Cultivation Path of Compound Talents in Ophthalmic Diagnosis, Treatment, and Nursing Based on Artificial Intelligence

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Abstract: Artificial intelligence can effectively improve the efficiency and accuracy of medical diagnosis, clinical data analysis, medical image recognition, treatment plan decision-making, *etc*. It has broad application prospects in the ophthalmic diagnosis, treatment, and nursing industry. However, the application of artificial intelligence in the ophthalmic diagnosis and nursing industry in China started relatively late, and there are insufficient ophthalmic diagnosis and nursing personnel who are familiar with artificial intelligence technologies. In order to promote the modernization of ophthalmic medicine in China and accelerate the development of a high-quality and modern medical education system, it is necessary to train a new generation of compound ophthalmic medical talents who are skilled in artificial intelligence and develop an advanced talent training model that meets the needs of the ophthalmic profession and the society. Based on the application status and development prospects of artificial intelligence in the ophthalmology industry, this paper analyzes the current medical education model in ophthalmology, examines the path of cultivating compound talents in ophthalmic diagnosis, treatment, and nursing, as well as proposes suggestions for developing a high-quality and modern medical education system.

Keywords: Artificial intelligence; Ophthalmology; Medical personnel training; High-quality education

1. Introduction

The demand for ophthalmic diagnosis and treatment in China is increasing with the growth of the population and the aged society [1]. At present, ophthalmic diagnosis mainly relies on doctors to manually identify medical images. Ophthalmic medical images are delicate and complex, and they carry a substantial amount of information [2]. The level of professional knowledge and clinical experience of the doctors have a huge impact on the diagnostic and treatment process [3]. Making a diagnosis itself is time-consuming and labor-intensive. Furthermore, the diagnosis and treatment efficiency is low [4]. The unevenness in the cultural level of eyecare personnel in China imposes certain restrictions on eye care and medical care. The rise of a new generation of intelligent technologies, such as artificial intelligence (AI), has injected new vitality into the development and progress of the ophthalmology industry [5].

Artificial intelligence is capable of adapting to the rich ophthalmic medical image data characteristics [6]. The use of AI image recognition technology for ophthalmic medical image recognition, data extraction, and analysis [7] can significantly improve the efficiency of ophthalmic medical image recognition and reduce the workload of medical staff [8]. For pixel levels that ophthalmologists cannot recognize with naked eyes, artificial intelligence recognition technology can be used to carry out in-depth analysis [9], improve

the accuracy of ophthalmic medical diagnosis, and improve the efficiency and accuracy of ophthalmic medical image data identification and analysis work. In that way, the identification and analysis work would no longer be limited by the physiological function of manual analysis [10]. In addition, the highly informatized and intelligent characteristics of artificial intelligence technologies can significantly improve the cross-temporal and spatial capabilities of ophthalmic medical care [11], as well as provide solutions and ideas for remote intelligent diagnosis and treatment in areas with unbalanced development of ophthalmic medical resources [12].

At present, the use of artificial intelligence for diagnosis and treatment in the field of ophthalmology in China has a late start; additionally, the artificial intelligence medical resources in the ophthalmology department are uneven. The medical and nursing staffs have different levels of knowledge of artificial intelligence, and their proficiency in the operation and application of advanced artificial intelligence equipment also varies. In addition to the aforementioned, the industry lacks unified standards [13]. Therefore, while promoting the upgrading of ophthalmic medical equipment, it is necessary to focus on cultivating high-quality compound ophthalmology talents who have a good grasp of the principles of artificial intelligence and mastered the operation of artificial intelligence equipment as well as able to use artificial intelligence equipment for diagnosis, treatment, and nursing, so as to realize the simultaneous progress of China's ophthalmic medical talents and equipment as well as promote the high-quality development of China's medical modernization.

This paper analyzes the current status of the AI-based ophthalmology talent training system from several aspects, including the talent training objectives, teaching mode, teaching platform, and so on. Subsequently, improvement measures and suggestions are put forward based on the existing problems, so as to provide a reference for the construction and improvement of the AI-based ophthalmic personnel training system and promote the construction of a high-quality modern medical education system in China.

2. Current situation of the ophthalmology talent training system based on artificial intelligence
2.1. Training objectives
Building a high-quality education system is of great significance for cultivating outstanding talents, coping with the challenges of intelligent technology, and promoting the construction of an educational power [14]. In order to develop a high-quality education system in ophthalmology and cultivate high-quality ophthalmology professionals with comprehensive medical and nursing skills in the new era, it is imperative to first change the talent training concept, set new teaching goals, and establish a talent training system based on this. The emergence of artificial intelligence has brought both, opportunities and challenges to the development of ophthalmic diagnosis and treatment, in which the traditional training model cannot adapt to these changes. At present, the ophthalmology education offered is still limited by traditional teaching goals; advanced science and technology, such as artificial intelligence, have not been integrated into teaching; the grasp of industry development trends and technological frontiers is lagging behind; and the talent training plan does not meet the needs of the society for social talents.

2.2. Teaching mode
The current teaching mode is still confined to the simple combination of traditional classroom teaching and hands-on practice due to the backdated teaching concept. The talent training mode is single, and students are only exposed to simple receptive learning. This type of learning, which cannot be integrated with AI practices, disables further discovery and research learning, thus leading to poor guidance and development of innovative thinking. Many scholars have applied artificial intelligence to the ophthalmology industry. For example, Asaoka et al. [15], Wang et al. [16], and Kucur et al. [17] have successively used convolutional neural network, random forest, support vector machine, and other artificial intelligence technologies to

improve diagnostic performance when classifying and detecting glaucoma. Therefore, some traditional ophthalmology teaching cases are no longer suitable for the current teaching environment. They need to be expanded and updated in line with the application of artificial intelligence in the field of ophthalmology. In addition, traditional teaching and assessment methods also compel students to place emphasis on rote memorization of knowledge [18], which limits their innovative development. The new talent training mode must reflect the depth and breadth of students' thinking in applying artificial intelligence to solve problems in the field of ophthalmology.

2.3. Teaching platform and resources

With the continuous development of information technology and the wide application of the network teaching model following the new crown epidemic, the network teaching platform has been expanded, and teaching resources have been enriched [19], all of which are in line with the characteristics of artificial intelligence. However, in the current state of ophthalmology diagnosis and treatment, as well as nursing personnel training, the integration of teaching resources is insufficient, the advantages of network resources cannot be fully utilized, and the role of modern technology in education has not been effectively brought into play [20]. The teaching platform is restricted to colleges and universities, hospitals, as well as their partner institutions. This prevents the complete integration of artificial intelligence into the talent training plan. In that case, innovative ophthalmology talents would not be able to access more advanced and deeper teaching resources, nor can they conduct extensive or sufficient learning exchanges. At the same time, with the construction of high-quality education system in the new era, virtual simulation experiment teaching, as a specific measure to realize "intelligence + education," has gradually become an important teaching method for the cultivation of innovative talents [21]. However, the scale and system of virtual simulation experiment teaching in ophthalmology diagnosis and treatment as well as the nursing industry have not been fully established.

2.4. Integration of ophthalmology, production, and education based on artificial intelligence

Compared with other industries, the ophthalmology industry is closely associated with students' theoretical learning, practice, and career decisions. However, with the rise of artificial intelligence in the field of ophthalmology, the new generation of compound ophthalmology talents should not only have a good grasp of diagnosis, treatment, and nursing, but also keep pace with the development trend of the industry. Other than that, they must be able to use artificial intelligence to identify ophthalmic disorders and solve ophthalmic problems. In the current education model of the ophthalmic diagnosis, treatment, and nursing industry, it is still impossible to achieve a good integration of artificial intelligence with ophthalmic medical education. Therefore, it is impossible to guarantee that students can achieve a strong connection between theoretical learning and industrial application.

3. Suggestions on the cultivation path of ophthalmic medical talents based on artificial intelligence

In order to provide ideas and references for promoting the construction of a modern education system related to ophthalmic care, this paper summarizes and analyzes the current status of the AI-based ophthalmic diagnosis, treatment, and nursing personnel training system in China, and subsequently puts forward several suggestions.

(1) Orientating the training goals to the demand for talents who have mastered artificial intelligence technologies in the ophthalmology industry

The application and development of artificial intelligence has gradually brought a profound impact on all walks of life in the society. With the continuous development of China's economy, science, and technology, the society's demand for ophthalmic diagnosis, treatment, and nursing talents is diversified,

and the development and upgrading of many advanced artificial intelligence diagnosis and treatment equipment has also raised the level for ophthalmic practitioners in terms of professional knowledge. The requirements of the application of advanced artificial intelligence technologies for ophthalmic diagnosis and treatment as well as compound talents have become the needs of social ophthalmic medical care. Therefore, it is necessary to meet the needs of the society and cultivate high-level compound talents with solid professional foundation and knowledge of advanced technology to meet the social demand for ophthalmic talents under the background of artificial intelligence.

(2) Updating teaching concepts according to the frontiers of industry science and technology as the basis for developing a teaching model

With the continuous development of artificial intelligence technologies, the corresponding ophthalmic diagnosis, treatment, nursing methods, facilities, and equipment would also be iteratively upgraded. At present, the application of artificial intelligence in the ophthalmic diagnosis and nursing industry still lacks standardized data and good clinical adaptability. Therefore, the development of artificial intelligence in the ophthalmology industry is a combination of opportunities and challenges. In order to develop a modern ophthalmology talent training system, it is necessary to update the teaching concepts according to the needs of artificial intelligence application, grasp the technological frontier of the industry and the development trend of the industry, as well as cultivate students' ability to understand the principles of artificial intelligence and its application. The application and development of artificial intelligence in the nursing industry will lay a solid talent foundation.

(3) Reconstructing the teaching mode in combination with artificial intelligence to encourage innovative practice

The reconstruction of the teaching model should focus on cultivating students' interest and guiding students to think and explore actively by combining a series of teaching cases of artificial intelligence application in ophthalmology diagnosis, treatment, and nursing, so as to deepen their understanding of the principles of artificial intelligence application in ophthalmology. Students should also be encouraged to conduct case studies and exchanges through debates, discussions, and other forms of teaching activities. On this basis, it is necessary to strengthen practical education. The purpose of training ophthalmology talents based on artificial intelligence is to enable students to apply artificial intelligence to the ophthalmic medical industry. Therefore, we should uphold the idea of paying equal attention to theory and practice as well as encourage students to strengthen their understanding of artificial intelligence through practice. For example, artificial intelligence can be used to train data sets and for screen diagnosis of fundus images. It is also necessary to strengthen innovation orientation in the assessment and put forward more open thinking cases, such as applying artificial intelligence to improve the diagnostic rate of cataract, or applying artificial intelligence to assist surgery methods, *etc*. so as to expand the depth and breadth of students' thinking.

(4) Integrating artificial intelligence teaching resources and strengthening the construction of learning and exchange platforms

In order to cultivate compound talents in ophthalmology based on artificial intelligence, it is insufficient to rely on one college and one school alone. The focus should be on the integration of artificial intelligence teaching resources, including online teaching resources, as well as schools, hospitals, and enterprises with other social institutions. It is also necessary to strengthen the construction of online and offline communication and learning platforms for ophthalmic medical care, enrich and expand the breadth and depth of online and offline communication and learning platforms, as well as maximize the resource advantages and field operation advantages of online platforms and offline platforms, respectively. Expanding digital educational resources and educational platforms for ophthalmic medical care as well as setting up a medical artificial intelligence digital resource library and a virtual simulation

experiment platform would be beneficial. Activities such as academic lectures, case sharing and learning, innovation competitions, and other activities are encouraged to provide maximum support for the cultivation of compound talents in ophthalmic diagnosis, treatment, and nursing through the teachers, equipment, technology, and other teaching resources.

(5) Developing an integrated model of production and education to ensure a connection between students' theoretical learning and practical application

When constructing an education and training system for compound talents in ophthalmology diagnosis and treatment, we should consider the connection between students' learning and practice as well as the needs of talents in the ophthalmic medical industry. Moreover, we must adapt to the development trend of artificial intelligence in the ophthalmic diagnosis, treatment, and nursing industry; unite schools, hospitals, enterprises, and other social institutions; as well as form a deep integration of production and education. We should also focus on the level of knowledge of artificial intelligence among students, their learning and innovation ability and work adaptability developed under the training of the comprehensive education system, as well as their understanding of the ophthalmology career under artificial intelligence in advance. We must guide and help them in career planning to achieve a good transition from theoretical study to practical application and subsequently to ophthalmology practice.

4. Conclusion

Artificial intelligence has a good application effect on ophthalmic diagnosis, treatment, and nursing. The further development of artificial intelligence in the field of ophthalmology requires compound talents who are proficient in advanced technologies, such as artificial intelligence, in addition to ophthalmic diagnosis, treatment, and nursing. At present, colleges and universities have not fully integrated the two fields in the teaching process. This paper analyzes the problems existing in the current ophthalmology talent training model and proposes several suggestions for improving the ophthalmology talent training model based on artificial intelligence, in order to promote the transformation of traditional ophthalmology to advanced intelligent informatization based on artificial intelligence by encouraging high-level ophthalmology medical talents to serve the society and developing an ideal and advanced ophthalmology diagnosis and nursing system based on artificial intelligence, thus promoting an advanced, informationized, intelligent, and efficient construction for ophthalmic diagnosis and care.

Disclosure statement

The authors declare no conflict of interest.

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