AsPac J. Mol. Biol. Biotechnol. 2024
Vol. 32 (2) : 84-97

Review and bibliometric analysis of AI-driven advancements in healthcare

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Received 24th November 2023 / Accepted 3rd March 2024 / Published 16th April 2024

Abstract. Purpose: This research intends to use literature review and bibliometric analysis methods to visually review the development status and important historical milestones of Artificial Intelligence, as well as the basic research, key topics, and future potential research hot spots of AI in the healthcare field. **Methodology:** Conduct in-depth analysis of AI in healthcare through bibliometrics methods such as publication activity analysis, co-occurrence analysis, and co-authorship analysis. **Findings:** This study outlines the development time trajectory of AI technology and its application in healthcare. Research shows that "algorithm", "machine learning", "deep learning", "controlled study", "major clinical study" and "healthcare delivery" as well as "decision support systems" are key topics for research. Gender-related research and ethical issues are areas of future focus. **Research implications:** The practical significance is that it can clarify and optimize the key directions of AI to improve the quality of medical decision-making, improve diagnostic accuracy and guide market investment. The originality is reflected in the comprehensive analysis of the development trajectory of AI in the medical and health field. Through a unique perspective and systematic approach, it provides an important reference for research trends and future directions in the field.

Keywords: artificial intelligence, bibliometric analysis, healthcare, review, visualization

INTRODUCTION

With the deepening of research and development, AI has expanded from its initial pattern recognition to include machine learning, computer vision, natural language processing, computer hearing, robotics and other subfields (Abioye *et al.*, 2021; Dunjko & Briegel, 2018). Through the comprehensive application and continuous optimization of these technologies, AI is working hard to give machines vision, hearing, and problem-solving abilities similar to humans (Zhang & Lu, 2021). The application of artificial intelligence has become more widespread in recent years, ranging from manufacturing, education, finance and even healthcare. It is worth mentioning that the application of AI in healthcare is rapidly transforming and innovating the traditional healthcare field. Due to the emergence of new healthcare trends such as m-health, e-health and telemedicine, the application of AI not only solves the shortcomings of the shortage of professionals and the high cost of training talents, but also promotes and improves the accuracy of diagnosis and treatment as well as decision-making (Kampmeijer *et al.*, 2016). It also provides a lot of convenience and support for medical electronics and clinical records (Payrovnaziri *et al.*, 2020; Sheu *et al.*, 2023).

Although the application of AI in healthcare has received widespread attention and discussion, comprehensive and systematic analysis to examine its multi-dimensional impact in the healthcare field is still scarce. At this stage, most

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academic research focuses on the development and application of AI technology(Dwivedi *et al.*, 2021; Zhang & Aslan, 2021). There are relatively few comprehensive studies on its long-term impact and sustainability, especially the lack of comprehensive visualization of current research trends on the topic, such as the long-term benefits of AI in healthcare, ethical and privacy issues, potential data security issues. (Guo *et al.*, 2020). Given the importance of artificial intelligence and the lack of research integrating existing literature related to health care applications of these technologies, this study aimed to fill this research gap by performing a systematic visual review of the existing literature. Through detailed bibliometric analysis, it aims to comprehensively sort out and analyse the multi-dimensional application and impact of AI in healthcare. This research will review the historical development of AI and provide a preliminary description of the current situation and theoretical development in the medical field. Following that, this study will conduct a comprehensive overview and visual analysis of existing relevant academic research based on bibliometrics analysis, such as co-occurrence analysis, keyword analysis, co-authorship analysis and so on. It is intended to identify the themes and foundations of the academic field of artificial intelligence application in healthcare research, and provide an academic research framework and visual reference for future research.

The concept of AI

With the development of AI and its outstanding performance in various industries, economic entities such as citizens, enterprises and governments have gradually reached a clear consensus on the importance of today's intelligent machines with the ability to learn, reason and adapt. AI has gradually become a social an important part of development (Arrieta *et al.*, 2020). There is no universally accepted definition of artificial intelligence, and various industries and scholars have different understandings of it (Duan *et al.*, 2019). Initially, AI was usually considered to be an intelligent machine that can perform or simulate human behaviour by relying on algorithms or computers, including but not limited to problem solving, knowledge representation, and machine learning (Duan *et al.*, 2019). It is worth mentioning that machine learning (ML) can not only explicitly program machines to perform certain tasks, but can also perform self-learning and gradually improved algorithms through data to perform specific tasks. For example, ML can range from simple data classification to complex image and language recognition and imitation. As black-box machine learning (ML) models are increasingly used to make important predictions in critical environments, there is an increasing demand for transparency from various stakeholders in the AI field (Arrieta *et al.*, 2020).

The origins of AI can be traced back to the practical test of computer intelligence introduced by Turing (1950) to solve whether a machine can think. At the Dartmouth Conference in 1956, the concept of artificial intelligence was officially named (McCarthy *et al.*, 2006). It is defined as new technologies that research, analyse, develop, and use theories, methods, technologies, and application systems to simulate, extend and expand human intelligence (Hamet & Tremblay, 2017; McCarthy & Hayes, 1981; McCarthy *et al.*, 2006). Beginning in the 1960s, preliminary exploration of AI began. For example, Rosenblatt (1967) created Perceptron, the first binary linear classifier. This laid the foundation for multilayer neural networks and deep learning that later could handle nonlinear problems (Olazaran, 1993). However, the initial perceptron model can only handle linearly separable data (Minsky & Papert, 1969). Due to certain reasons, such as excessive expectations, technical bottlenecks and so on, the development of artificial intelligence has slowed down and investment in R&D funds has decreased, which has led to the development of AI entering a cold winter period (Duan *et al.*, 2019; Nilsson, 1991). To be more specific, during the period of the 1970s, under the macroeconomic background of economic recession, investment in research funds decreased significantly, and the market's disappointment after excessive expectations directly had a negative effect on the confidence of investors and researchers. In the absence of insufficient R&D funds, specific obstacles encountered in technological development cannot be effectively broken through and solved in the short term, such as algorithm complexity, computing power limitations, or data processing problems. These

factors have caused AI to enter a short development winter period.

It was not until the 1980s that expert decision-making systems based on rules that could simulate specific fields and be marketed emerged, which proved the commercial value of AI. Machine learning methods also emerged during this period, especially technologies such as support vector machines and decision trees, neural networks and Bayesian networks, which accelerated and laid the foundation for the development and maturity of AI (Duan *et al*., 2019) Following that, in the 2000s, the computing power of algorithms was gradually strengthened, data mining and predictive modelling also began to make significant practical contributions in various industries, and Neural Networks also received great attention during this period (Duan *et al*., 2019). In 2011, IBM Watson won Jeopardy, an important milestone in the field of artificial intelligence. This means that AI has huge technological development space in natural language, data mining and analysis and prediction, and illustrates its potential market value. In addition, Baidu's Minwa supercomputer in 2015 used convolutional neural networks (CNN) to process image data, and its performance was significantly better than that of ordinary people (Zhang *et al*., 2019). What's more, in 2016, AlphaGo invented by DeepMind beat the Go master Lee Sedol (Binder, 2022). These examples intuitively verify the excellent capabilities of AI, especially in image recognition and game strategy. There have been notable successes in everything from image and speech recognition to natural language processing and augmented reality and even gaming strategy.

With the advancement of deep learning and massive data sets, it is worth mentioning that ChatGPT based on GPT (Generative Pre-trained Transformer) developed by OpenAI in 2023 has been rapidly integrated into people's daily life (Dwivedi *et al*., 2023). Such large language models are even capable of conducting natural, coherent conversations with users. It can be said that with the continuous advancement of electronic speed, capacity and algorithmic computing, artificial intelligence may one day be as smart as humans, or even surpass humans in completing corresponding tasks (Hamet & Tremblay, 2017). This also means that it is crucial to grasp the current development status and future technology trends of AI. Based on the above literature review, to intuitively visualize the development history of AI, this study summarized the AI timeline (Figure 1).

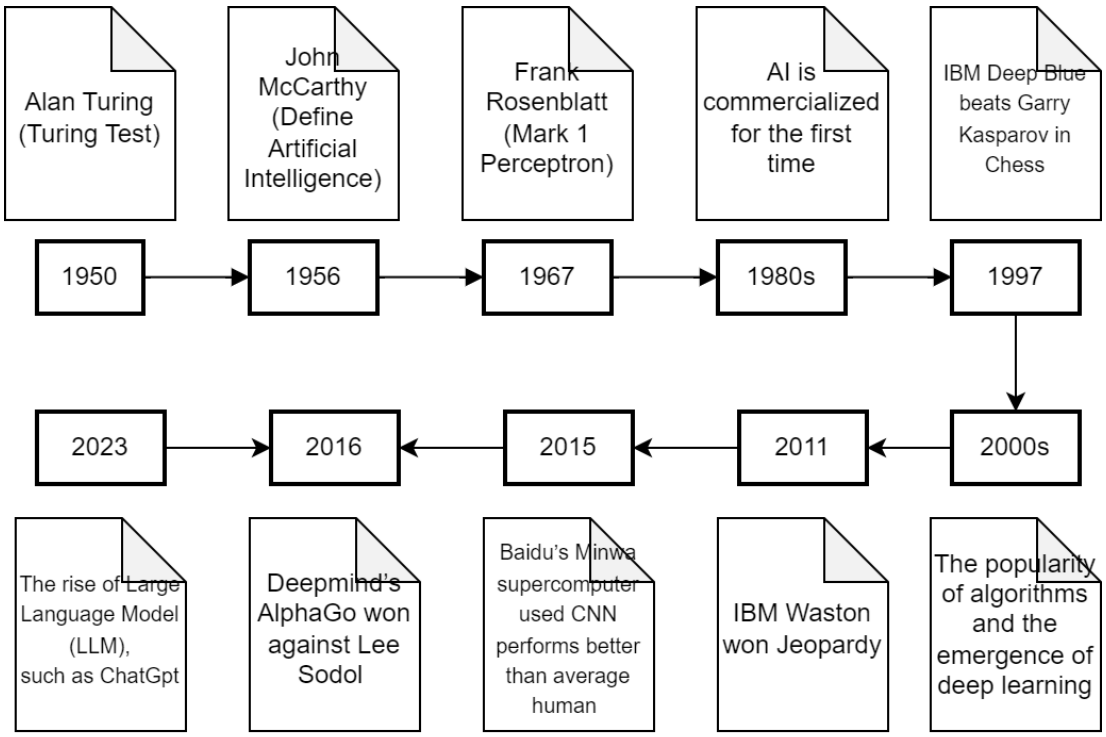

Figure 1. The development timeline of AI

AI in healthcare

According to Figure 1, this study intuitively and clearly reviews the development route of AI and the significant results brought about by the integration of various industries. To a certain extent, it can be concluded that the adoption and application of artificial intelligence (AI) can give traditional industries bring technological innovation and development, which also improve social welfare. For example, in the healthcare field, artificial intelligence has been applied to assist medical decision-making as early as the 1980s, improving medical efficiency and social benefits (Cowls *et al.*, 2021).

With the emergence and improvement of algorithmic computing power and big data technology, file management, medical imaging diagnosis, genomics, drug research and development, disease prediction and patient care have all been qualitatively improved (Taglang & Jackson, 2016). Hamet and Tremblay (2017) summarized the main applications of artificial intelligence in healthcare, represented by virtual components such as machine learning, which are specifically embodied and adopted in clinical data recording and tracking of electronic medical records, wearable devices and sensors, and virtual robots participate in therapy and interactions. These applications help track medical data in real time, improve the efficiency of medical decision-making, save medical care costs and so on. At the same time, the advancement of medical equipment and the introduction of physical robots are also important innovations in healthcare (Hamet & Tremblay, 2017). To be more specific, especially in radiological image recognition, the clarity and accuracy of imaging are improved (Mese *et al.*, 2023). This means that the adoption of AI has significantly improved the precision and accuracy of data and diagnosis, helped reduce misdiagnosis, and even played a crucial role in early monitoring, diagnosis, and prediction of certain diseases. For example, Convolutional Neural Network (CNN) can realize image layering and detect local features in images, providing strong support for tumor monitoring, identification, diagnosis and prediction in the radiology department (Mahmood *et al.*, 2022). In addition to the innovation of medical technology and the optimization of patient treatment experience, AI has also provided substantial help to the management and operation of hospitals and even healthcare systems. For example, these technologies can effectively monitor and predict the flow of patients, supervise and manage pharmaceutical inventory, shelf life and supply chain data, greatly saving inventory management costs and improving operational efficiency (Bhakoo *et al.*, 2012). Not only that, AI can break the inequality among regional medical resources through technologies such as remote diagnosis and virtual health assistants, which can help solve problems such as medical development and settlement in remote areas and the scarcity of medical staff.

Based on the existing academic background and industry status, it can be concluded that the recognition and understanding of artificial intelligence by all sectors of society is no longer limited to just a tool or technology. The integration of AI and various fields, especially its adoption and application in healthcare, has created a new system and management paradigm. Further research is still needed on the specific definition and more systematic review of artificial intelligence in the field of healthcare. This will also help determine the themes and foundations of the academic field of artificial intelligence application in healthcare research, and provide an academic research framework for future research, a visual reference for industry development and market investment.

MATERIALS AND METHODS

Choosing the techniques for analysis

In order to have a more systematic and comprehensive understanding of the development trend, research status and impact of AI in healthcare, this study uses bibliometric analysis, specifically using Vos viewer and other tools to analyse the bibliometric and literature graphic information of AI in the healthcare field, and provide visual analysis and review (Goodell *et al.*, 2021). In addition, bibliometric analysis can also identify the publication trends of academic articles on AI in healthcare through methods such as co-citation analysis, bibliographic coupling, and co-occurrence (or co-word) analysis, to identify

key topics and establish topic evolution (Mukherjee *et al*., 2022). To be more specific, each refined analysis method in bibliometric analysis provides corresponding visual reference from different dimensions. For example, co-occurrence analysis can quickly identify key topics and high-frequency keywords of AI in the healthcare field. Identifying these key concepts can better analyse their relationships and development trends (Bhakoo *et al*., 2012). Secondly, co-authorship can reveal the cooperation network between academic research and the current status of academic research in various countries, thereby better understanding and analysing the history and evolution in theoretical development (Merigó *et al*., 2016).

Data collection

Based on the research purpose and research design, to conduct an in-depth bibliometric analysis of artificial intelligence research in the healthcare field, this study selected Scopus as the data source of text data. This is because Scopus is one of the commonly used academic databases in the academic world (Baas *et al*., 2020). It covers many documents from multiple disciplines, languages, and countries, which shows that the database has a wide coverage. Secondly, the data in the Scopus database is updated quickly, the user interface is simple, and it can be associated with Vosviewer (Rose & Kitchin, 2019). This will help this research collect the latest and more comprehensive data, and conduct quick and convenient document export and various analysis of citation trends, cooperation networks and so on. Although Scopus has strong academic advantages, no single database can completely cover all literature, especially considering that research on artificial intelligence in health care is growing rapidly worldwide. However, after weighing the advantages and disadvantages of multiple databases, Scopus's comprehensiveness and ease of use made it the preferred data source for this study. The data collection process for healthcare research also adheres to additional ethical principles, including obtaining consent, ensuring privacy protection and data security measures, etc. Due to the openness of the data in the Scopus database and the fact that the research methods relied on secondary data, individual patient data are usually not involved. This study will still emphasize that no patient personal information is used or exposed during the data collection process. Meanwhile, the data collected have a certain degree of integrity, and the openness and availability of these data are widely accepted within the academic community. The specific search, screening and collection steps are as follows.

The first step is to search the Scopus database using the following keywords "artificial intelligence", "AI", and "healthcare". These keywords accurately target the literature related to AI, and at the same time ensure the limitation in the field of healthcare, which is fully consistent with the research theme and research objectives. The second step is to further screen during the process of selecting literature data. Initially, 14,217 documents related to the search terms were obtained. Due to the large number of documents, in order to conduct accurate analysis, this study only selected relevant and highly reliable English journal articles, a total of 5,242 articles. Among the existing articles, the screening time is all documents as of October 2023. Since some journals have accepted but have not officially published them and are still in article in press status, after excluding them, 4,955 articles remain. Next, to accurately analyze the literature related to the AI topic, the key words were limited to the word "artificial intelligence", articles not directly related to the topic were excluded, and duplicate articles were deleted to obtain the remaining 3,162 documents. Since the sample size is relatively large and the documents in 2023 are still in the process, the time for document selection was finally ended in 2022, and a final 2,396 documents were obtained as the data set. The third step is to extract and export the filtered 2,396 literature data into CSV format. For visual research, the exported data items include title, author, publication year, affiliations, abstract and other information.

RESULTS

Publication activity of AI in healthcare

With the integration of artificial intelligence (AI) and new healthcare systems, its application and research in this field have attracted great attention.

As of October 2023, there are a total of 14,217 documents related to AI in healthcare in Scopus. The specific distribution of paper publications per year is shown in appendix Figure 2.

According to Figure 2, the research on AI in health care research can be traced back to 1985. With the innovation and transformation of healthcare such as m-healthcare, e-healthcare, and telemedicine, from 2015 to 2022, the overall related literature on artificial intelligence in the health care field has shown a rapid growth trend, especially in the past five years. The number of publications has increased significantly in 2020, with 1,401 articles published, rising to 2,380 articles in 2021, and continuing to rise to 3,325 articles in 2022. Although 2023 is not over yet, according to the data, it can be predicted that this upward trend will continue in 2023 and 2024.This significant growth trend may represent that AI in healthcare has gradually entered the public and academic field of vision, and indicates that it has huge industry development potential and commercial value in the future.

The main distribution of existing literature on AI in the healthcare field is shown in Figure 3, which mainly includes journal articles (37.0%), conference papers (32.4%), reviews (12.6%), book chapters (10.6%) and so on. It is worth mentioning that conference papers and academic articles account for most of the literature, accounting for approximately 37% and 32.4% respectively. This reflects the dynamic and timely nature of research in the AI and healthcare fields. To explain specifically, conference papers usually bring together the latest research directions and topics in academia, but sometimes they are extended abstracts rather than mature research. While academic journal articles intuitively feedback relatively highly relevant and highly reliable research progress. For this reason, although there have been tens of thousands of relevant publications so far, 2,396 formal highly relevant journal academic articles were screened out according to the search criteria in Table 1. These data will be used for further bibliometrics analyses.

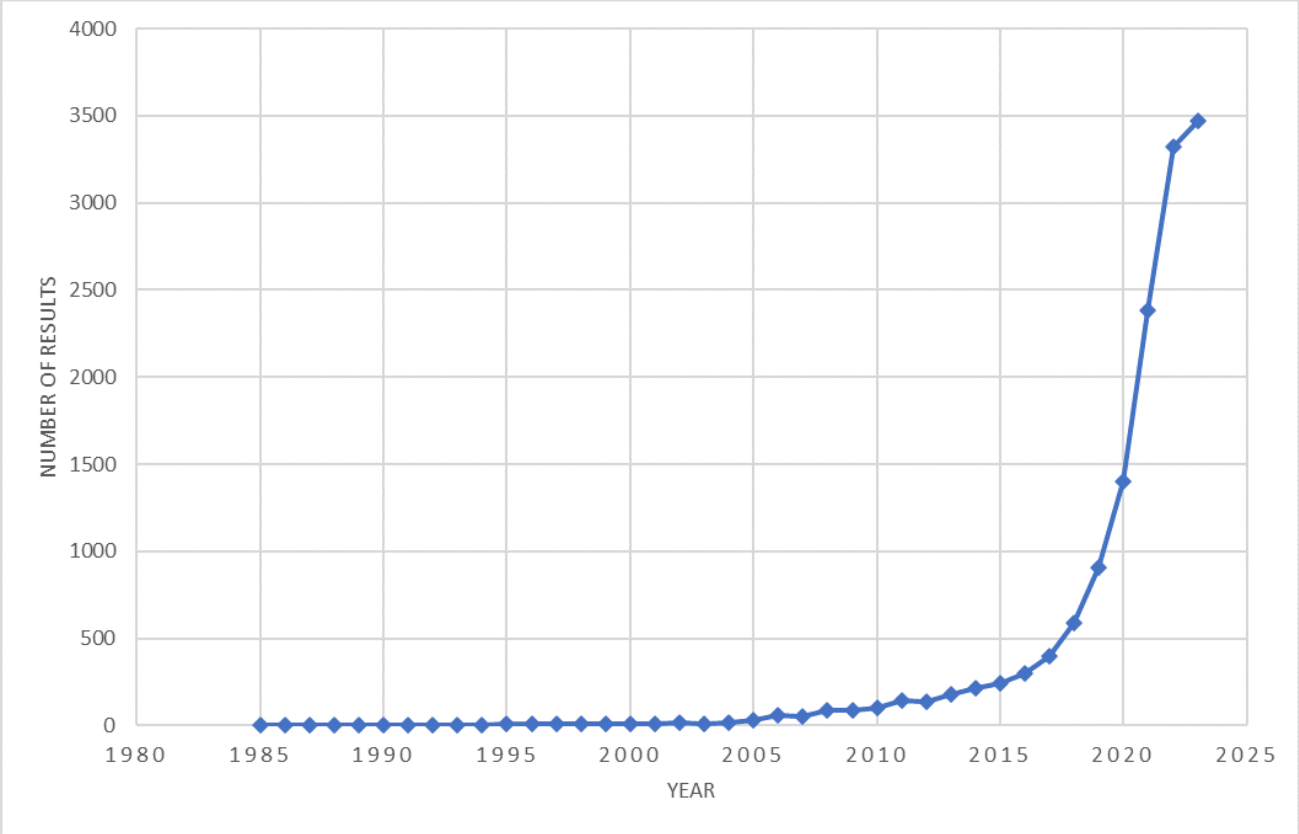

Figure 2. Annual publication results of AI research in healthcare (1985-2023)

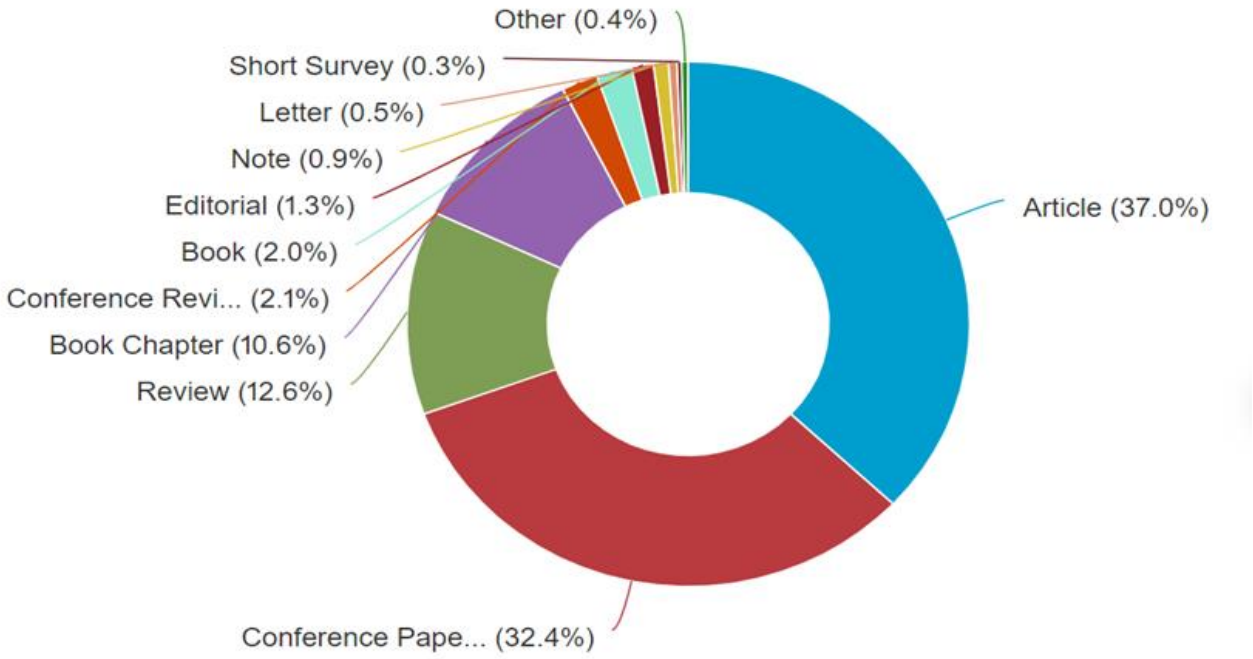

Figure 3. The documents classified by type for AI in healthcare

Bibliometrics results

This study conducted co-occurrence analysis based on existing text data, and performed visual mapping by identifying the associations between different items in the text or high-frequency words, aiming to quickly identify and visualize research trends, hot topics, and potential relationships in the text data. The co-occurrence graph based on text data is shown in Figure 4.

According to the co-occurrence map, existing AI research in the healthcare field mainly comes from three basic clusters, namely technology (red nodes), models and algorithms (green nodes), internet and network (blue nodes). This shows that part of the research is focused on improving the adoption and acceptance of technology, perception and patient attitudes, part is focused on improving the diagnosis, performance, reliability, and validity of the technology itself and so on, and part is dedicated to strengthening device interconnection with other technologies, such as cloud computing, Internet of Things, blockchain, big data. By counting the number of times keywords co-occurrence in text data, the close relationship between keywords is intuitively displayed (Merigó *et al.*, 2016). Each keyword is represented by a node, and the thickness of the lines connecting the nodes also represents the frequency with which they appear together (Merigó *et al.*, 2016). Among them, support vector machine (occurrence:75; relevance:4.28), logistic regression (occurrence:49; relevance:3.70), convolution neural network (occurrence:68; relevance:3.65), decision tree (occurrence:48; relevance:3.21), sensitivity (occurrence:164; relevance:3.09), and other key topics have significant high frequency and strong correlation. These co-occurrence results provide a visual review of AI in healthcare to a certain extent and reveals the development trends, research hot spots and basic research clustering in the research field. Meanwhile, it also reveals market directions that may have high economic value and investment potential for investors.

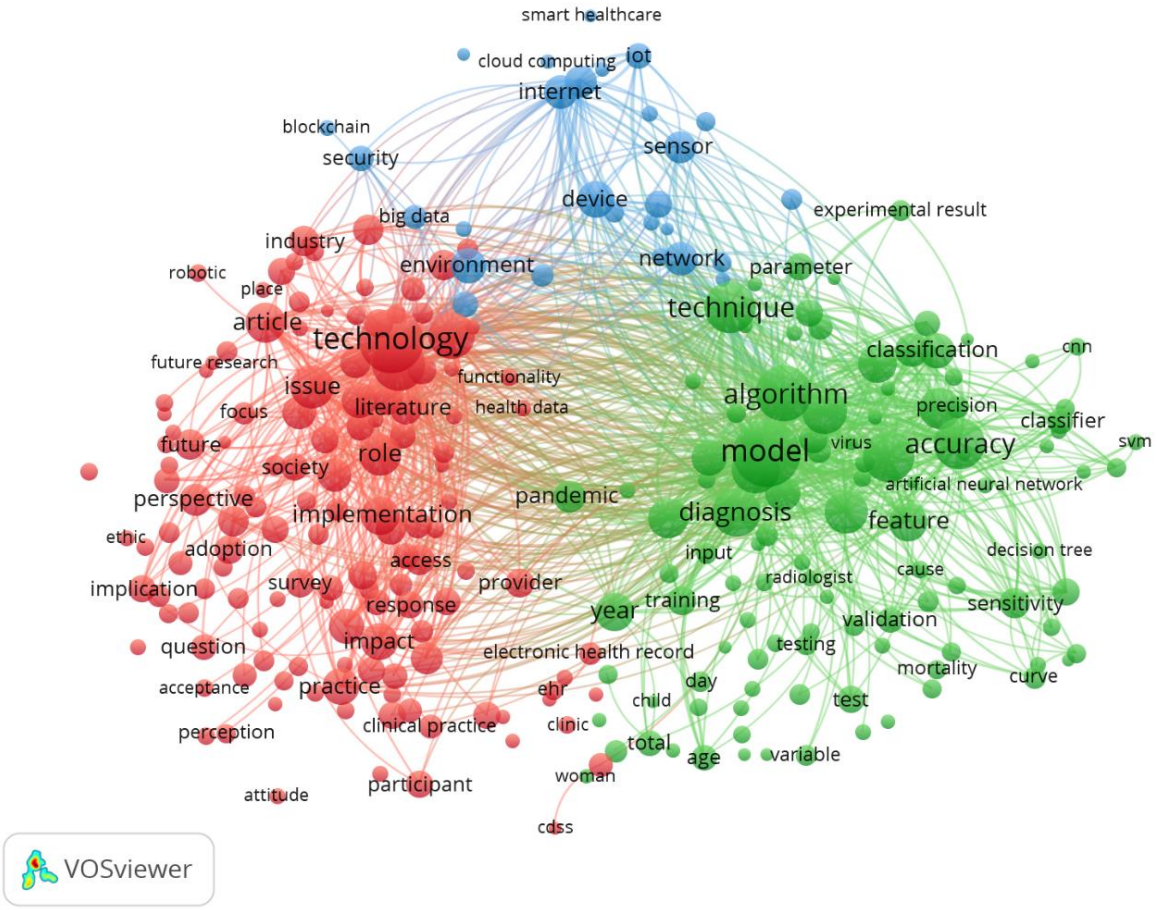

Figure 4. Co-occurrence map based on text data for AI in healthcare

To have a deeper understanding and review of AI in the healthcare, this study next conducted a keyword co-occurrence analysis. Using the collected literature data, we extracted keywords for each article and constructed a co-occurrence matrix to identify pairs of keywords that often co-occur. This reveals not only the core concepts of the study but also the intrinsic relationships between these concepts (Gu *et al.*, 2020). According to Figure 5 and Table 1, the co-occurrence frequency of keywords "algorithm", "machine learning", "deep learning", "controlled study", "major clinical study" and "healthcare delivery" as well as "decision support systems" is gradually increasing, among which "deep learning" "algorithm" and "machine learning" have been analysed. These are three core keywords that are crucial in the development timeline of AI technology. In addition, the co-occurrence of "female" (number of occurrences: 362, total link strength: 9225) and "male" (number of occurrences: 329, total link strength: 8620) is also quite high. This suggests that future AI technology research may need to further examine the impact of customer attitudes of different genders on AI, as well as the motivations of patients and medical staff of different genders to adopt AI in healthcare. Not only that, the occurrence of "human" and "humans" is also as high as 1347 and 990, which shows that the relationship between AI and humans and the ethical issues that may be faced in the future are undergoing intense academic controversy and exploration. What's more, "healthcare delivery" and "decision support systems" are emerging keywords, which reflects that with the widespread application of AI technology in the medical field, how to ensure remote delivery and participation in supporting decision-making has become a key issue.

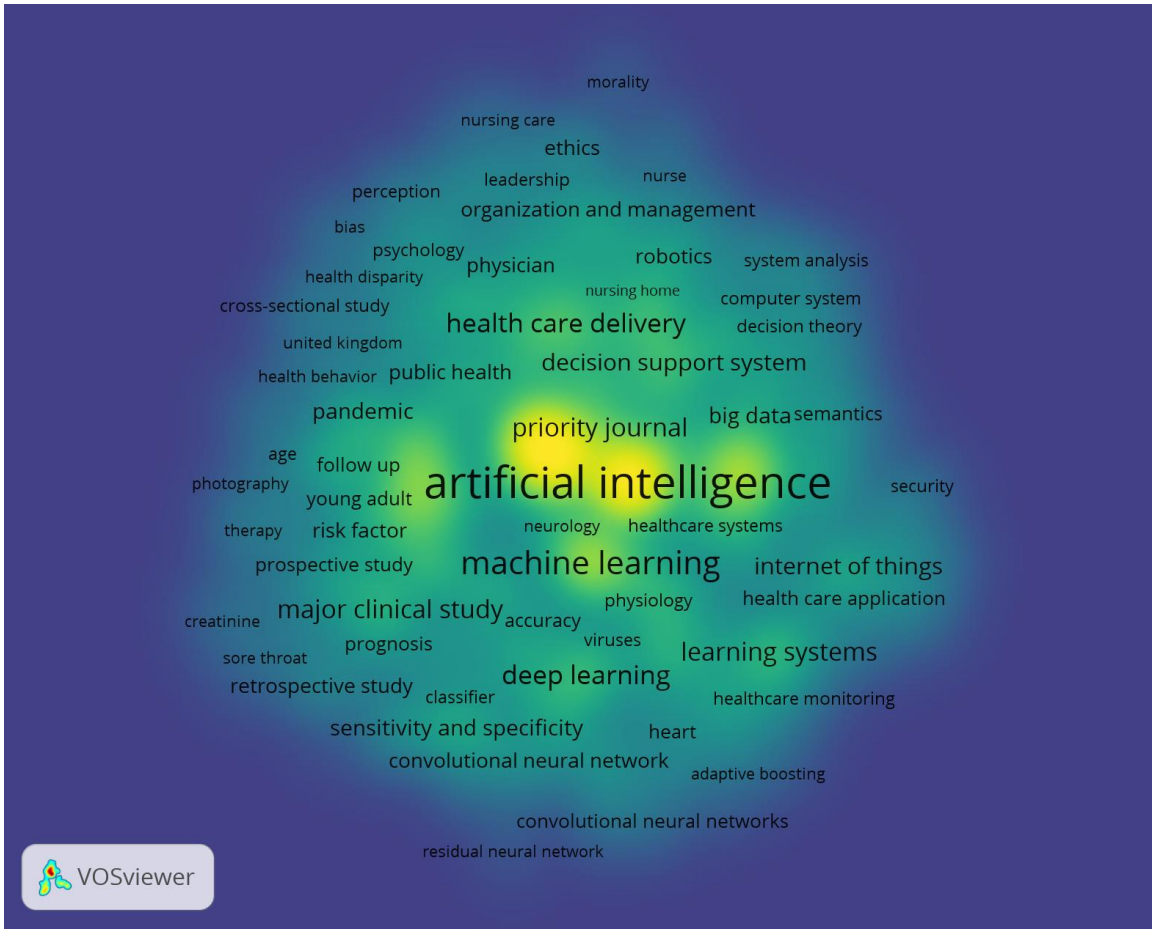

Figure 5. Co-occurrence (all key words) for AI in healthcare

Table 1. Co-occurrence (all key words) results

Item	Cluster	Links	Occurrences	Total link strength
artificial intelligence	3	999	2396	33365
human	1	999	1347	26357
article	1	993	1162	24389
humans	1	998	990	20142
machine learning	3	977	694	11792
female	2	932	362	9225
health care	3	958	574	9180
male	2	927	329	8620
adult	2	895	373	8613
algorithm	5	926	307	6859
controlled study	2	885	253	6307
priority journal	4	912	242	6270
major clinical study	2	810	227	6169
healthcare delivery	1	862	312	5562
deep learning	5	802	315	5257
procedures	5	855	201	4880
algorithms	5	834	223	4837
decision support systems	4	722	253	4540

Following that, this study extracted the author information and their country of origin from the collected documents, and further analysed the cooperation network relationship between authors, institutions, and countries, as shown in Figure 6 below. In the co-authorship (country) analysis, the nodes represent the country, the node size represents the number of publications in the country, and different colours represent the average publication time to reveal the main contributors and collaboration networks in the research field. According to Figure 7 and Table 2, highly relevant articles come from multiple countries and regions, including developed countries such as the United States and the United Kingdom, and developing countries represented by China and India, indicating that the research on AI in healthcare has global characteristics. Among them, the United States (685 articles) and India (307 articles), the UK (295 articles) and China (232 articles) have relatively high research output, which demonstrates these countries are in a leading position in research in the field of AI and finance. Secondly, in addition to technologically advanced countries, some emerging markets and developing countries, such as Saudi Arabia and Pakistan, are also active in this field.

It can be seen from the timeline of research and development that the United States was one of the first countries to start. Following that, India, China, Australia, and other countries also rapidly developed and researched AI in healthcare. Especially in recent years, Vietnam, Saudi Arabia, and other countries have also begun to carry out research. related academic research and scientific research investment. It is worth mentioning that there are 685 related studies in the United States, cited 21,170 times. This shows that the United States dominates research in this field, and reflects that the U.S. medical industry and AI technology are relatively developed. In addition to the dominant position in academic research in the United States itself, the frequency of cooperation with other countries is also high. In particular, the cooperation with Canada, the United Kingdom and India is very close, which may be related to the research strength, language advantages, economic cooperation, and long-term academic relations of these countries. At the same time, European countries, the United Kingdom, Germany, Italy and other countries also have very close regional cooperation relationships, which benefits from the location advantages of regional development. Based on co-authorship analysis, future academic cooperation between other regions can be predicted, and academic exchanges at the national and national levels will further strengthen ties.

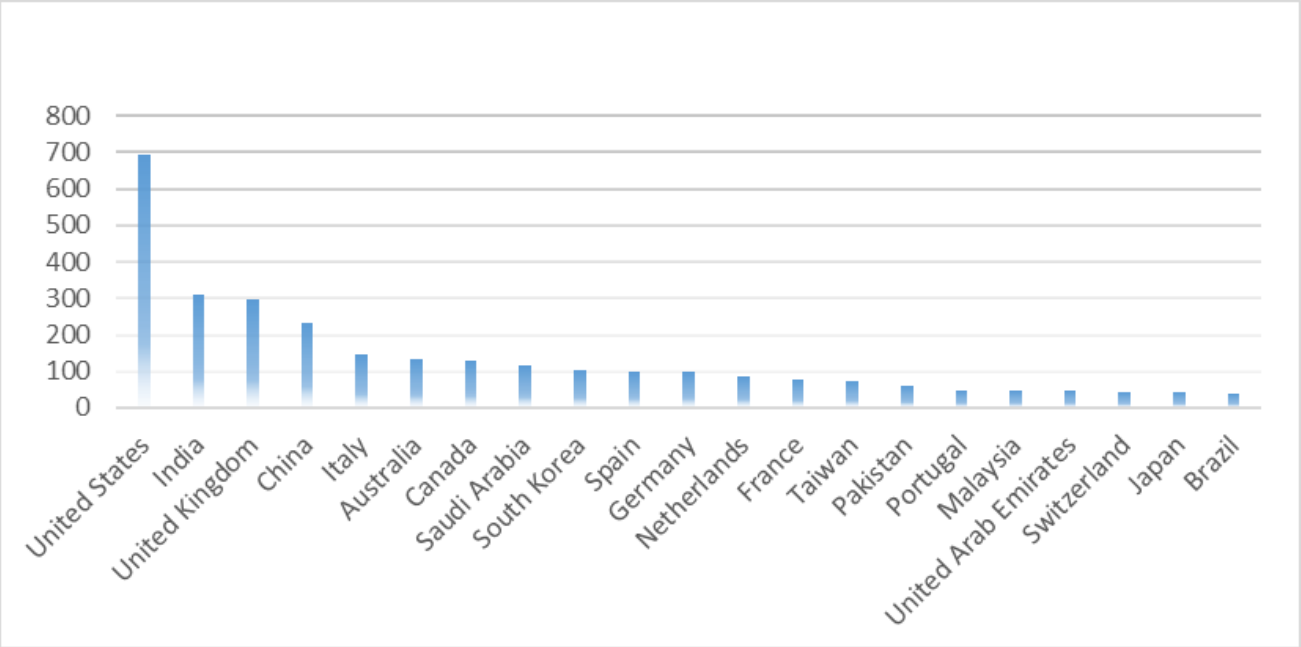

Figure 6. Documents by main country or territory

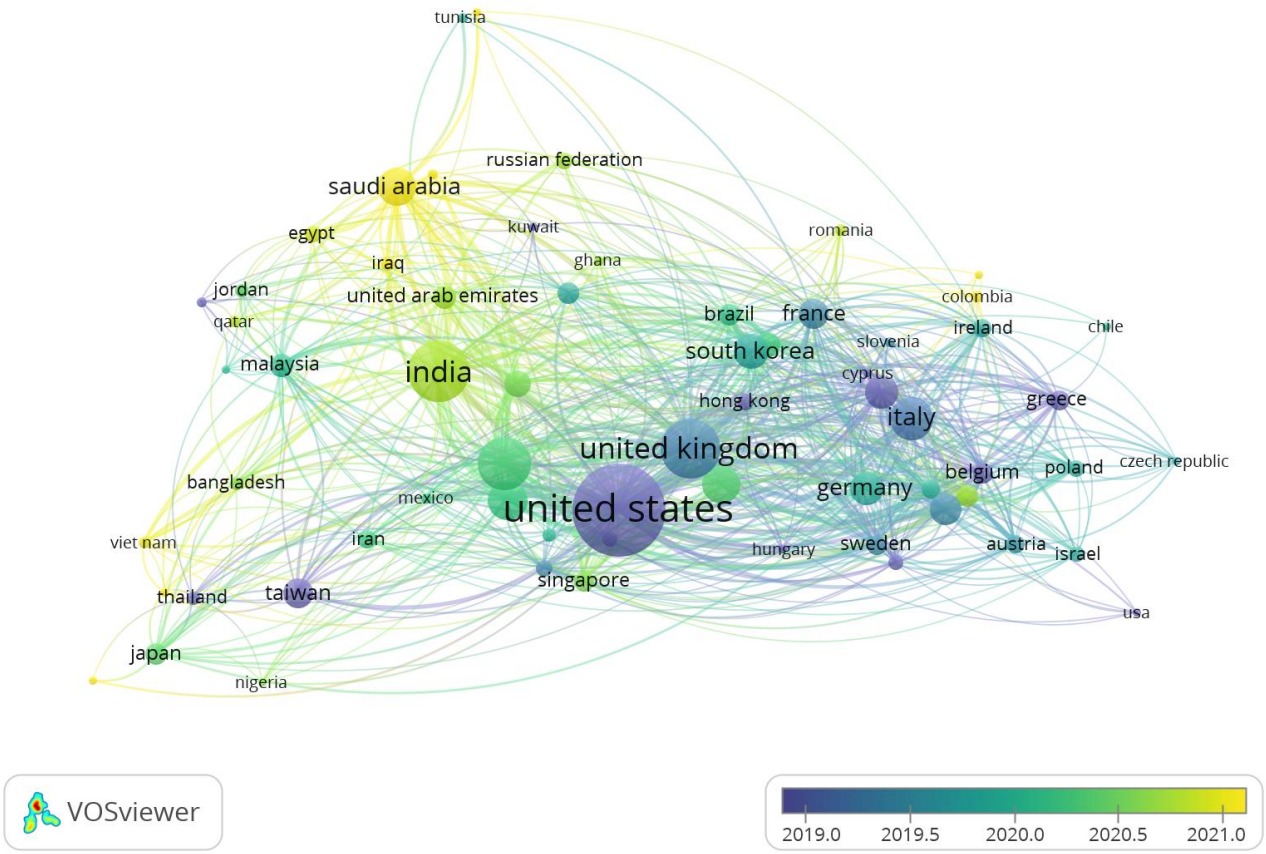

Figure 7. Co-authorship (country) analysis map

Table 2. Co-authorship (country) analysis results

Item	Cluster	Links	Total link strength	Document	Citations	Avg. Pub. Year
United States	3	56	481	685	21170	2018.67
United Kingdom	1	51	375	295	9423	2019.36
India	2	51	277	307	7177	2020.68
China	4	39	225	232	10051	2020.27
Saudi Arabia	2	39	179	118	2291	2021.04
Italy	1	37	164	147	3292	2019.26
Australia	3	39	159	127	3215	2020.2
Germany	1	40	155	91	1640	2019.91
Spain	4	43	134	92	2257	2018.79
Netherlands	1	35	127	82	2509	2019.43
Pakistan	4	37	125	61	2229	2020.39
Canada	5	35	116	122	2258	2020.32
South Korea	4	29	82	100	2916	2019.77

DISCUSSION AND CONCLUSION

This study reviews the historical development, evolution, and innovation of AI as a technology, identifies milestone breakthroughs in technology development and emphasizes the key role of machine learning and deep learning as well as the commercial potential of AI. From early concepts to commercial applications to eye-catching technological breakthroughs and applications in different industries, especially healthcare. The advantages and potential of AI are to enhance medical decision-making, improve diagnostic accuracy, reduce misdiagnosis, and improve the operational efficiency of medical systems. At the same time, judging from the research time distribution chart, the number of publications and the number of annual authors continue to increase, indicating the importance and market potential of this research. In addition, this study obtained further visual results through bibliometric research. First, keyword co-occurrence analysis clarified that research on AI in health care mainly focuses on technical applications, model and algorithm optimization, and Internet and network connections. Secondly, the co-occurrence analysis results also revealed some core themes, such as "algorithm", "machine learning", "deep learning", "controlled study", "major clinical study" and "healthcare delivery" as well as "decision support systems". These core keywords also quantify and illustrate the high degree of adoption of AI in healthcare and its high performance and reliability in solving potential problems in the industry, and provide strong evidence for defining AI in healthcare. It can be concluded that artificial intelligence in the field of healthcare may refer to technology that uses computer algorithms to simulate intelligent human behavior to support tasks such as medical decision-making, diagnosis, treatment planning, patient monitoring, and health management in major clinical studies. These technologies include machine learning, deep learning, natural language processing and other technologies, aiming to improve the quality and efficiency of medical services, reduce misdiagnosis, and improve patient outcomes. Apart from these, gender-related keywords, such as “female” and “male,” indicate that future research needs to focus on different genders’ attitudes towards AI and different needs in the healthcare field, as well as ethical issues between AI and patients. This phenomenon shows that men and women have different needs for AI in healthcare, which means men and women may have different speeds and comfort levels in adopting new technologies. Understanding these differences can help develop more effective education and training programs, as well as design AI solutions that better meet user needs. At the same time, considering gender factors can enhance the accuracy and effectiveness of AI in healthcare, and even better meet the needs of different patient groups. Finally, co-authorship (country) intuitively demonstrates the global academic research distribution of AI in healthcare research, and clarifies the leading positions of the United States, India, the United Kingdom, China, and other countries in this field. Meanwhile, other countries, such as India, China, Australia, Vietnam, and Saudi Arabia, have also begun to actively invest and carry out related research, indicating that academic cooperation between different regions will be further strengthened in the future. To promote transnational and interdisciplinary cooperation, we recommend establishing a multilateral cooperation platform, using digital technology and online platforms to promote communication and exchange, and committing to realizing cooperation and sharing of medical technology. These measures aim to overcome cultural and language barriers, facilitate the sharing of knowledge and technology, and ensure transparency and open communication, thereby increasing the efficiency and results of cooperation.

This study also has some limitations. Bibliometric analysis is mainly based on published research only from the Scopus database and may ignore gray literature or important studies that are about to be published or included in other databases. In addition, research language may impose limitations on research. In other words, this analysis only focuses on English literature in journals that are strongly related to AI. As the primary language of academic communication, this does facilitate communication among researchers around the world, but it can also result in important findings and perspectives in non-English literature being marginalized or ignored.

Based on the potential of AI in healthcare, this study recommends in-depth exploration of the application of AI technology in algorithm, machine learning and deep learning in emerging healthcare in future research. In addition, as artificial intelligence technology continues to advance, its gender ethics and data security in the medical field are also worthy of further study. Finally, due to the complexity and comprehensiveness of AI, follow-up research should be made to transcend language and cultural boundaries by integrating research from different countries and various database, such as Web of Science, PubMed, IEEE Xplore, and non-English literature databases, to ensure a more comprehensive and in-depth study of artificial intelligence in the field of health care.

CONFLICT OF INTEREST

The authors have declared that no conflict of interest exists.

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