Research on Discipline Construction of Civil Engineering Based on Artificial Intelligence

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Abstract. Artificial intelligence is gradually changing the development direction of civil engineering, and the traditional civil engineering specialty needs to be transformed. This paper discusses the application of artificial intelligence technology in the field of civil engineering, and analyzes the opportunities and challenges brought by the combination of artificial intelligence and civil engineering. A feasible scheme for the integration of artificial intelligence and civil engineering disciplines is proposed to help civil engineering majors better adapt to market demand and technological development trend, and realize transformation and upgrading.

Keywords: Artificial intelligence; Civil engineering; Transformation; Personnel training; Curriculum system.

1. Introduction

In the way of civil engineering technical personnel training, there are more traditional courses. The course construction of civil engineering technology based on artificial intelligence is still in its initial stage. At present, there are still a few courses combining the two technologies, the depth of the combination is not enough, and the lack of teachers taking into account the two kinds of professional knowledge reserves.

1.1 Increasing demand for the combination of artificial intelligence and civil engineering disciplines

The traditional civil engineering major is supported by mechanics and civil engineering disciplines. With the cross-integration of civil engineering and other disciplines, such as electronic engineering, computer science and engineering, materials science and engineering, many subversive new things emerge endlessly. For example, the application of artificial intelligence in urban planning is a landmark change in the era of urban planning discipline. Artificial intelligence will change the traditional urban planning methods and realize urban intelligent planning through deep learning of the existing urban environment, disaster, human and traffic behavior big data, combined with virtual reality situation representation technology. Harbin Institute of Technology recently used deep learning to generate topologically sensitive 3D models of large cable-stayed Bridges using images captured by unmanned aerial vehicles [1].Since 2018, 23 universities, including Tongji University, North China University of Technology and Southeast University, have set up intelligent construction major, which is a new engineering major set up to adapt to the transformation and upgrading of the construction industry characterized by "informatization" and "intelligence". It is an emerging interdisciplinary subject developed on the basis of civil engineering and integrates big data, artificial intelligence and other new technologies. It is also a new training mode for civil engineering professionals.

1.2 Insufficient training of civil engineering professionals based on artificial intelligence

According to the White Paper on Smart Buildings released by Alibaba in 2017, the total number of smart building projects in China is equal to the total number of smart building projects in Europe. There are more than 5,000 smart building system integrators in China, and the market size of smart building integration has reached 400 billion yuan.The shortage of intelligent construction technical

talents is prominent in intelligent design, intelligent equipment and construction, intelligent operation and management and other professional fields. In the next 10 years, technical and management personnel in the construction industry will account for 20% of the total number of employees in the industry (the current proportion is only 9%), and there is a huge gap between the demand for talents and the number of training.Artificial intelligence itself has a high requirement on the knowledge reserve of talents, which requires the basis of computer and information technology, while the traditional civil engineering major is based on mechanics. The complexity of curriculum is the main reason for the lack of talent training. Only by integrating civil engineering and artificial intelligence and setting them reasonably can the two disciplines be perfectly crossed, so as to cultivate more qualified talents [2].

1.3 Lack of teacher support

At present, the biggest difficulty in realizing the new mode of civil engineering professional personnel training is the lack of a matching team of teachers. If the courses of civil engineering and artificial intelligence are undertaken by the teachers of civil engineering and information technology respectively, and there is a lack of mutual integrated practice in the middle, the final result is that the students cannot form a knowledge system and have poor practical application ability. The talent training of "artificial intelligence + civil engineering" is inevitably difficult to achieve the expected training goal.

2. Application of artificial intelligence technology in the field of civil engineering

2.1 Intelligent design and simulation

Artificial intelligence technology can use a large amount of data and algorithms to automatically generate efficient, reliable and sustainable civil engineering design solutions, which can be verified and optimized through simulation and testing. For example, using artificial intelligence technology can quickly generate 3D models and structural designs of infrastructure, and improve its stability and security through simulation and optimization algorithms. In addition, AI technology can predict the service life and maintenance needs of infrastructure, helping civil engineers develop more scientific and sustainable designs.

2.2 Automatic construction and maintenance

Artificial intelligence technology can automate and intellectualize civil engineering construction and maintenance through machine learning, visual recognition and automatic control. For example, machine learning can automatically identify and classify soil and rock types to help civil engineers develop more accurate and efficient excavation and foundation construction schemes [3]. Meanwhile, artificial intelligence technology can also monitor and diagnose the running state and health status of infrastructure in real time through intelligent devices such as drones, robots and sensors, so as to give early warning and repair potential problems in advance, and reduce maintenance costs and risks [4].

2.3 Data analysis and decision support

In the process of engineering design and construction, a large number of data need to be analyzed and processed. The traditional civil engineering specialty lacks this knowledge background, so it needs to enhance the ability of data analysis and processing. Artificial intelligence technology can use big data and machine learning algorithms to mine key data and information in the construction and operation process of civil engineering, so as to provide more scientific and accurate decision support for civil engineering practitioners. For example, using data analytics can enable comprehensive monitoring and evaluation of infrastructure construction and operations,

helping civil engineers optimize resource allocation and management to improve efficiency and sustainability.

3. Establish a new curriculum system of civil engineering major under the background of artificial intelligence

With the application of artificial intelligence technology, civil engineers need to constantly update and improve their skills and knowledge to adapt to new ways and tools. For example, it is necessary to master the basic theories and algorithms of artificial intelligence technology, to understand its application and limitations in the field of civil engineering, and to also need to have skills such as data analysis, programming and machine learning, and to be able to use artificial intelligence technology to solve specific problems in civil engineering practice. In the talent training program, consider infiltrating the content [5] of artificial intelligence and big data into multiple courses. In "engineering survey", "building materials", "construction engineering quality and safety management" and other courses to join big data analysis and the content of the machine learning, introduces the basic concept of machine learning and related algorithms, and discusses how to put its application to civil engineering problems, such as quality intelligent control, material testing and measurement results big data analysis, etc. In the course of Architectural Design, adding the knowledge of artificial intelligence can provide more accurate architectural design solutions by analyzing a large number of data and images. In addition, AI can also use machine learning algorithms to optimize building materials and structures to make buildings stronger, safe and energy-efficient. Penetrate data Analysis and Application, Data Visualization and other courses to civil engineering courses, introduce the basic concepts and tools of data analysis and visualization, and discuss how to apply them in civil engineering problems, such as traffic flow prediction, geological exploration and structural health monitoring [6]. Courses on smart city and smart transportation are offered to introduce the basic concepts and applications of smart city and smart transportation, such as urban planning, public transportation optimization and traffic congestion prediction, and to discuss how to apply artificial intelligence to these problems. Establish industry-university-institute cooperation mechanism, can establish cooperative relations with related enterprises and institutions, let the students participate in the actual project, the theory and skills applied to practice, to strengthen practice ability and innovation consciousness, encourage students to promote independent thinking, innovative design and practical ability, to be in the field of civil engineering.

4. Feasible plans for the integration of artificial intelligence and civil engineering disciplines

At present, the main problems facing the integration of artificial intelligence and civil engineering disciplines are the lack of teachers and the weak foundation of artificial intelligence for civil engineering students.First of all, the problem of insufficient faculty can be solved by promoting interdisciplinary cooperation. For example, exchanges and cooperation between experts in artificial intelligence and civil engineering can be organized to promote cross-integration of the two fields. Secondly, education and training in related fields can be strengthened, for example, cross-disciplinary courses and majors can be set up to attract more talents to devote themselves to this field. In addition, teachers from the School of Computer and Information and teachers majoring in civil engineering can be used to teach jointly. Finally, school-enterprise cooperation can promote the research and investment of enterprises in this field.Secondly, the weak foundation of students' artificial intelligence can be solved from the following aspects. 1. In the course design, the difficulty can be reduced appropriately and the explanation of basic knowledge, such as the basic concept, algorithm and application of artificial intelligence, can be increased to lay a solid foundation for students. 2. Provide auxiliary teaching materials: students can be provided with some corresponding

auxiliary teaching materials, such as introduction to artificial intelligence, online courses, video courses, etc., for self-study and reference. 3. Students can be guided to actively participate in relevant courses and lectures, and participate in AI related competitions and projects to stimulate students' learning enthusiasm and interest and improve their learning effect. 4. It can provide students with corresponding practical opportunities, such as artificial intelligence experiments, projects, internships, etc., so that students can experience and practice, and improve the learning effect. 5. Regularly evaluate and adjust the curriculum, constantly optimize the curriculum and improve the teaching quality according to the feedback of students and the actual situation.Through the above measures, the problems of insufficient teachers and weak artificial intelligence foundation of students can be solved, so as to improve the learning effect of students and promote the integration of artificial intelligence and civil engineering disciplines.

5. Conclusion

Under the background of the rapid development of artificial intelligence technology, the cultivation of civil engineering professionals needs to keep pace with The Times. The transformation of civil engineering majors needs to start from strengthening the study and application of artificial intelligence technology, promoting the application of artificial intelligence technology, focusing on the cultivation of students' comprehensive quality, strengthening practical ability and innovation ability. The "New curriculum System for Civil Engineering Major under the background of Artificial Intelligence" proposed in this paper provides a reference for curriculum teaching under the new situation, and the "feasible scheme for the integration of artificial intelligence and civil engineering disciplines" provides a reference for cultivating high-quality civil engineering professionals.

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