Research Progress on the Application of Artificial Intelligence in Information Engineering: A Bibliometrics Study from 2014 to 2024

Zhenkun Liu*
School of Communication and Electronic Engineering
Jishou University
Xiangxi Tujia and Miao Autonomous Prefecture, Hunan, China
lzk3275269674@163.com

Zhu Xiao
School of Medicine
Jishou University
Xiangxi Tujia and Miao Autonomous Prefecture, Hunan, China
19386915205@163.com

Dengyuan Pan
School of Civil Engineering
Changsha College
Changsha, Hunan, China
19313169342@163.com

Zhuo Yang
School of Traffic and Transport Engineering
Changsha University of Science and Technology
Changsha, Hunan, China
yzhuo3271610744@163.com

Yuzhi Peng
School of Business
Jiangnan university
Wuxi, Jiangsu, China
PYZ20061217@163.com

Abstract

In order to understand the global research trends and application development of artificial intelligence (AI) in information engineering from 2014 to 2024, this paper quantitatively analyzed and visualized the relevant literature in Web of Science (WoS) using VOSviewer and CiteSpace to identify the main authors, institutions and national collaboration networks of emerging research hotspots and cutting-edge topics. Through co-occurrence analysis and visual analysis, the research hotspots, evolutionary paths and development trends of artificial intelligence (AI) in information engineering applications were revealed, providing a theoretical basis for understanding the role of AI in information engineering and suggesting future research directions. The research found that : (1) Some stable collaborative networks dominated by small groups have been formed in this field; (2) A few countries have concentrated a large amount of scientific research resources in this field, and the global distribution of scientific research resources is unbalanced; (3) The depth and breadth of research in this field have expanded rapidly in the last decade, with research hotspots being rapidly updated and iterated, and technical application scenarios becoming more specific.

CCS Concepts

• **Information systems** → Data management systems; Information integration.

*Corresponding author

BDICN 2025, Guangzhou, China

ACM ISBN 979-8-4007-1242-5/2025/01
https://doi.org/10.1145/3727353.3727478

Keywords

artificial intelligence, information engineering, bibliometrics, visual analysis

ACM Reference Format:
Zhenkun Liu, Zhu Xiao, Dengyuan Pan, Zhuo Yang, and Yuzhi Peng. 2025. Research Progress on the Application of Artificial Intelligence in Information Engineering: A Bibliometrics Study from 2014 to 2024. In *2025 4th International Conference on Big Data, Information and Computer Network (BDICN 2025), January 10–12, 2025, Guangzhou, China.* ACM, New York, NY, USA, 5 pages. https://doi.org/10.1145/3727353.3727478

1 INTRODUCTION

The use of artificial intelligence (AI) in information engineering has grown significantly, especially in the era of big data, where AI plays a crucial role in data processing and intelligent analysis [1]. This paper presents a systematic review of the application of AI in information engineering using bibliometrics to emphasize the contribution of AI to the field through key techniques such as data mining, pattern recognition and machine learning. In addition, it discusses the challenges encountered by AI in these applications and suggests future research directions. The analysis provides a comprehensive perspective that aims to guide ongoing research and development to integrate AI into information engineering.

2 RESEARCH METHODS AND DATA SOURCEs

2.1 Research methods

Bibliometrics is an interdisciplinary field that applies mathematical and statistical methods to quantitatively analyze academic literature through indicators such as the number of publications, citation frequency and relevance [2]. Bibliometrics is a discipline that combines the disciplines of mathematics, statistics, and intelligence, and it reveals the intrinsic connections and trends in the academic field. Key techniques include descriptive statistics and network analysis

of keywords, texts, citations, authors, and institutions. This study employs a bibliometric approach using VOSviewer and CiteSpace to identify research hotspots, trends, and structural patterns. These tools visualize complex bibliometric data and allow for a clearer understanding of the dynamics and thematic evolution of specific research areas.

2.2 Data sources

As an important digital literature resource, Web of Science database has gained wide recognition among researchers and is considered the most suitable platform for bibliometric analysis [3]. Compared to other databases, Web of Science provides a comprehensive data structure including title, author, institution, country, abstract, keywords, references, citation counts, and other relevant fields. In addition, it provides data formats compatible with VOSviewer and CiteSpace, facilitating robust bibliometric analysis [4]. For thorough and authoritative data assessments, the Web of Science (Core Collection) was selected as the primary data source, utilizing the SSCI and SCI-Expanded indices. The search strategy employed was TS= ((”Artificial Intelligence” OR ”AI” OR ”Machine Learning” OR ”Deep Learning”) AND (”Information Engineering” OR ”Information Systems” OR ”Data Engineering”)), covering the period from January 2014 to November 2024, and was restricted to English-language articles, resulting in 1462 initial records. However, data obtained directly through search formulas may have problems such as duplication or inconsistency with the subject matter, and thus need to be cleaned prior to analysis to avoid affecting the results of the analysis due to the quality of the data itself [5]. The process of data cleaning includes cleaning the data of duplicate entries, erroneous records with biased retrieval, and low-frequency interfering keywords. After the researcher screened each article, 730 valid documents were finally obtained.

The 730 papers used in this study came from 2790 authors from 1303 institutions in 80 countries, were published in 256 journals, and were cited 44503 times in 17518 journals.

3 DESCRIPTIVE STATISTICS

3.1 Bibliometric analysis of annual publication volume

Changes in the number of publications are an indicator of trends in a research field. Figure 1 shows the global trend of publications on AI in information engineering from 2014 to 2024. The number of papers increases dramatically from 7 in 2014 to 200 in 2024, a nearly 20-fold increase. The limited exploration in the early years of 2014 is followed by an explosive growth phase in 2019 - 2024, with a deepening research focus. The number of publications stabilizes in 2023 and 2024 with more than 145 articles per year, demonstrating continued interest in the field. Universities and research institutes have emerged as major contributors to this field, reflecting the growing academic interest in the application of AI to information engineering. Given these trends, it is expected that this area will continue to grow as a central focus of AI research.

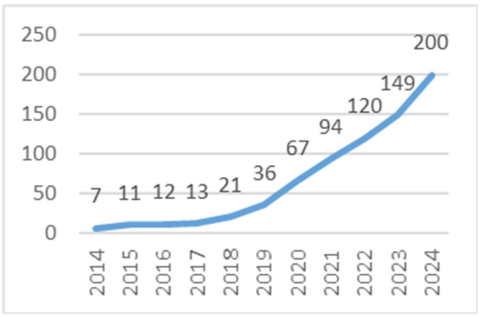

Figure 1: Distribution of publications from 2014 to 2024

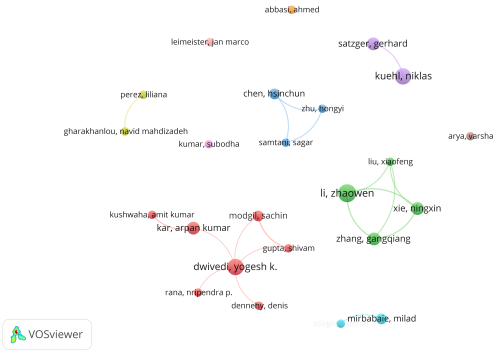

Figure 2: Co-authorship of authors

3.2 Bibliometric analysis of authors

The analysis of author collaborations allowed the identification of key scholars and core research groups in the field of AI applications in information engineering. Out of 2790 authors of 730 documents, 135 authors published more than 2 papers and 6 authors published more than 5 papers (see Table 1).

We generated an author collaboration map using VOSviewer to create an overlay visualization of authors with more than two publications (see Figure 2). In this map, core nodes represent authors who collaborate frequently, highlighting those authors who are particularly active and influential in the research network. Collaborative networks show a distribution of small groups, with authors typically working closely together in compact groups that share a particular research focus or interest. The intensity of collaboration within these groups is typically higher than that between groups, reflecting a trend towards professional academic collaboration and close team interaction. This pattern suggests that large-scale cross-group collaboration is still limited in this area of research.

3.3 Bibliometric analysis of organization

Analyzing academic institutions reveals collaborative networks, leading institutions, and research impacts, all of which foster academic collaboration and knowledge innovation. Of the 1303 contributing institutions, 63 have published more than four papers and seven have published more than seven papers. Using VOSviewer, we created a global map of academic collaborations (see Figure 3),

Table 1: The most important authors in the field of artificial intelligence applications in information engineering

Rank	Author	Documents	Citations	Average Citation
1	Li,Z.	8	226	22.60
2	Dwivedi,Y.K.	7	1623	231.86
3	Kuehl,N.	7	111	15.86
4	Kar,A.K.	5	402	80.40
5	Xie,N.	5	194	38.80
6	Zhang,G.	5	194	38.80

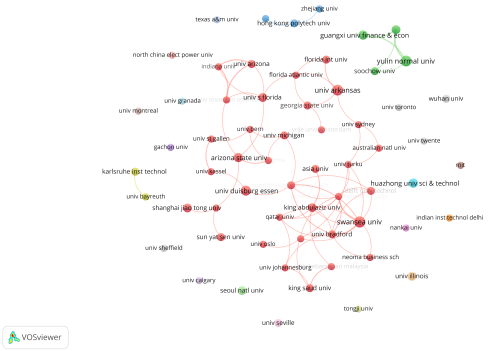

Figure 3: Co-occurrence of academic institution

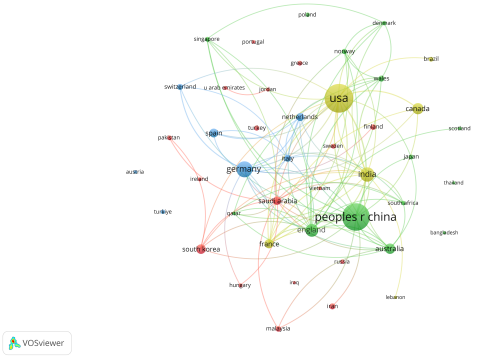

Figure 4: Co-occurrence of countries

showing the collaborations between countries. Prominent institutions such as the University of Arkansas, Swansea University, Universität Duisburg-Essen, and Yulin Normal University exhibit significant nodes and extensive connections, highlighting their influence in global collaborations.

The finding shows that the University of Arkansas has fostered academic collaborations with institutions such as King Abdulaziz University, NEOMA Business School, IT University Copenhagen, and the University of Auckland, generating valuable insights into how digital agents and reconfigurable assets can influence decision-making in information systems [6]. Meanwhile, Shanghai Jiao Tong University has pioneered the development of a novel analog-to-digital converter (ADC) architecture that leverages deep learning and photonics to significantly improve the speed, bandwidth and accuracy of ADC [7]. In addition, institutions with smaller networks, like Wuhan University, continue to exert significant regional influence. The collaboration map illustrates the intricate nature of global academic networks, highlights the importance of key institutions, and points to a growing trend of cross-regional and cross-disciplinary partnerships, providing strategic insights for future collaborative efforts.

3.4 Bibliometric analysis of countries

To identify the countries that contribute most significantly to the field of artificial intelligence applications in information engineering, this study analyzed the publication output of 80 countries. 45 countries published at least 5 papers and 10 countries published at least 28 papers. By using VOSviewer, we visualized the countries with 28 or more publications, as shown in Figure 4.

In Figure 4, larger circular nodes indicate countries with a higher number of publications, while connecting lines indicate the frequency of cooperation; a higher number of lines indicates stronger cooperation. The color of the nodes classifies countries into clusters known for frequent collaboration, including the United States, Canada, India, and France. The distribution of published papers is very uneven, with research concentrated in a few countries, notably China, the United States and Germany. Chinese scholars lead with 207 publications, or 28% of the total, but are still relatively poorly cited. The United States was second with 192 papers and 6239 citations. The United Kingdom has 51 papers with the highest average number of citations per paper at 88.63, indicating the high impact of each paper.

4 VISUAL ANALYSIS AND DISCUSSION

4.1 Co-occurrence analysis on keywords

Keywords are the basic elements of academic papers, summarizing the core research questions. By analyzing keyword co-occurrence, researchers can gain insights into research trends and hotspots in specific fields, revealing knowledge structure and research dynamics. We used VOSviewer to map the keyword density of 730 papers and selected keywords with a frequency of 15 or higher for visualization. To prevent certain high-frequency keywords, such as “artificial intelligence” and “information engineering”, from distorting the results, they were excluded from the co-occurrence analysis. In addition, we adjusted the node size in the visualization so that only the keyword label size indicates the frequency. The results are shown in Figure 5.

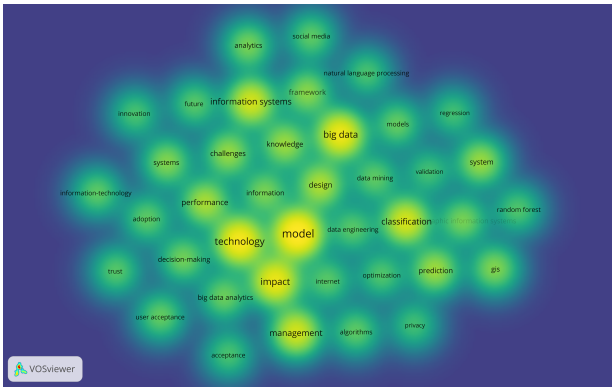

Figure 5: Map of keyword density

As shown in Figure 5, the keyword density map visualizes the research focus areas within the field. Higher brightness indicates higher keyword frequency, with terms such as “information systems,” “technology,” , “big data,” “modeling” and “impact” have become representative terms. To further elucidate the keyword details, we list the high-frequency keywords (more than 50 occurrences) in Table 2.

Figure 5 and Table 2 highlight core keywords such as ”design” and ”prediction,” reflecting AI’s role in information engineering. Choi, T. M., et al. addressed AI’s impact and human-machine conflicts in operations, proposing strategies for Industry 5.0 to balance human-machine roles and promote social welfare [8]. Zdravković, M., et al. introduced AI-enhanced services for optimizing manufacturing decisions, integrating industrial IoT, distributed systems, and cloud computing [9].

Keywords such as “deep learning” and “models” emphasize specific AI approaches in information engineering. Deep learning now plays a crucial role in big data analysis, which can help in areas such as mapping [10]. Terms such as “design”, “management” and “prediction” further represent areas of application of AI. Ostheimer, J., et al. developed a hybrid system for industrial operations, emphasizing human-AI trust [11]. Sun, Z., et al. created Geoweaver to streamline AI workflow management [12], while Lei, X., et al. introduced IISFI, a machine learning-based system for financial risk detection, including fraud [13].

4.2 Keyword emergence analysis

Highlighted keywords reflect terms that have seen a sudden increase in frequency of use over a specific period of time. They can often highlight hot research topics, emerging trends, or significant advances in the field. By analyzing salient keywords, researchers can identify influential topics that drive the development of related technologies, theories, and methods. In this study, we applied a burst detection algorithm [14] using CiteSpace software to cluster terms with sudden changes in frequency in titles, keywords, abstracts, and other identifiers in 730 selected English language documents from the Web of Science (Core Collection).

As shown in Figure 6, it can be found that since 2014, early keywords such as “data mining” and “algorithms” have exploded with scores of 3.32 and 3.12, respectively. however, their prominence faded away by 2017 and 2019 which suggests that basic research in these areas has matured. Similarly, “attribute reduction” and “rough sets” gained attention in 2015 and 2016. However, their attention weakened in 2019 and 2018, respectively. This trend reflects the fact that research on feature selection and rough set theory in dealing with information uncertainty and simplifying the structure of information data received more attention in a specific period of time, but the intensity of these research topics has declined over time.

Since 2017, the burst intensity of keywords such as “artificial intelligence learning,” and ”neural networks” has increased significantly, and “artificial intelligence learning,” in particular, has shown a very high level of activity. Meanwhile, keywords related to intelligent transportation and autonomous driving (e.g., driver information systems and road safety) also started to show high burst intensity in 2018, indicating that the research focus in this field is gradually shifting to more specific application scenarios, such as information fusion [15], driver behavior analysis, and road safety assessment.

In recent years, there has been continued growth in terms such as ”data privacy,” ”Internet of Things (IoT),” and ”data quality management.” Emerging keywords from 2020, including ”privacy protection,” ”data management strategies,” and ”community-based data applications,” reflect new directions. ”Internet of Things” has garnered attention, especially in smart homes, industrial automation, and smart cities since 2022.

All in all, keyword trends in Figure 6 suggest future research will likely focus on data processing, AI applications, security and privacy, and IoT development. These findings provide valuable insights for researchers.

Table 2: High-frequency keywords

Rank	Keywords	Frequency	Total Link Strength
1	information-systems	122	325
2	model	74	184
3	Deep learning	74	143
4	technology	61	201
5	artificial-intelligence	57	184
6	big data	55	189
7	impact	53	168

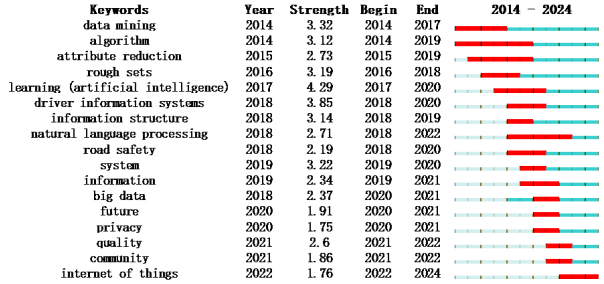

Figure 6: Temporal Distribution Map of Prominent Keywords

5 Conclusion

The application of artificial intelligence in information engineering is a multidisciplinary cross research field, which integrates the knowledge and methods of many disciplines such as information technology, computer science and engineering. With the rapid development of big data and artificial intelligence technology, this field has become a global research hotspot, which has a profound impact on social and economic development and scientific and technological innovation. In this study, a bibliometric analysis methodology, combined with VOSviewer and CiteSpace software tools, was used to systematically analyze the research literature on the application of AI in information engineering globally, including core authors in the authors' research areas, high-yield national institutions, and keywords, between 2014 and 2024. This combination of methods and tools provides a scientific and reliable analytical framework that reveals research trends and academic collaboration networks in a quantitative manner. The conclusions obtained are presented below:

(1) A number of stable collaborative networks have been formed in the field. These collaborative groups exist in small groups, and some of the best teams have contributed to the development of the discipline.

(2) The high percentage of papers published by authors from a few countries in this field may reflect the relative concentration of scientific resources and the strong research capacity of these countries in this field. At the same time, these countries may provide abundant research funding and policy support, thus encouraging researchers to conduct research and publish results. This phenomenon reveals an imbalance in the global allocation of research resources.

(3) In the past decade, the research breadth and depth of this field have been greatly expanded, the research hotspots have been updated and iterated rapidly, the technical application scenarios have become more and more specific, and the data privacy issue has begun to receive attention.

These findings are important for understanding the development of AI application areas in information engineering. They not only reveal hotspots and trends in research, but also provide guidance for future research directions, emphasize the importance of interdisciplinary collaboration, and point to the need for technology integration and application scenario expansion. The study also points out the ethical issues in the process of data collection and application, which is an emerging concern in the field. As the application of AI technology becomes more and more widespread, how to ensure the security and privacy of data and how to rationally utilize the data have become issues that cannot be ignored in research and practice. The conclusion of this study provide a solid foundation for subsequent researchers to help them quickly grasp the core content and overall framework of the field. By deeply analyzing the limitations and challenges of existing research, this study points out the direction for future research, especially in the areas of interdisciplinary cooperation, application scenario expansion, and research quality improvement. These findings will help promote the continuous innovation and development of AI technology in the field of information engineering.

References

[1] An, S. (2021, September). Application of Artificial Intelligence Technology in Electronic Information Engineering. In Journal of Physics: Conference Series (Vol. 2037, No. 1, p. 012108). IOP Publishing.
[2] Salinas-Ríos, K. (2022). Bibliometrics, a useful tool within the field of research. Journal of Basic and Applied Psychology Research, 3(6), 9-16.
[3] Ding, X., & Yang, Z. (2022). Knowledge mapping of platform research: a visual analysis using VOSviewer and CiteSpace. Electronic Commerce Research, 1-23.
[4] Carvalho, M. M., Fleury, A., & Lopes, A. P. (2013). An overview of the literature on technology roadmapping (TRM): Contributions and trends. *Technological Forecasting and Social Change*, *80*(7), 1418-1437.
[5] Jassim, M. A., & Abdulwahid, S. N. (2021, March). Data mining preparation: process, techniques and major issues in data analysis. In IOP conference series: materials science and engineering (Vol. 1090, No. 1, p. 012053). IOP Publishing.
[6] Krancher, O., Sabherwal, R., Oshri, I., & Kotlarsky, J. (2024). Digital sourcing: A discussion of agential, semiotic, infrastructural, combinatorial, and economic shifts. Journal of Information Technology, 02683962241260841.
[7] Xu, S., Zou, X., Ma, B., Chen, J., Yu, L., & Zou, W. (2019). Deep-learning-powered photonic analog-to-digital conversion. Light: Science & Applications, 8(1), 66.
[8] Choi, T. M., Kumar, S., Yue, X., & Chan, H. L. (2022). Disruptive technologies and operations management in the Industry 4.0 era and beyond. Production and Operations Management, 31(1), 9-31.
[9] Zdravković, M., Panetto, H., & Weichhart, G. (2022). AI-enabled enterprise information systems for manufacturing. Enterprise Information Systems, 16(4), 668-720.
[10] Kang, Y., Gao, S., & Roth, R. E. (2024). Artificial intelligence studies in cartography: a review and synthesis of methods, applications, and ethics. Cartography and Geographic Information Science, 1-32.
[11] Ostheimer, J., Chowdhury, S., & Iqbal, S. (2021). An alliance of humans and machines for machine learning: Hybrid intelligent systems and their design principles. Technology in Society, 66, 101647.
[12] Sun, Z., Di, L., Burgess, A., Tullis, J. A., & Magill, A. B. (2020). Geoweaver: Advanced cyberinfrastructure for managing hybrid geoscientific AI workflows. ISPRS International Journal of Geo-Information, 9(2), 119.
[13] Lei, X., Mohamad, U. H., Sarlan, A., Shutaywi, M., Daradkeh, Y. I., & Mohammed, H. O. (2022). Development of an intelligent information system for financial analysis depend on supervised machine learning algorithms. Information Processing & Management, 59(5), 103036.
[14] Zhang, X., & Shasha, D. (2006, April). Better burst detection. In 22nd International Conference on Data Engineering (ICDE'06) (pp. 146-146). IEEE.
[15] Zeng, Y., Liao, B., Li, Z., Hua, C., & Li, S. (2024). A comprehensive review of recent advances on intelligence algorithms and information engineering applications. IEEE Access.