it is rapidly penetrating various areas of the social industry. It can be seen that “AI + medical education” is the need of the historical trend and the development of the times. As every medical educator, we must face up to the challenges and tremendous opportunities brought to medical education, reshape the role of educator, improve “digital literacy”, update information knowledge and education concept, and deeply integrate information technology, to lead the further development of medical education.

The mechanism of dynamic sample weight is put forward proposed in this paper. The conventional loss function in the operation process is as follows:
\begin{equation}
\text{Loss} = \frac{1}{N} \sum_{i} \text{loss}(x_i)
\end{equation}

Where $N$ represents the number of samples, $\text{loss}(\cdot)$ represents the loss of a single sample, and $x_i$ represents the i-th sample.

\begin{equation}
\text{Loss} = \sum_{i} d_i \cdot \text{loss}(x_i)
\end{equation}

Hence, the targeted calculation can be performed in the loss function to facilitate faster convergence of the network.

3. Current Technological Level and Characteristics of AI

AI can be divided into Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Superintelligence (ASI). ANI does not have real intelligence yet. It is more like a tool or an assistant that helps complete specific tasks. AGI can think, plan, solve problems, abstract thinking, understand complex concepts, learn quickly from experience, and make decisions independently like human beings in a way that reaches or even exceeds the human intelligence level. Nick Bostrom, an Oxford philosopher and AI thinker, general knowledge and social skills”. The thinking can evolve into a completely different way of thinking from human beings, “ability in all aspects can be a little stronger than human beings in all aspects, or it can be a trillion times more than human beings in all aspects.”.

Computational intelligence refers to the ability of machine intelligent storage and operation; perceptual intelligence refers to the capacity of “Listening, speaking, seeing and recognizing” as human beings other technologies; cognitive intelligence refers to the ability of “Understanding and thinking”, which is extensively used in education evaluation, knowledge service, intelligent customer service, machine translation and other fields.

In the field of medicine, the research of AI mainly focuses on deep learning algorithm, data mining analysis, intelligent image recognition, medical information and so on. For example, Watson and Keith of IBM developed the intelligent heart rate and hysterography computer-aided analysis system, art's AI-assisted cardiac MRI imaging system, QView medical's 3D automatic breast ultrasound screening CAD system based on neural network and Baidu's medical brain.

In general, mainstream studies focus on ANI, and has made considerable achievements in this field. The study of AGI is still in the stage of exploration, while ASI is still in the stage of concept discrimination and research. The review process of clinical pharmacy prescription is shown in Figure 1 as follows.

![Review process of clinical pharmacy prescription](image)

**Figure 1.** Review process of clinical pharmacy prescription

4. Application and Prospect of AI in Clinical Pharmacy Training

(1) AI can be used to assist cultivating and learning the interpretation and analysis of examination results
The auxiliary examination is one of the methods for medical staff to carry out medical activities and obtain relevant data. By analyzing and interpreting the images, graphs and data of medical examination and laboratory tests, we determined the medical meaning of the examination results and obtained relevant clinical data. The interpretation and analysis were combined with the actual situation of the patients to facilitate the diagnosis, analysis of the changes and progress of their conditions and the evaluation of the prognosis, to facilitate the treatment schemes and guidance, etc. The auxiliary examination includes various common imaging examination, electrocardiogram, electroencephalogram examination, pathology examination, routine laboratory examination, etc. The main problems in clinical pharmacy are shown in Figure 2 as follows.

Figure 2. Main problems in clinical pharmacy

Currently, there are relatively mature application examples of AI in medical image recognition. Through relatively mature algorithms and big data applications, AI is used to perform intelligent image recognition, and through rapid learning of existing images, to achieve automatic judgment of medical images, which can be used as an auxiliary tool to improve the work efficiency of doctors, and can be more objective, efficient and accurate. The analysis and interpretation of conventional clinical auxiliary examination results, whether in teaching or in student training, has the issues of scattered teaching contents, involvement of complicated teaching personnel, professional limitations of teachers, inability to conduct unified training effectively and organizationally. Hence, it is a challenging and weak link in clinical pharmacy teaching to determine and analyze the results of auxiliary examination effectively. The emergence of AI can provide each student with an accurate and personalized learning path according to their progress through learning management software, and effectively check the learning effect of medical students on the results of various commonly used clinical laboratory tests, imaging tests, electrocardiogram tests, etc. To help medical students improve their comprehensive analysis and interpretation capability for clinical auxiliary examination results, AI can also broaden their learning space and time, playing a role of comprehensive, objective, real-time, and accurate learning guidance not available from clinical teachers.

(2) AI can be an essential supplement to clinical pharmacy practice training

By integrating personalized modeling, social simulation and knowledge expression, AI can provide support for learning at anytime, anywhere. AI is equivalent to a “Virtual Tutor” for every medical student, implementing customized, personalized and accurate adaptive learning. The application of AI in the cultivation of clinical medicine will pay more attention to the improvement of learners' soft skills such as self-guidance, self-assessment and team cooperation. Through digital technology, AI can provide more opportunities for medical students to participate in on-site clinical pharmacy training in the fixed environment of textbooks or classrooms. In the virtual space, medical students can directly see through the detailed anatomical structure of human body, and doctors can operate and explain it. This new model breaks through the limitation of time and space and improves the quality and efficiency of teaching. For example,
the “intelligent reality virtual clinical teaching center” established by the Medical College of Tsinghua University takes the lead in opening a new clinical teaching and training mode of “AI + VR” in China. In this mode, the CT, MRI and other image data of patients are processed by AI system, and the holographic three-dimensional anatomical structure of the human body is obtained and mapped in virtual space. Doctors can directly view the anatomical details of the real human body structure of patients in the virtual space of augmented reality through special facilities, and can carry out 3D geometric analysis of organs and lesions in real-time via gesture and voice operation, and accurately measure the location, volume, path, distance and other parameters of the target structure, At the same time, it can also carry out virtual dissection, simulated surgical resection, surgical scheme design and surgical risk assessment. With the integration of holographic image technology, 3D printing technology, virtual reality and virtual simulation technology, AI can create an era of “AI + full quantitative VR simulation”. For example, the training of common clinical puncture technology can be performed in virtual space through AI fusion virtual simulation puncture equipment. Through the access of virtual equipment, physical examination training such as palpation and auscultation of heart and lung, palpation of abdomen can be carried out in virtual simulation environment. AI can assist teachers in designing and building 3D printing organs and models, which can be used for model training physical examination, case discussion, demonstration of organ disease anatomy, demonstration of the clinical process such as delivery process, etc.

5. Conclusion
There are more and more applications of AI in medical diagnosis and treatment, with increasingly mature technology, which has promoted the progress of medical diagnosis and treatment as well as medical teaching. As deep learning and neural network are further improved and matured, coupled with the construction and improvement of interconnected and AI-based medical databases, the role of AI technology in medical diagnosis and teaching will become increasingly prominent. It will definitely lead the new era of reform in the medical education information technology characterized by “Cross-border, integration, and innovation”, providing tremendous opportunities and development room for medical education.

References
[1] Safadi, F. , Fonteneau, R. , & Ernst, D. . (2015). Artificial intelligence in video games: towards a unified framework. International Journal of Computer Games Technology, 2015, 1-30.
[2] Rahmanifard, H. , & Plaksina, T. . (2018). Application of artificial intelligence techniques in the petroleum industry: a review. Artificial Intelligence Review(5), 1-24.
[3] Gyasi, E. A. , Kah, P. , Wu, H. , & Kesse, M. A. . (2017). Modeling of an artificial intelligence system to predict structural integrity in robotic gmaw of uhss fillet welded joints. International Journal of Advanced Manufacturing Technology, 93(15), 1-17.
[4] Xiong, B. , Ruan, L. , Gu, G. , Lu, W. , & Zhang, X. . (2015). Application of evaporative cooling technology in magnet of high charge state ecr ion source-lecr4. Diangong Jishu Xuebao/Transactions of China Electrotechnological Society, 30(10), 219-225.
[5] Liu, W. , & Zhao, Y. . (2016). Application of three dimensional roaming technology in virtual campus system. Journal of Computational and Theoretical Nanoscience, 13(11), 8058-8062.
[6] Claudia Schulz, Andreas Fischer, Winnie Vogt, Katja Leichenberg, & Holger Knoth. (2019). Clinical pharmacy services in germany: a national survey. European Journal of Hospital Pharmacy, ejhpharm-2019-001973.