

Research on the Cultivation of Artificial Intelligence Professionals in Vocational Colleges

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Abstract: With the rapid development of the global economy and the continuous advancement of technology, the artificial intelligence industry has become a new engine for the development of the world economy today. China's vocational colleges have launched a wave of professional construction in the era of artificial intelligence. However, during the construction process, there have been problems such as a mismatch between the level of education and the needs of industry enterprises, a dilemma in the positioning of talent training goals, curriculum construction lagging behind the actual application of enterprises, a lack of teaching staff and low level of specialization, low coupling of demands between school enterprise cooperation, and obvious lag in the construction of practical teaching conditions. In response to technological changes and industrial development trends, vocational colleges should actively take measures to address these issues under the macroeconomic regulation and specific coordination of the government, with the full participation of industry enterprises. To cultivate more high-quality talents with innovative spirit, practical ability, and international competitiveness for the artificial intelligence industry.

Keywords: Artificial Intelligence; Vocational Colleges; Professional Development; Response Strategy.

1. Introduction

Currently, artificial intelligence is regarded as a strategic and disruptive technology that leads future development, and has become an important direction for technological innovation and industrial transformation in countries around the world. Governments around the world are strengthening their strategic layout for artificial intelligence and actively promoting the development of the AI industry. Faced with the rapid development of artificial intelligence technology and its industrial applications, vocational colleges that cultivate technical and skilled talents required by the industry, guided by the national strategic layout, actively adapt to the trend of job changes and changes in knowledge, abilities, and qualities required for positions in the era of artificial intelligence. In just a few years, they have set off a professional construction boom for the era of artificial intelligence and achieved certain results. However, they also face many problems in rapid development, which are worthy of research.

2. The Current Situation of Professional Construction in Vocational Colleges Facing the Era of Artificial Intelligence

Since the concept of "artificial intelligence" was proposed at the Dartmouth Conference in the United States in 1956, artificial intelligence has a development history of several decades. However, as a major in undergraduate and junior colleges in Chinese universities, it is a recent development. Under the guidance of national strategy, China's higher education institutions have rapidly launched a wave of professional construction for the era of artificial intelligence.

2.1. Construction of Artificial Intelligence and Related Majors in Ordinary Undergraduate Colleges

The establishment of artificial intelligence majors in

ordinary undergraduate colleges in China began in 2018. Prior to this, talent cultivation in the field of artificial intelligence mostly focused on graduate education, and the training institutions were mostly specialized research institutions. However, there has been some development in the setting of artificial intelligence related majors. In 2003, Peking University was the first in China to establish an undergraduate program in Intelligent Science and Technology and began enrolling students in 2004. In the following decade, the number of undergraduate majors in Intelligent Science and Technology continued to grow slowly. By the end of 2016, a total of 30 regular higher education institutions in China had established undergraduate programs in Intelligent Science and Technology. In addition, other undergraduate majors related to artificial intelligence have been developed, including Data Science and Big Data Technology (2015), Robotics Engineering (2015), Intelligent Medical Engineering (2017), Intelligent Manufacturing Engineering (2017), etc. In 2018, the Ministry of Education issued the "Action Plan for Artificial Intelligence Innovation in Higher Education Institutions", which deployed efforts to accelerate the construction of artificial intelligence disciplines and majors, leading to the rapid rise of artificial intelligence majors. According to the notice on the registration and approval results of undergraduate majors in ordinary colleges and universities released by the Ministry of Education, from 2018 to 2021, 35, 179, 130, and 95 ordinary colleges and universities were approved to set up undergraduate majors in artificial intelligence, totaling 439. Artificial intelligence has become the undergraduate major with the largest number of new majors added in ordinary colleges and universities in recent years.

2.2. Construction of Artificial Intelligence and Related Majors in Vocational Colleges

In vocational colleges, the establishment and construction of artificial intelligence related majors are slightly earlier than those of artificial intelligence majors. According to the data provided by the National Vocational College Professional

Setting Management and Public Information Service Platform, in 2013, Jiangmen Vocational and Technical College opened the "Intelligent Product Development" major, Wuxi Vocational and Technical College opened the "Intelligent Control Technology" major, Changchun Automotive Industry College and Changzhou Mechanical and Electrical Vocational and Technical College opened the "Industrial Robot Technology" major. According to statistics, vocational colleges across the country first deployed 50 majors in "Cloud Computing Technology and Application" in 2016, 64 majors in "Big Data Technology and Application" in 2017, and 86 majors in "Virtual Reality Application Technology" in 2019. The "Action Plan for Artificial Intelligence Innovation in Higher Education Institutions" proposes to "add artificial intelligence related content to big data and information management majors in vocational colleges, and cultivate technical and skilled talents in the field of artificial intelligence applications," opening the prelude to the construction of artificial intelligence majors in vocational colleges. In 2019, the "Artificial Intelligence Technology Service" major was added for the first time in the electronic information category of the "Catalogue of Higher Vocational Education (Specialized) Majors in Ordinary Colleges and Universities", and in 2021, it was adjusted to the "Artificial Intelligence Technology Application" major. In March 2021, the Ministry of Education issued the "Catalogue of Vocational Education Majors (2021)", which added the undergraduate major of higher vocational education - "Artificial Intelligence Engineering Technology". Statistics show that in 2020, the first batch of 173 majors in "Artificial Intelligence Technology Services" were deployed in vocational colleges across the country, and by 2022, the number of majors in "Artificial Intelligence Technology Applications" will increase to 458; In 2021, the first batch of 1627 majors in "Big Data and Accounting" were deployed, and this number will increase to 1657 in 2022. In addition, there are more majors that enhance their professional content with the concept of "AI+" based on the needs of the artificial intelligence era. Vocational colleges have sparked a wave of professional construction in the era of artificial intelligence. With the establishment of undergraduate vocational schools, the major of "Artificial Intelligence Engineering Technology" at the undergraduate level has also emerged. At present, Nanjing Industrial Vocational and Technical University, Lanzhou Resource and Environment Vocational and Technical University, Hunan Software Vocational and Technical University, Hainan University of Science and Technology, Guangxi Agricultural Vocational and Technical University, etc. have been approved to establish undergraduate majors in "Artificial Intelligence Engineering Technology".

3. Issues Concerning the Professional Construction of Vocational Colleges in the Era of Artificial Intelligence

From the establishment of artificial intelligence related majors to the rapid layout of artificial intelligence majors, from the construction of "artificial intelligence+X" composite majors to the application of artificial intelligence related technologies to transform traditional majors, due to the short development time and fast development speed, as well as insufficient research and preparation, there have been several prominent problems in the professional construction of vocational colleges in China facing the era of artificial

intelligence.

3.1. Misalignment between Educational Level and Industry Enterprise Demand

Currently, the widespread application of new generation information technologies such as artificial intelligence and its related cloud computing, big data, blockchain, and the Internet of Things in intelligent manufacturing, transportation, logistics, security, healthcare, education, home furnishings, retail, and other fields has not only promoted industrial transformation and upgrading, but also raised the requirements of industry enterprises for talent knowledge, abilities, and qualities. At present, vocational colleges in China mainly focus on cultivating talents in the artificial intelligence industry at the associate degree level, which creates a mismatch between the tendency of these industry enterprises to recruit talents with higher education levels. According to the "Report on the Development of Talents in the Artificial Intelligence Industry (2019-2020 Edition)" released by the Talent Exchange Center of the Ministry of Industry and Information Technology (hereinafter referred to as the "Report"), vocational positions in artificial intelligence technology enterprises, as well as positions in other types of enterprises that use artificial intelligence related technologies to modify or reshape their own products and services, have set high admission thresholds for talents' education. 17.9% of positions require a master's degree or above, and only 11.9% of positions accept a vocational degree; In common positions such as algorithm research, application development, practical skills, and product manager, only 1.2%, 1.2%, 6.9%, and 3.6% accept associate degrees. The reason for this is that industry enterprises that apply artificial intelligence technology more often are technologically advanced, with higher levels of work intelligence and relatively higher requirements for talent education levels; Secondly, whether artificial intelligence is combined with other majors to form composite majors or as a composite technology based on multidisciplinary technology, its talent cultivation requires a relatively long education system.

3.2. The Positioning of Talent Cultivation Goals Faces a Dilemma

The positioning of talent cultivation goals is influenced by various factors and is not arbitrarily determined. It should take into account the development level and needs of politics, economy, culture, technology, and other aspects, as well as the laws and levels of human physical and mental development. Currently, the industrial transformation triggered by artificial intelligence technology is driving a rapid change and improvement in the requirements of talent knowledge, abilities, and qualities for industry enterprises, objectively requiring adjustments in the positioning of talent training goals. However, in the practice of vocational colleges in China, whether it is offering artificial intelligence and related majors or transforming traditional majors with the concept of "AI+", they are facing a dilemma in terms of training goal positioning. On the one hand, the talent cultivation goals of vocational colleges, whether focusing on the job requirements of artificial intelligence technology enterprises or positioning themselves as job requirements for other enterprises to apply artificial intelligence technology to transform or reshape their own products and services, all face the problem of relatively weak disciplinary foundations for students. On the other hand, with the development of artificial

intelligence technology and the continuous advancement of its industrial applications, traditional simplified, mechanical, repetitive physical labor and highly standardized mental labor may be replaced by artificial intelligence. In this situation, what enterprises need more are compound and innovative technical and skilled talents, while vocational colleges at the junior college level are facing the dilemma of short educational system for cultivating talents.

3.3. Curriculum Construction Lags Behind Real Enterprise Applications

In the process of promoting professional construction in the era of artificial intelligence, vocational colleges in our country have also promoted curriculum construction from two aspects: curriculum system and curriculum content. However, due to a shortage of teachers and a short period of adjustment between courses, many schools' curriculum construction lags behind the actual application of enterprises. From the perspective of curriculum system construction, many artificial intelligence majors in vocational colleges are transformed from computer related, electronic information related, and automation related majors. Their curriculum system is often based on the curriculum system of related majors, and is constructed by removing some traditional courses and introducing some cutting-edge courses. The "Artificial Intelligence+X" composite major or other majors that introduce artificial intelligence technology are generally based on the curriculum system of other majors, and are composed of more or less artificial intelligence courses. This curriculum system, based on the actual shortage of teaching staff, has a relatively low degree of systematization and integration of related technologies, which is significantly different from the real application of artificial intelligence technology in enterprises. From the perspective of curriculum development, many courses related to artificial intelligence and their development subject - teachers - are transferred from other courses and teachers. This results in a lack of technical experience in the design of teaching content from the perspective of artificial intelligence, and the construction of teaching resources and textbooks has not kept up, leading to a significant gap between the courses already offered and the demand for cultivating artificial intelligence professionals. The report shows that in 2019, only 3.4% of vocational positions related to artificial intelligence accepted fresh graduates, and only 5.4% accepted work experience of less than one year, which to some extent reflects the problem of lagging curriculum construction in schools.

3.4. Lack of Teaching Staff and Low Level of Specialization

At present, vocational colleges in China are rapidly promoting professional construction in the era of artificial intelligence, facing prominent problems such as insufficient teaching staff and low level of specialization. On the one hand, artificial intelligence is a composite profession and technology based on multiple disciplines. It is impossible to effectively master such interdisciplinary knowledge and composite technology in a short period of time. In addition, the requirements of vocational college teachers for professional skills and practical experience determine that the growth cycle of talents who can be competent in teaching artificial intelligence majors is long. However, in China, whether it is vocational colleges or undergraduate colleges, the talent cultivation of artificial intelligence majors has just

begun, and the industry has a strong demand for AI professionals with practical experience. Vocational colleges have weak attraction to such talents, resulting in a shortage of professional teachers. On the other hand, in the absence of sufficient professional teaching staff, many vocational colleges can only form teams based on teachers in related majors such as computer science, electronic information, and automation. With limited time for training and mutual adaptation, it is difficult for teachers to complete cross disciplinary knowledge and technology learning and internalize it into their own knowledge, abilities, and quality structure. There are also problems such as some teachers being unwilling to transform and some old teachers having difficulties in transformation, resulting in a significant lack of professional knowledge and practical ability in the overall teaching staff, and a low level of specialization.

3.5. Low Coupling of Demands Between Both Parties in School Enterprise Cooperation

The rapid development of artificial intelligence is accompanied by its increasingly expanding industrial applications, and practical experience plays a very important role in the cultivation of artificial intelligence related talents. However, the investigation found that the cooperation between vocational colleges and enterprises in the cultivation of artificial intelligence related talents faces the problem of low coupling of demands from both sides. On the one hand, these enterprises with relatively strong willingness to cooperate with vocational colleges are generally small and medium-sized enterprises. In order to cultivate technical and skilled talents that meet the needs of industrial innovation and transformation and upgrading, vocational colleges tend to choose to cooperate with industry leaders and backbone enterprises. However, these enterprises are mainly limited to a limited number of artificial intelligence industry giants, such as Baidu, Huawei, Alibaba, Tencent, iFlytek, DJI Innovation, etc. They have weak willingness to cooperate with vocational colleges, and the degree of cooperation is not deep. Currently, their cooperation is only in providing schools with some teaching platforms, courses and teaching resources, teaching equipment, etc., and mostly stays in businesses with relatively low technological content. Students cannot access the main business and core technology of enterprises. On the other hand, the current development of China's AI industry is mainly concentrated in the Beijing Tianjin Hebei, Yangtze River Delta, Guangdong Hong Kong Macao Greater Bay Area and Sichuan Chongqing region, where the demand for AI industry talents accounts for 90.9% of the country's total demand. The artificial intelligence industry in many regions has not yet developed, and the demand for cooperation between vocational colleges and local enterprises in promoting professional construction is also difficult to couple. In this situation, vocational colleges lack real problem scenarios and solutions for cultivating talents related to artificial intelligence. The trained talents are difficult to adapt to the increasingly rich working environment and rapidly developing industrial changes in the era of artificial intelligence, and even face structural unemployment threats and risks of supply-demand mismatch.

3.6. The Construction of Practical Teaching Conditions is Significantly Lagging Behind

Driven by the new generation of information technology revolution centered on artificial intelligence, new

technologies, industries, formats, and models emerge one after another, posing higher requirements for practical teaching in vocational colleges. However, due to the low coupling of demands between schools and enterprises in cultivating artificial intelligence related talents, many vocational colleges mainly rely on on campus training for practical teaching, and the corresponding construction of practical teaching conditions is significantly lagging behind. Taking the artificial intelligence major as an example, the vast majority of vocational colleges have practical teaching conditions that are difficult to support the corresponding talent cultivation of artificial intelligence. On the one hand, there is a lack of sufficient training equipment. As a composite technology based on multiple disciplines, artificial intelligence involves a wide range of teaching content, requires a variety of equipment, has complex configurations, and updates rapidly. This is a major challenge for vocational colleges with relatively low investment in educational funds; Vocational colleges with better conditions have purchased some hardware equipment, such as facial recognition systems, artificial intelligence experimental boxes, intelligent robots, etc., but the overall equipment is insufficient and often lags significantly behind the equipment actually used in the industry. On the other hand, there is a lack of practical data resources. The practical teaching related to artificial intelligence cannot be separated from the support of real industry application scenarios and massive data. In the absence of deep cooperation between schools and enterprises, promoting practical training activities mainly through vocational colleges often lacks sufficient quantity and quality of data and information support.

4. Strategies for Professional Construction in Higher Vocational Colleges in the Era of Artificial Intelligence

Adapting to the trends of new technologies and new economic development and promoting professional construction is an unchanging principle for the sustainable development of vocational colleges. Currently, vocational colleges in China are actively promoting professional construction in response to the development trend of artificial intelligence and its industrial applications, which is an inevitable choice to meet the needs of the times. It is necessary to take measures to address problems under the macro-control of the government and the support of industry enterprises.

4.1. Enhance the Training Level of Artificial Intelligence Professionals and Increase the Supply of Technical and Skilled Talents at the Undergraduate Level

If the industrial chain of artificial intelligence is divided into the foundation layer, technology layer, and application layer, the artificial intelligence related talents cultivated by vocational colleges should be concentrated in the application layer. However, due to the high requirements of industry enterprises for such talents, the educational level of artificial intelligence majors is misaligned with the needs of industry enterprises. To adapt to the trend of artificial intelligence and its industrial applications, vocational colleges need to rely more on undergraduate and higher vocational education to

cultivate talents related to artificial intelligence, in order to meet the needs of industry enterprises. According to the 2021 education statistics, there are 1486 vocational colleges and 32 undergraduate vocational schools in China. It can be seen that undergraduate vocational schools are still in their infancy, and the cultivation of artificial intelligence industry talents at this level and type has not yet formed a scale. During the 14th Five Year Plan period, in accordance with the needs of high-quality economic and social development, China should steadily develop undergraduate level vocational education. The government should coordinate and promote the adjustment of vocational education levels and professional layout, provide preferential and supportive professional settings for the training of artificial intelligence industry talents who truly need undergraduate level, and control the distribution and training scale of vocational colleges.

4.2. Optimize Talent Cultivation Objectives and Specification Positioning, Strengthen the Cultivation of Compound Technical and Skilled Talents

The widespread application of artificial intelligence technology has promoted interconnectivity and integration between industries and professions. While it has eliminated some occupational positions, spawned new ones, and promoted structural changes in social division of labor, it has also brought about changes in the skills required for occupational positions, resulting in an increasing demand for versatile talents. China has been guided by policies. The "Internet plus" Three Year Action Implementation Plan for Artificial Intelligence "jointly issued by the National Development and Reform Commission and other four departments in 2016 and the" New Generation Artificial Intelligence Development Plan "issued by the State Council in 2017 put forward the requirements of conforming to the development trend of artificial intelligence technology and its industrial application, and paying attention to the training of composite talents. The "Action Plan for Artificial Intelligence Innovation in Higher Education Institutions" issued by the Ministry of Education in 2018 clearly proposes a new training model for the "Artificial Intelligence+X" composite major. At present, vocational colleges in China are developing rapidly in the establishment of artificial intelligence and related majors, as well as "artificial intelligence+X" composite majors. However, the positioning of talent cultivation goals faces a dilemma of weak student subject foundations and short educational systems. The cultivation of composite talents based on artificial intelligence technology in the vast majority of other majors is still in the conceptual or planning stage. In the face of the demand for skill combination among talents in related industries, vocational colleges should scientifically position talent training goals and specifications based on the needs of different levels and types of talents for industrial development, combined with the foundation of student sources and the length of education system. For majors where students have weak subject foundations and are at the vocational level, it is necessary to reasonably formulate talent training goals based on the ability to set employment positions (groups), clarify the composite knowledge and skills that the trained talents need to master, and avoid the phenomenon of blindly seeking high positions.

4.3. Promote the Integration and Development of Artificial Intelligence Courses, and Promote the Construction of Courses That are Close to the Real Applications of Enterprises

As a composite technology based on multiple disciplines, the cultivation of talents in the artificial intelligence industry cannot be separated from the integrated development of courses. For artificial intelligence majors, the integration and development of multidisciplinary knowledge and technology involved in artificial intelligence technology can be achieved through strengthening joint course development, collective lesson preparation, and other means. For the "Artificial Intelligence+X" composite major, on the one hand, we should focus on the needs of the development of "X" and strengthen the supporting role of artificial intelligence courses in the curriculum system of the major. On the other hand, we should actively promote the deep integration of artificial intelligence knowledge and technology with professional knowledge and technology, and develop integrated courses. For other majors, the main approach is to integrate artificial intelligence related content into professional courses to meet the needs of industry development. Therefore, it is also necessary to actively develop courses that integrate artificial intelligence knowledge and technology with professional knowledge and technology. Another important aspect of cultivating talents in the artificial intelligence industry is curriculum development that closely aligns with the practical applications of artificial intelligence technology in enterprises. In response to the problem that the construction of artificial intelligence related courses in vocational colleges in China lags behind the actual application of enterprises, vocational colleges must strengthen cooperation with relevant industry enterprises, jointly develop courses, or select teaching resources developed by enterprises, including specialized textbooks, courseware and lecture notes, industry real datasets, experimental cases and codes, industry application cases, etc.

4.4. Strengthen the Construction of the Teaching Staff in the Field of Artificial Intelligence and Comprehensively Enhance the Artificial Intelligence Literacy of Teachers

In response to the prominent problems of insufficient number and low level of specialization in the teaching staff, it is urgent to strengthen the construction of the AI professional teaching staff and comprehensively enhance the AI literacy of the teaching staff. At present, in the context of strong demand for high-end talents in artificial intelligence but obvious lack of training, the attractiveness of vocational colleges to such talents is not strong. To solve the problem of shortage of artificial intelligence professional teachers and insufficient artificial intelligence literacy of other professional teachers, the main way is to cultivate and drive teachers to improve their professional level and literacy in artificial intelligence through school enterprise cooperation and teacher resource integration. Specific measures include: firstly, dispatching teachers to participate in practical training in artificial intelligence industry enterprises or receiving artificial intelligence related training to enhance professional level, professional literacy, and practical ability. The second is to adopt flexible introduction methods, such as setting up special

professor and technical professor positions, establishing master studios, etc., to attract a group of AI industry elites to participate in professional construction and drive the improvement of the professional level of the teaching staff. The third is to actively hire artificial intelligence technology experts and technical backbones from industry enterprises as part-time teachers to make up for the shortage of professional teaching staff and practical experience. The fourth is to integrate the artificial intelligence teaching staff in schools, build an artificial intelligence empowerment platform, and solve the teaching problems of other majors by forming mixed teaching teams, collective lesson preparation, and organizing artificial intelligence literacy training. This will enhance the artificial intelligence literacy of teachers in other majors.

4.5. Multi Level Promotion of School Enterprise Cooperation, Misalignment to Enhance the Coupling of Needs Between Both Parties in School Enterprise Cooperation

Artificial intelligence technology and its industrial applications are a mutually reinforcing process, and it is the continuous expansion of its industrial applications that drives the continuous progress of artificial intelligence technology. Artificial intelligence technology brings rapid and uncertain changes, making close school enterprise cooperation particularly important for professional development. In response to the current problem of low coupling of demands between vocational colleges and enterprises in China, vocational colleges can promote school enterprise cooperation at multiple levels according to the different needs of different enterprises. One is to actively strive for cooperation with leading and backbone enterprises in artificial intelligence under the coordination or policy support of the government and industry associations, and actively develop and accumulate teaching resources such as curriculum standards, teaching standards, and textbooks for the cultivation of artificial intelligence technical and skilled talents in this process. The second is to strengthen cooperation and education with enterprises that have employment cooperation relationships, and carry out comprehensive cooperation in the formulation of talent training plans, curriculum development, teaching implementation, construction of teaching staff and teaching conditions, and evaluation of talent training quality. Advanced elements such as new knowledge, new technologies, new processes, new standards, and new norms required for enterprise positions will be incorporated into the curriculum and teaching to enhance the fit between talent training and enterprise needs. The third is aimed at small and medium-sized enterprises that apply artificial intelligence technology, actively applying the results of cooperation with leading and backbone enterprises in artificial intelligence, cooperating to carry out research and development of artificial intelligence application technology and achievement transformation, and widely conducting artificial intelligence technology skills training.

4.6. Strengthen the Construction of "Artificial Intelligence+" Training Bases and Improve Practical Teaching Conditions

The cultivation of skilled personnel in artificial intelligence technology relies heavily on the comprehensive application

and transformation of knowledge, technology, and skills during practical training experiments. There is a strong practical training process that cannot be separated from advanced technological equipment and massive data support. Due to the huge investment in practical training facilities and the low degree of coupling between the demands of both schools and enterprises, many schools' related professional construction faces problems such as insufficient practical training equipment and lack of practical data resources. In this regard, vocational colleges should adopt new ideas and measures to build on campus and off campus "artificial intelligence+" training bases. In the construction of on campus training bases, comprehensive consideration should be given to the needs of artificial intelligence majors, artificial intelligence related majors, and other professional constructions, combined with the construction of artificial intelligence teacher resource integration mechanisms, to systematically design, construct, and utilize training facilities and data resources. At the same time, we should actively strive to make full use of the practical teaching platforms and resources developed by leading and backbone enterprises in artificial intelligence, with the coordination or policy support of the government and industry associations. We should expand the "AI+" training bases outside the school, and integrate real-life work scenarios, massive data, industry application cases, etc. from the front line of enterprises into practical teaching.

5. Conclusion

This article takes the demand of the artificial intelligence industry as the guide, analyzes the current situation of artificial intelligence talents and industry demand in domestic

universities, reshapes the curriculum system, and establishes a mechanism for industry education integration and collaborative education. Build an industry oriented artificial intelligence talent cultivation model, help universities and the artificial intelligence industry complement each other, promote mutual learning, shorten the distance between talent supply and demand, and achieve excellence in intelligent system development and design, intelligent data processing and application, create models, and promote talent cultivation with the latest development needs of industrial technology.

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