A Scientometric Analysis and Visualization of Research on the Fusion of New Engineering and AI in Chinese Higher Education

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Abstract: *As one of the important strategic technologies for future development, AI has a significant impact on the innovation and deepening of reform in the development of higher education in the new era. The fusion of new engineering and AI in Chinese higher education has attracted increasing attentions from both researchers and practitioners. However, few studies have attempted to make a comprehensive and quantitative review on this topic. This study used Citespace to conduct visual analysis of document metrology since the emergence of the research on the integration of new engineering and AI, mainly from five dimensions: author distribution characteristics, research institution analysis, discipline distribution, keyword analysis and cluster analysis. The paper presented the research hotspots and evolution rules of the spatial distribution characteristics of the integration of new engineering and AI, and tracked the frontier research issues. The results showed that the research on new engineering and AI is developing rapidly, and the distribution of research institutions and authors presents a trend of diversification. The research focused on talent cultivation showed the characteristics of diversified collaborative development, which is mainly reflected in the curriculum system, teaching reform, innovation and entrepreneurship, and the integration of industry and education. This study suggested that the focus of future research will be on questions such as how to deeply understand the connotation of the construction of "new engineering", how to realize the full integration of traditional characteristics and advantages of engineering specialty and AI, and how to realize the transition from specialty segmentation to cross-border crossover fusion.*

Keywords: *New Engineering; AI; Research hotspots and trends; Sceintometric; Citespace; Visualization*

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1. Introduction

In 2016, the State Council issued the 13th five year plan for the development of national strategic emerging industries, emphasizing the key areas of cultivating new drivers of development and gaining future competitive advantages, and constantly promoting the construction and development of new engineering disciplines. Engineering education has become an important driving force for China's national competitive advantage. The construction of "new engineering" is not only the guiding direction of the development and transformation of Engineering Education Specialty in the new era, but also a strategic place to deal with a new round of technological and industrial changes (Lin Jian et al. 2020). The cultivation of cross-border integration ability of engineering talents is the requirement put forward by the development of new economy, cross-fertilization is further deepened and cross-border becomes the inevitable innovation. In the new round of global scientific and technological revolution and industrial transformation, AI has become the main battlefield of competition all over the world. The deep integration of AI and all fields is an irresistible trend of the times, which is having a strategic and overall impact on economic and social development (Wang Li et al. 2021). It is a strategic technology leading the future and the driving force of a new wave of industrial revolution. AI, as a highly inclusive and interdisciplinary field, has been elevated to a national strategic position. The development of new engineering cannot be separated from the integration of AI, and it is an important task for higher education institutions to combine AI with the construction of "new engineering" in a comprehensive and in-depth manner（Yu Hongbin et al. 2020）. This can not only fill the gap of top talents in China and meet the challenges of AI technology on traditional education and curriculum system, but also make full use of the advantages brought by AI technology to help cultivate new engineering talents, discover challenging scientific problems from big data, promote the development of interdisciplinary disciplines, and create a new engineering composite talent cultivation mode.

The integration of new engineering construction and AI can lead the development of education towards online, quantitative, personalized and intelligent direction, and will have an impact on traditional education from three aspects: specialty setting, curriculum system and education methods (Zeng Yong, 2020). Therefore, scholars have carried out research on the connotation and development path of the integration of new engineering and AI. Xu Tao et al.(2018) believe that the essence of "new engineering + AI" is the strategic assumption and choice of engineering education to deal with the new scientific and technological revolution, new industrial revolution and new economic model in the era of AI. Zhang Mengyi et al.(2020) put forward the postgraduate education mode of the combination of new engineering and AI, which is interdisciplinary and multi-field cooperation, takes engineering innovation as the core, connects the chain of experiment and practice, and trains compound teachers. Yang Zhengxiang et al.(2020) put forward the measures to transform and upgrade the traditional electrical automation specialty into an intelligent "new engineering" from the perspective of talent training mode and teaching method. It can be seen that scholars' research on the fusion of new engineering and AI focuses on the prospect and mode of integration, and the whole is still in the exploratory

stage. The integration of new engineering construction and AI is a new issue in the field of education research. On the one hand, it is necessary to compile the research on this issue, which will not only sort out the pulse, but also further enhance the research ability of scholars in this field, enrich the research vision and point out the direction for the construction of new engineering disciplines. On the other hand, no scholars have yet conducted a systematic analysis on this issue, so it is necessary to study the research hotspots and development trend of the integration of new engineering construction and AI.

Bibliometric analysis is the most common method for systematically sorting out research and has been widely used in the field of education research. For example, Sun Zhendong et al.(2021) sorted out the stages and trends of research on "teaching-labor integration" and made recommendations to improve the policy guarantee mechanism for sustainable research and strengthen empirical research. Philip Hallinger et al. (2020) applied the bibliometric analysis of simulation-based learning in management education, affirming the influence of simulation-based learning. Daniel Hernández-Torrano et al. (2020) systematically reviewed research trends in the field of creativity in educational contexts and summarised the main findings in this area. Bibliometrics enable to identify and visualize the trends and developments in the scientific development of a study field. This study applied Citespace, a classical method in international scientific bibliometrics, to visualise and analyse the relevant research included in the CNKI database. Through sorting out the research hotspots, research frontiers and the evolution of research hotspots on the integration of new engineering construction and AI, it provides reference for grasping its development trend and in-depth research, so as to promote the integration development of new engineering and AI.

Based on the context, this study is divided into the following six parts: “Introduction”, “Research methods”, “Metrological characteristics of the fusion of new engineering and AI”, “Visual analysis of research hotspot of the fusion of new engineering and AI” ,“Keyword cluster analysis of fusion of new engineering and AI” and “Conclusion”.

2.Research methods

Bibliometrics is one of the most commonly used analytical research methods (Daniel Hern á ndez-Torrano et al. 2020). Through quantitative research methods such as mathematical statistics, analyzing the amount of published literature and the development process of research topic hotspots can reveal the research status and trend in a certain field (Zhang Xiuping et al. 2017, Jiang Hongxing et al. 2016). Its basic process includes sample collection and acquisition, clear sample data, selection of knowledge units (keywords, authors, institutions, journals, etc.), construction of unit relations, data standardization, sample data simplification, knowledge visualization, results analysis, etc.

CiteSpace software is a citation network visualization analysis tool developed by Dr. Chen Chaomei of Drexel University based on Java language (Li Shaohui et al. 2018). This tool can be used to detect and analyze the changing trend of the research frontier of a discipline and the relationship between the research frontier and its knowledge base and between different research frontiers. This study intends to explore the research status and

trends of the integration of new engineering and AI, so the search terms are "new engineering" and "AI". 483 Chinese journal papers retrieved from the Chinese Journal Full-text Database (CNKI) from March 2017 to March 2022 were used as data sources, and each document information (author, title, keyword, abstract, reference, etc.) was exported to Refworks data format. CiteSpace software is imported to process the data and analyze the content of the journal literature related to the fusion of new engineering and AI, and the relationship between high-frequency keywords in the literature is described by visual knowledge mapping, which reveals the research hotspots and evolution process of the integration of AI and specialty under the background of new engineering in the past four years.

3.Metrological characteristics of the fusion of new engineering and AI

A) Annual trend of literature

The annual trend of literature is a broken line chart drawn according to the number of documents issued by the annual statistical sample, as shown in Figure 1.

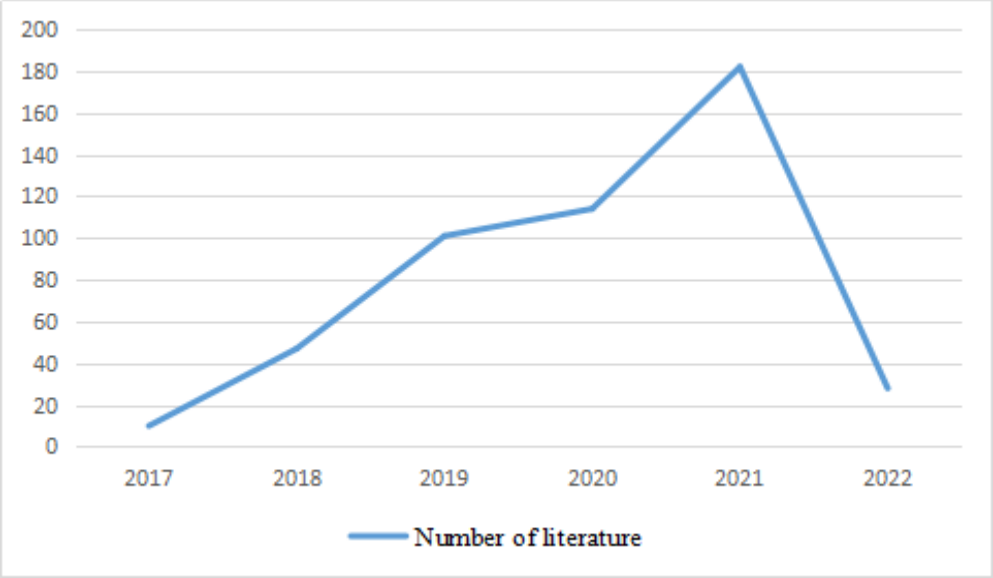


Figure1.Annual distribution of relevant literature.

The earliest relevant literature began in 2017, which is also a key year for the implementation of new engineering construction. Seminars have been held in Fudan University, Tianjin University and Beijing to launch "Fudan consensus", "Tianda action" and "Beijing Guide", signifying that the engineering education reform under the background of new engineering has entered a new stage. Based on this background, scholars began to explore the integrated development of the fusion of new engineering and AI. However, because the research is still in the preliminary exploration stage, there is a lack of theoretical knowledge, and the number of relevant literature published is low. With the deepening of research, the number of documents issued has increased year by

year. The number of relevant documents surged from 2018 to 2019, which is closely related to the further issuance of relevant notices and measures by the Ministry of education to promote the construction of new engineering and AI. For example, in the notice on publishing the first batch of "new engineering" research and practice projects issued by the Ministry of education in 2018, it is pointed out that we should pay attention to the cross integration of AI and professional education of other disciplines. It can be seen that the research on the combination of new engineering background and AI is a research direction developed in recent years, which is in the stage of rapid development and meets the current practical needs.

B) Analysis of the author and the sending research institution

We set the node types of CiteSpace software as author and institution respectively, and make statistical and visual analysis on the authors and source institutions of 255 journal papers. The connection thickness in figures 2 and 3 represents the number of times the author or research institution cooperates. The more times the connection, the thicker the connection is; the size of the font reflects the amount of documents issued by the author or organization. Because this research field has only developed in recent years, the number of papers published by authors is generally not high. As can be seen from the author's cooperation network diagram (Figure 2), the current research of the fusion of new engineering and AI is mainly based on the small-scale cooperation between scholars. Among them, Cai Zhicheng, Deng Chengzhi and Yu Yang are the main research authors to explore the learning methods, talent training modes and systems of different majors under the background of new engineering.

Figure2. Author collaboration grid map.

Table I. shows that the institutions with the highest number of documents are Beijing University of technology, followed by Tsinghua University and Shanghai University of technology. There are 2 institutions that have issued 7 articles, 6 articles and 5 articles. Using CiteSpace to analyze the co-occurrence of research institutions (Figure 3), it can be seen that at present, most of the research institutions issuing documents in the field of the fusion of new engineering and AI are distributed in Beijing and Shanghai, mainly cooperating with different colleges of the same university, which is closely related to the school of computer and the Institute of education. Among them, research institutions such as China AI Society, Tsinghua University, Information Technology New Engineering Industry University Research Alliance and Beijing University of technology have close cooperative relations. Generally speaking, there is little cooperation between scholars and institutions on the research of the fusion of new engineering and AI, and the mechanism and platform of collaborative research have not been established.

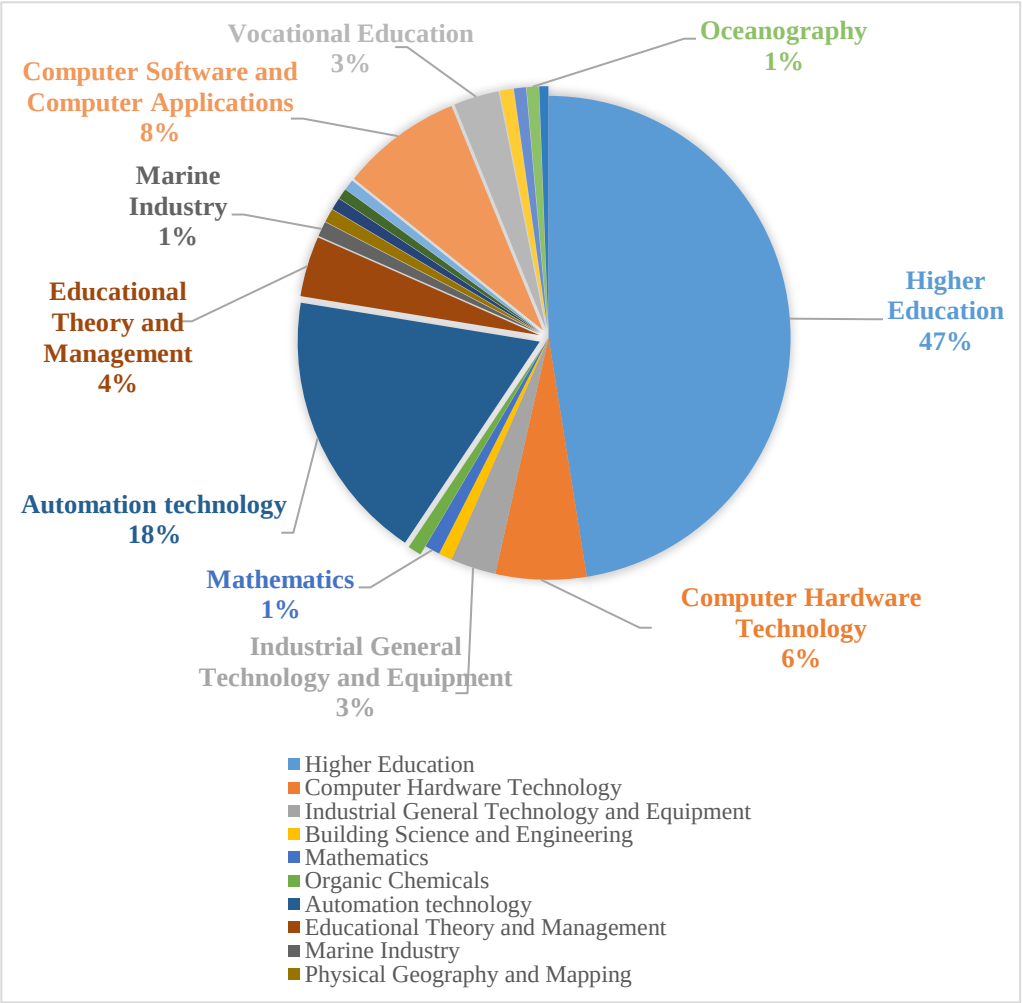
Table1. Statistical table of research institutions.

Issuing body	Frequency of issuance	Issuing body	Frequency of issuance
Beijing Institute of Technology	7	Huazhong University of Science and Technology	3
Tsinghua University	6	Tianjin university	3
University of Shanghai for Science and Technology	6	Jiangsu Normal University	3
University of Science and Technology Beijing	5	Henan Polytechnic University	3
Nanjing University of Aeronautics and Astronautics	5	University of Electronic Science and Technology of China	3
Renmin University of China	4	Shandong Jiaotong University	3
Zhejiang university	4	Chongqing University of Arts and Sciences	3
Wuhan University of Technology	3	Anhui University of Science& Technology	3

Figure3. Institutional cooperation chart.

C) Discipline distribution statistics

In the action plan for AI innovation in colleges and universities, the Ministry of education stressed that we should jointly promote the professional construction in the field of AI and "new engineering" and build a new training mode of "AI + X" composite professionals. In this context, the integration of AI and specialty is the focus of this study. Therefore, the disciplines involved in relevant research papers are counted, as shown in Figure 4. It can be seen that the fusion of new engineering and AI is most closely related to higher education research, followed by automation technology and computer specialty. According to the characteristics and nature of different majors, scholars put forward suggestions on the development of AI and different majors under the background of new engineering. For example, Yang Zhengxiang put forward suggestions on adjusting talent training methods, optimizing teaching process and adopting modern educational technology for the transformation and upgrading of traditional electrical automation specialty to intelligent "new engineering".



Note: The location is limited and only disciplines with a percentage greater than or equal to 1% are marked in the chart

Figure4.Subject statistical charts.

4. Visual analysis of research hotspot of the fusion of new engineering and AI

A) Keyword hotspot analysis

We select the node type as "keyword" in CiteSpace software. After the operation is completed, we remove the search keywords of "AI" and "new engineering", adjust and optimize the map with relevant functions, and draw the keyword co-occurrence network diagram of the fusion of new engineering and AI research literature with high frequency and high centrality, as shown in Figure 5. The size of the keyword font in the figure indicates the frequency of the word. The larger the font, the more it appears in the literature. The line represents the relationship between keywords, reflecting whether keywords appear in the same literature. The more times they appear in the same literature, the thicker the line, indicating the closer the relationship between the two keywords.

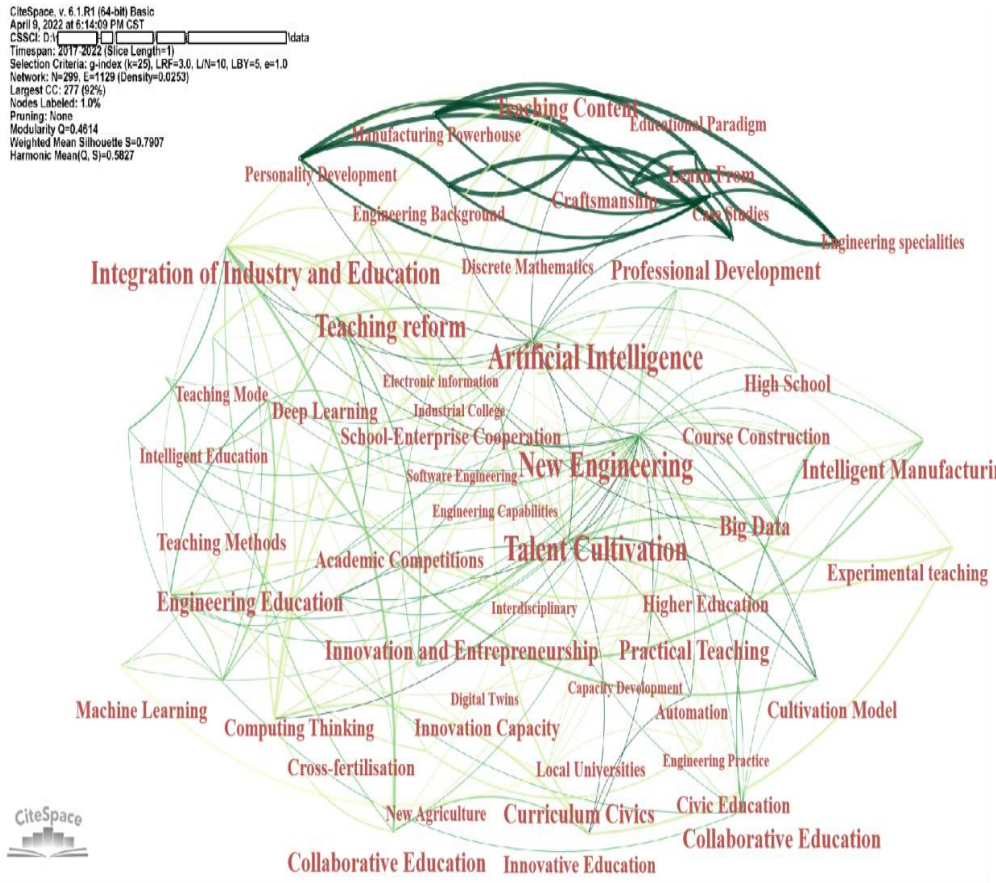


Figure5. Fusion of new engineering and AI research paper high frequency keyword co-occurrence chart.

Key words	frequency	centrality	Key words	frequency	centrality
Talent cultivation	35	0.28	Colleges and universities	5	0.02
Transformation of education	24	0.17	Training mode	5	0.04
Curriculum system	12	0.09	Computational thinking	5	0.06
robut	11	0.11	Automation specialty	5	0.04
Innovative undertaking	11	0.05	Intelligent	5	0.01

			manufacturing		
Integration of production and education	9	0.11	Teaching method	4	0.03
Professional building	9	0.01	Discipline competition	4	0.00
Engineering education	9	0.04	Intelligence education	3	0.01
Practical teaching	8	0.01	Chiastopic fusion	3	0.00
Big data	7	0.02	Craftsmanship spirit	3	0.01
Deep learning	7	0.07	Creative education	3	0.01
Cooperative education	6	0.01	Model of teaching	3	0.02
Innovation ability	6	0.11	Curricula construction	3	0.00

Table2. Statistical Table of Keyword Frequency and Centrality.

The occurrence frequency, centrality and mutual relationship of keywords can intuitively reflect the hotspots concerned by scholars in the research field of the fusion of new engineering and AI and the relationship between hot spots. In Table II, the centrality and frequency of keywords that occur more than twice are counted (search keywords are not included). The higher the frequency, the more likely it is to become a research hotspot in the keyword co-occurrence network. Centrality is the concept of graph theory and network analysis. The higher the centrality, the closer the relationship between the keyword and other keywords in the co-occurrence network, and the stronger the centrality. It can be seen that according to the frequency of occurrence, the leading keywords are talent training, teaching reform, curriculum system, robot, innovation and entrepreneurship, industry education integration, professional construction and engineering education. According to the order of centrality, the key words at the forefront are talent training, teaching reform, robot, industry education integration, innovation ability and curriculum system. The statistical results of keyword frequency and centrality show that in the research related to the fusion of new engineering and AI, talent training, curriculum system, teaching reform, innovation and entrepreneurship and the integration of industry and education are the key hotspots of the research.

Through the keyword co-occurrence chart and keyword frequency statistics, as well as the combing of related literature, we can see that the research on the fusion of new engineering construction and AI presents the following characteristics: (a) The research scope is extensive. Scholars have taken the new engineering talent cultivation mode as the main content and sorted out the multi-dimensional contents such as the path of

practical teaching reform of engineering majors, the optimization content of curriculum system, the development mode of innovation and entrepreneurship education, and the improvement direction of teaching mode and method. It provides a reference development framework for the integration of new engineering majors and AI. (b) Rich research perspectives. Scholars have explored how to combine engineering majors with new technologies such as machine learning from the perspective of multiple disciplines. For example, the research on the exploration of educational reform of computer science majors in the context of new engineering and the construction of curriculum system of physical engineering majors. (c) Research is mainly based on qualitative methods. At present, scholars' research on the integration of new engineering construction and AI is mainly based on literature, government documents and practical experience, and puts forward targeted suggestions on the construction of majors, but on the whole, it seems that few studies lack quantitative methods for analysis and research.

B) Research hotspot evolution analysis

Research hotspot evolution analysis is presented by selecting time zone in CiteSpace software, which intuitively reflects the occurrence time of keywords and the co-occurrence relationship between keywords, and shows the knowledge cycle and development track of domestic the fusion of new engineering and AI research in different stages.

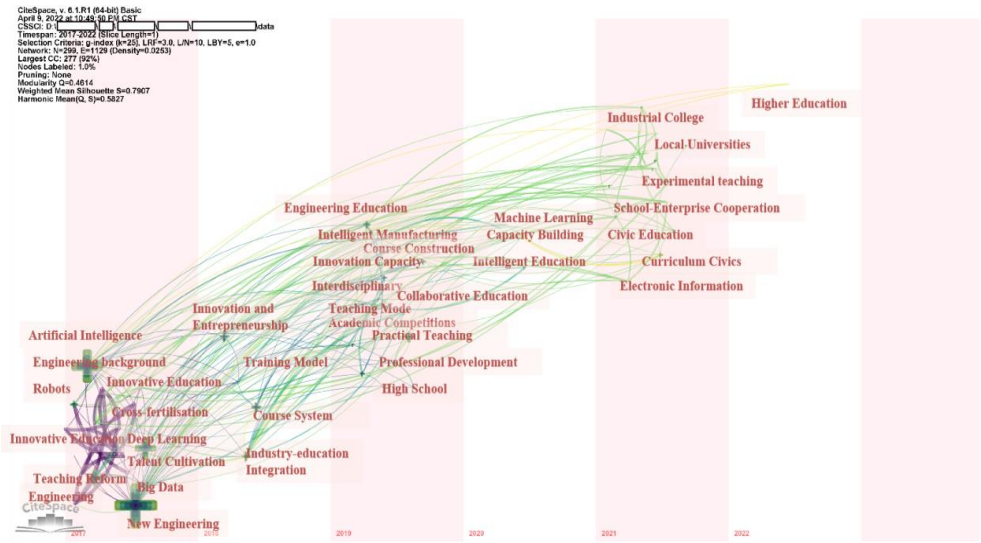


Figure6. Keyword concurrent current area map.

From this time zone map, it can be seen that scholars started to study the integration of new engineering construction and AI in 2017, and the scope and objects of the study have been expanding. At the National Education Conference, General Secretary Xi emphasized that "we should improve the ability of education to serve economic and social development, adjust and optimize the regional layout, discipline structure and specialty

setting of colleges and universities, and establish and improve the dynamic adjustment mechanism of disciplines and specialties". In this context, scholars have constructed a number of research frameworks for the emerging field of new engineering and AI to explore the talent training mode. The new engineering aims to cultivate new engineering talents with innovative and entrepreneurial thinking, attitude, skills and knowledge. Therefore, innovation and entrepreneurship has gradually become a hot topic for scholars' research. With the development of AI technology, scholars gradually think about the feasibility of combining professional construction with AI more, and conduct in-depth research from curriculum system, teaching mode, collaborative education and so on. On the whole, the research on the integration of new engineering and AI is gradually improving. Based on this time zone diagram, the evolution process of this research filed is summarized by combining the relevant literature and the analysis of the previous research hotspots.

Embryonic stage (2017-2018): as can be seen from Figure 6, hot keywords include talent training, teaching reform, in-depth learning, cross integration, industry education integration, innovation and entrepreneurship, discipline competition, etc., indicating that this stage focuses on the theoretical research on the basic concepts of new engineering and AI, the importance of their integration, the basic perspective of integration, etc.

"New engineering" is the cross integration of science, humanities, engineering and other knowledge fields under the background of social and economic development driven by technological innovation, and it is also an important way to cultivate innovative and entrepreneurial talents. Since 2016, the state has issued a series of guiding documents on major strategies for the development of AI, and pointed out that it is necessary to optimize the scientific and technological innovation system in the fields related to AI in colleges and universities, and promote colleges and universities to establish a talent training system suitable for the needs of scientific and technological innovation and industrial development. Therefore, "talent training", as the keyword with the highest frequency in the embryonic stage, is an important aspect of the integration of AI and new engineering, and it is also a research hotspot of scholars.

Rapid development stage (2019 to now): this stage is the rapid development stage of new engineering and AI research. In the rising stage, on the basis of continuing the research scope of the embryonic stage, the research theme has been continuously expanded, and hot keywords such as talent training mode, curriculum system, engineering education, professional construction, innovation ability, collaborative education and so on have been added.

The new keywords reflect the hot topics in the following aspects: first, the research on talent training mode. The development of innovative talents training in new engineering based on AI can cultivate compound top-notch innovative talents with cross-border integration ability and lifelong learning ability. Scholars emphasized that interdisciplinary and multi-disciplinary integration is the direction of talent training mode under the background of new engineering (Li Lijuan et al. 2020), and put forward suggestions on paying attention to school enterprise cooperation and innovating management mechanism from the aspects of talent training system, talent training team and talent training practice

platform, so as to promote the deep integration and development of new engineering majors and AI in the new era of AI development (Yue Shudan, 2020). The second is the research of curriculum system. Curriculum system is the main way to cultivate talents, which is very important to the development of higher education. Combining the requirements of the development of the times, the reconstruction of the curriculum system is an important content in the research of talent training. Based on the new engineering subject with deep interdisciplinary integration and data-driven, Du Shengdong (2020) proposed to design a curriculum system for the development of new engineering education oriented to special topics and modules, and an interdisciplinary curriculum based on subject integration. Zhang Wei (2019) proposed the "intelligent chemical engineering" curriculum system with the cross integration of chemical engineering, control and computer, and He Qinming (2019) proposed the university computer basic curriculum system for new engineering from three aspects: the cultivation of computing thinking ability, the basic curriculum of new industry demand and the construction of cross curriculum. The third is the research on the mechanism of collaborative education. In order to better build fusion of new engineering and AI, more and more scholars paid attention to the construction of talent training mechanism and mode reform of the deep integration of industry and education, and pointed out that expanding the connotation and path of school enterprise collaborative education can effectively help promote the development path. Jiang Aihua (2019) proposed to incorporate the engineering practice training of young teachers and the knowledge updating of enterprise employees into the school enterprise collaborative education system, so as to facilitate the overall planning of enterprise employee training and incremental talent training, university talent training and teacher development. Chen Zhuoran (2019) and others suggested that industry, industry experts and education experts should participate in many aspects, accurately grasp the current demand for talents in new technologies and industries, jointly complete the formulation of new engineering talent training plan, and form a training mode of multi-party collaborative education.

5.Keyword cluster analysis of fusion of new engineering and AI

The key words are analyzed by cluster analysis. The cluster diagram generated by Citespace is shown in figure 7.

From the content of the keyword clusters, the research on the fusion of new engineering construction and AI is mainly focused on the following aspects.

First, it focuses on the new requirements, opportunities and challenges of talent cultivation in the context of new engineering. The clusters under this theme are #0 AI, #1 Talent Cultivation, and #2 New Engineering. Specifically, with the development of technology, teaching methods such as reverse classroom and online education can help students understand professional knowledge and AI. Under the impact of intelligent education, traditional education is facing the impact of talent cultivation mode. Paying attention to students' innovation education and cultivating students' innovation ability are the key requirements for talent cultivation in the new engineering.

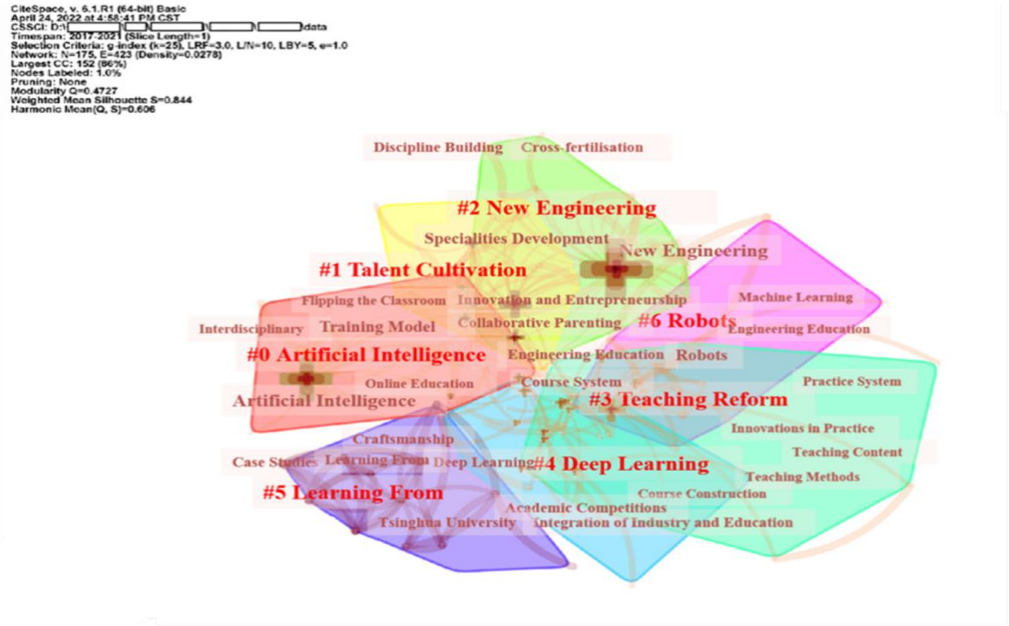


Figure7.Keyword clustering diagram.

Secondly, a series of ideas and frameworks are proposed for the need of integrating the development of new engineering and AI, including curriculum, teaching methods and engineering practice. The study mainly contains clustering group #3 teaching reform. Specifically, the engineering education model is further optimized by improving the teaching methods and curriculum system The integration of industry and education helps to promote the cultivation of students' innovation ability, and the improvement of the discipline competition practice system and innovation and entrepreneurship practical training system can be realized through the cooperation between schools and enterprises, etc. Under various frameworks, scholars put forward various specific measures. Such as clustering group #4 deep learning, #5 learning from, and #6 robotics. Specifically, promoting students' understanding of the integration of new engineering and AI through case studies, learning from good educational paradigms of other schools. Moreover introducing AI knowledge such as deep learning and machine learning in the curriculum system of engineering majors.

However, on the whole, there are still some deficiencies in the current research, mainly reflected in the following two aspects: first, it is necessary to further strengthen the localization of theoretical application. The combined development of new engineering and AI in China can be based on the experience of foreign universities. For example, the College of engineering and the College of Humanities and Sciences at the University of California, Berkeley, and the College of natural sciences at the University of Texas, Austin, offer the major of AI for localized application. This localization is not limited to the application of foreign experience in China, but also includes the construction of new engineering majors in different regions of China according to different local development

characteristics and different advantageous specialties. It can be seen from the previous analysis of research institutions that the current research is mainly concentrated in developed urban areas such as Shanghai and Beijing. However, for other provinces with relatively insufficient application of AI technology, it also needs to be further strengthened. For example, Shaanxi Province, which has a large number of undergraduate colleges and universities, has a solid foundation in engineering disciplines, accounting for nearly 40%. There are a large number of traditional characteristic advantageous engineering disciplines related to aerospace, machinery, textile, water conservancy and mining, and has the advantages of talents, technology, industry and environment in developing strategic emerging industries. Facing the major strategic needs of the country and the needs of economic and social development, based on the current situation and future trend of industrial development in Shaanxi Province, universities should accurately grasp the construction connotation of "new engineering majors and new requirements of Engineering", take the integration of AI and traditional characteristic advantageous majors as the entry point, and focus on the transformation and upgrading of pillar industries in Shaanxi Province Research on the development of strategic emerging industries and talent training in key areas of regional economic structure adjustment, and explore the transformation and upgrading path of engineering majors with traditional characteristics and advantages, which can strengthen and guide the school running characteristics and advantages of each school. Under the current situation that the problem of professional homogenization is prominent and the advantageous characteristics of connotation construction are not obvious, the study of regional characteristic advantageous majors is of great significance to the organic connection of education chain, talent chain, industrial chain and innovation chain in the region, so as to continuously optimize the collaborative education mechanism of industry education integration. Second, the practical research of new fusion of new engineering and AI is insufficient. Although scholars have learned a lot from the advanced experience of foreign universities and put forward a variety of integration modes of new engineering and AI, they lack micro case studies. The reason is the limitation of resources and the lack of practical theoretical knowledge. In reality, the proportion of colleges and universities that integrate AI into professional construction is relatively small, so the cases and data that provide research reference for scholars are also relatively limited. For scholars, on the one hand, they need to find out their background and find the right direction, and focus the training of engineering talents on the key areas supporting industrial transformation and upgrading, the development of strategic emerging industries and the adjustment of regional economic structure through theoretical research. In line with the new trend of the deep integration and development of AI and industry, they need to deepen the supply side structural reform of professional construction, and realize the transformation from discipline orientation to industrial demand orientation. While promoting the construction of new engineering, it can also improve the practical research in this field. On the other hand, they should focus on domestic and foreign universities that have combined AI with engineering majors as research cases, and conduct in-depth excavation in combination with quantitative research methods to promote the practicality of fusion of new engineering and AI research.

To sum up, if scholars want to overcome the shortcomings of fusion of new engineering and AI research, they need to accurately grasp the development trend of global AI, cultivate new growth points in cutting-edge and cross cutting fields, actively layout majors with large demand for talents for regional economic and social development, provide sustainable development power for the strategic emerging industry of fusion of new engineering and AI, and realize the transformation from adaptive service to support and guidance. They need to make full reference to the practical experience of foreign countries, and convert the practical research experience into theoretical knowledge for reference through empirical research methods such as expert interview and questionnaire survey, so as to further supplement the theoretical system of fusion of new engineering and AI.

6.Conclusion

With the help of bibliometric method, this study systematically sort out the existing research on the integration of new engineering and AI in China, and shows the research status, hotspots and trends in this field through chart visualization. The research conclusions are as follows: (a) according to the number of published documents, the research on new engineering and AI is divided into embryonic stage and rapid development stage, which is still in the stage of rapid development; (b) This paper summarizes the distribution of authors, research institutions and disciplines of fusion of new engineering and AI literature, and finds out that the authors and research institutions show diversified distribution characteristics, and the discipline distribution shows diversified integration characteristics; (c) Based on the keyword co-occurrence analysis, the research hotspots from 2017 to 2020 are determined, including the talent training, curriculum system, teaching reform, innovation and entrepreneurship and the integration of industry and education, together with the research hotspots and frontiers of talent training mode, curriculum system and collaborative education mechanism; (d) The research themes of AI integration were cluster analyzed, and the research issues were divided into two categories according to the clusters: New requirements, new opportunities and challenges for talent cultivation in the context of new engineering, and framework of education for the development of new engineering construction and AI integration.

However, at present, the literature on the integration of new engineering and AI lacks quantitative research. At the same time, in the face of the common situation of specialty construction in colleges and universities, such as the coexistence of blindness and lag of specialty setting, the coexistence of insufficient supply and excess supply of talent training, specialty homogenization and unclear advantages and characteristics of content construction. Therefore, how to deeply understand the connotation of "new engineering" construction, realize the full integration of traditional characteristic and advantageous engineering majors and AI, and realize the transformation from professional segmentation to cross-border cross integration will be the focus of future research.

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