ISSN: 2688-8645

A Visualized Bibliometric Analysis of Artificial Intelligence based on Biblioshiny (2014-2023)

Shuangyang Zhang*

School of Economics and Management, Southwest petroleum University, Chengdu 610500, China

*Corresponding author email: 1537759241@qq.com

Abstract

This paper is based on the artificial intelligence literature in the Web of Science™ Core Collection database from 2014 to 2023. Bibliometric methods are used to analyze the number of publications, highly productive authors, highly cited literature, research hotspots, and trends in the field with the help of the Biblioshiny program in R language. The hotspots of artificial intelligence research include data mining, prediction, classification, intelligent algorithms, deep learning and so on. In the future, AI will focus on the development of natural language processing technology and deep learning under the trend of interdisciplinary diversification, focusing on the analysis of Explainable Artificial Intelligence (XAI). At the same time, we will optimize algorithms and use multiple research methods to explore different hot topics in depth.

Keywords

Artificial Intelligence; Biblioshiny; Visual Econometric Analysis.

1. Introduction

Artificial intelligence (AI), a strategic technology leading the future, is profoundly changing the way people produce and live, and influencing the destiny of a country and nation. With the potential to augment technology in any field, AI is a general purpose enabling technology similar to the internal combustion engine or electricity. It is used in a wide range of other fields, from intelligent assistants to autonomous driving, and from medical diagnostics to financial analytics, with a growing influence. In July 2017, the State Council issued the New-Generation AI Development Plan, the first systematic strategic plan for AI issued by China since the turn of the century. This plan puts forward the guiding ideology, strategic objectives, key tasks and safeguards for China's new-generation AI development towards 2030, which promotes AI development.

A notable advancement in AI in recent years has been the rapid development of natural language processing (NLP). For example, the GPT-3 model demonstrated its power on multilingual tasks by being pre-trained on large amounts of textual data. This marks an important step forward for AI in understanding and generating human language [1]. In addition, the emergence of generative AI models such as ChatGPT has not only changed the public's perception of AI, but also sparked a discussion about possible major changes in the educational system and information generation in the future [2].

However, despite significant advances in AI technology, there are still some challenges and limitations. For example, there is still a gap between AI-generated scientific texts and human-authored texts, which includes issues such as linguistic redundancy and factual errors [3]. In addition, AI faces challenges in terms of interpretability, i.e., how to make the decision-making process of AI systems more transparent and explainable [4]. In the future, the development of AI will continue to deepen its application in various industries, while at the same time it will

ISSN: 2688-8645

face new ethical and safety issues. How to balance these challenges and how to utilize AI technologies for social well-being will be an important direction for future research. Based on the Biblioshiny program, this paper provides a visual econometric analysis of artificial intelligence literature in terms of the number of publications, highly productive authors, and highly cited literature. It mainly discusses the research hotspots and development trends in this field, and provides new ideas for artificial intelligence research.

2. Research Design

2.1. Research Questions

This paper answers the following questions.

(1) What is the overall state of development of AI research?

(2) What are the focuses and hotspots of AI research?

(3) What are the trends in AI research?

2.2. Data Sources

The data source for this paper is the Web of Science Core Collection database of highly cited and hot papers from SSCI and SCI journals. The database was last updated on 5/18/2024. Literature was published from 2014 to 2023, and the language was English. After searching by inputting the subject words "artificial intelligence" and "AI", book reviews, conference abstracts, book chapters, and literature not in line with specialized research areas were excluded, and 942 papers were finally obtained.

2.3. Data Analysis

Biblioshiny, a software package based on R language, was used in this study. With the help of it to sort out the development overview of artificial intelligence research, explore the distribution, remarkable characteristics and future trends of research achievements in this field. Biblioshiny can analyze data from Scopus, Web of Science and other databases in the following ways. The first is the analysis of basic measures of the literature - such as time and number of publications, journal rankings, highly cited papers, prolific authors and institutions. The second is to analyze the network structure of the literature-such as high-frequency keywords wordcloud and co-occurrence network, thematic map, historiograph, and co-citation network.

3. Basic Measurement Analysis of AI Research

3.1. Annual Scientific Production

The number of papers issued and annual distribution can intuitively reflect the research level and development trend of a certain field. Fig. 1 shows the annual publication volume of AI research from 2014 to 2023. From 2014 to 2023, the number of AI research is dynamically rising as a whole, and the annual publication volume growth rate is 74.5%, maintaining a good trend of stable growth (see Fig. 1). Fig. 1 can be divided into 3 stages: initial stage (2014~2016), development stage (2017~2021), and prosperity stage (2022~2023). The initial stage was from 2014 to 2016. A total of nine articles appeared in this stage, an average of only three per year, suggesting that international AI research was not conducted on a large scale during this period. The second stage is the development stage, from 2017 to 2021. The overall trend of AI-related research in this phase is steadily increasing, and continuous, larger-scale AI research is beginning to emerge. The third stage is the boom stage, from 2022 to 2023, in which AI-related research officially enters the boom period. As can be seen from the overall annual publication volume graph, over the past decade, the publication volume of AI-related research has shown a

ISSN: 2688-8645

significant upward trend. And the research is still continuing to explore and is steadily increasing.

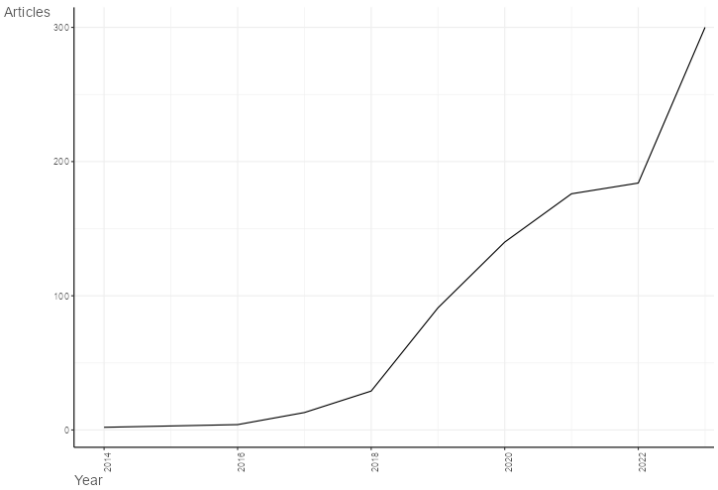

Fig 1. Annual Scientific Production

3.2. Highly Cited Literatures

The citation frequency of the literature can reflect the academic value of the literature, and the mainstream research direction of the field can be known by analyzing the highly cited literature in the field, as shown in Table 1.

Table 1. Highly cited literatures (Top 10)

Paper	DOI	Total Citations
VAN GRIETHUYSEN JJM, 2017, CANCER RES	10.1158/0008-5472.CAN-17-0339	3177
ARRIETA AB, 2020, INFORM FUSION	10.1016/j.inffus.2019.12.012	2735
ADADI A, 2018, IEEE ACCESS	10.1109/ACCESS.2018.2870052	2024
SZE V, 2017, P IEEE	10.1109/JPROC.2017.2761740	1954
ARULKUMARAN K, 2017, IEEE SIGNAL PROC MAG	10.1109/MSP.2017.2743240	1727
HOSNY A, 2018, NAT REV CANCER	10.1038/s41568-018-0016-5	1521
CHIANG M, 2016, IEEE INTERNET THINGS	10.1109/JIOT.2016.2584538	1445
JIANG F, 2017, STROKE VASC NEUROL	10.1136/svn-2017-000101	1302
OZTURK T, 2020, COMPUT BIOL MED	10.1016/j.compbiomed.2020.103792	1252
LIU RN, 2018, MECH SYST SIGNAL PR	10.1016/j.ymssp.2018.02.016	1210

Only the top three cited articles are analyzed in detail below. The article with the highest number of citations is an article published in the journal Cancer research by Van Griethuysen et al. with a computational radiomics system. Van Griethuysen et al. (2017) study computational imaging genomics systems that aim to quantify phenotypic features of medical imaging through the use of automated algorithms [5]. Radiomics artificial intelligence (AI) techniques based on engineered coding algorithms or deep learning can be used to develop biomarkers based on non-invasive imaging. However, the lack of standardized algorithm definition and image processing severely hampers the reproducibility and comparability of results. PyRadiomics, an open-source platform developed by Van Griethuysen, addresses this problem well by being able to extract a large number of engineered features from medical images. The paper discusses the workflow and architecture of PyRadiomics in detail and demonstrates its application in characterizing lung lesions to meet the critical needs of cancer research.

ISSN: 2688-8645

The second most cited article is an article published in the journal Information Fusion by Arrieta et al. with a study on explainable artificial intelligence (XAI). Arrieta et al. (2020) provide an overview examining the existing literature and contributions to the field of XAI, including a look at the prospects yet to be reached [6]. A new definition of interpretable machine learning is also established, covering previously existing conceptual propositions and focusing on an audience seeking interpretability. From the definitions, a taxonomy of recent contributions related to the interpretability of different machine learning models is presented and discussed, for which a second specialized taxonomy is constructed and studied in detail. The concept of AI in charge is also proposed, i.e., an approach for implementing AI methods at scale in real organizations, with fairness, model interpretability and accountability at its core. The aim is to provide newcomers to the field of XAI with a complete taxonomy that can be used as reference material to stimulate future research progress.

The third most cited article is an article by Adadi and Berrada also focusing on Explainable Artificial Intelligence (XAI), published in the IEEE access journal. Adadi and Berrada (2018) conducts a survey study on the field of XAI in order to understand the key aspects of the young and fast-growing research organization related to XAI [7]. Through the lens of the literature, its reviews the existing approaches on the topic, discusses the trends surrounding its field, and presents the main research trajectories. The aim is to increase trust and transparency in AI-based systems.

The brief analysis of the three highly cited papers above gives an idea of the general direction of mainstream research in the field. The research is on Explainable Artificial Intelligence (XAI) except for the first one which is on computational radiomics systems. The methods used for the studies are literature analysis methods, quantitative analysis methods, etc.

3.3. High Academic Impact Authors

Table 2. Author Impact Analysis (Top 15)

Element	H-index	G-index	TC	NP
DWIVEDI YK	15	16	3141	16
KATHER JN	9	9	705	9
WANG J	8	8	1851	8
LI J	7	7	1226	7
LI Y	7	7	1092	7
TING DSW	7	7	1608	7
ZHANG Y	7	7	696	7
CHEN X	6	6	2050	6
KIM J	6	6	359	6
LI X	6	6	1379	6
NIYATO D	6	6	1037	6
PHAM QV	6	6	1215	6
RANA NP	6	6	1611	6
WANG W	6	6	695	6
ZHANG J	6	6	613	6

Traditional bibliometric analysis adopts title analysis and citation analysis to evaluate the academic influence of scholars, which has certain defects. Biblioshiny evaluates the academic impact of authors through the H-index, G-index, TC (total citations) and the number of publications index to reflect the academic output and academic contribution of authors. The H-index, based on the frequency and number of citations, refers to the fact that at most h papers

ISSN: 2688-8645

of an author have been cited at least h times, taking into account both the quantity and quality of papers. The G-index, on the other hand, focuses on the cumulative contribution of the citation frequency of papers.

The evaluation results showed that the top 15 scholars in terms of academic impact of AI research (see table 2). DWIVEDI YK, KATHER JN, WANG J, LI J, LI Y, TING DSW, ZHANG Y, CHEN X, KIM J, LI X, NIYATO D, PHAM QV, RANA NP, WANG W, ZHANG J. Their postings, in order, are 16, 9, 8, 7, 7, 7, 6, 6, 6, 6, 6, 6, 6, 6. The H-index is in order 15, 9, 8, 7, 7, 7, 7, 6, 6, 6, 6, 6, 6, 6, 6. The G-index is in order 16, 9, 8, 7, 7, 7, 7, 6, 6, 6, 6, 6, 6, 6, 6. As a result, DWIVEDI YK has published 16 papers from 2014 to 2023, 15 of which have been cited at least 15 times, totaling 3141 citations, making it the expert with the highest quality of scholarly output and the greatest scholarly contribution among scholars of artificial intelligence research. The research interests of the above 15 scholars include but are not limited to generative AI, application of AI in information management, deep learning, big data analytics, and practice of AI in medicine. The scholars' academic achievements have strengthened the theoretical and practical foundation of AI research and made significant contributions to the continued development of the field.

4. Network Structure Analysis of AI Research

By analyzing the basic measurements of AI research, it is possible to understand the general development direction of this research. However, through the network structure analysis, the research hotspots and research trends in this field can be better grasped. Research hotspots are mainly an overview of the current stage of AI research. Research trends are a reflection of the overall development trend from the past to the future. In this paper, we will use the network structure analysis function in Biblioshiny function to analyze the research hotspots and research trends of artificial intelligence through keyword analysis and topic map.

4.1. Keyword Analysis

High-frequency keywords reflect the theoretical foundation and methodology of the research field, which is an important index of bibliometric research. In addition to the subject terms, high-frequency keywords for AI research include prediction (behavior), classification, modeling, big data, performance, neural networks, deep learning, acceptance, support vector machines, networks, databases, perspectives, and diseases.

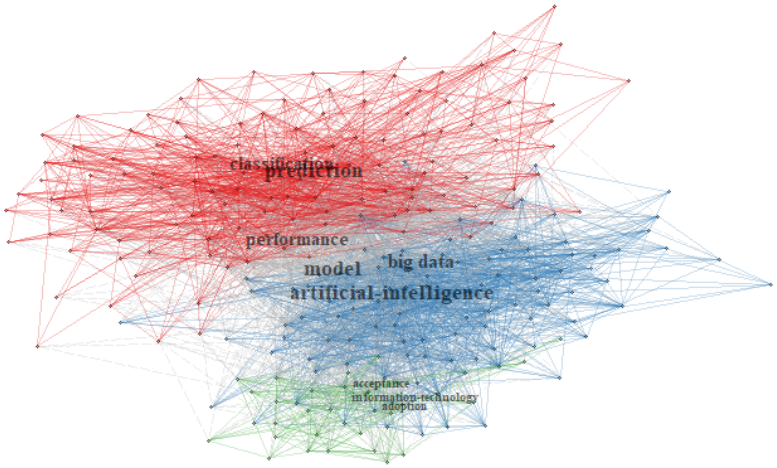

Fig 2. Keyword co-occurrences graph

In the keyword co-occurrence graph, a node represents a keyword, the closer to the core word, the higher the frequency of the keyword, the more likely to become a research hotspot, and the keywords of the same color are more closely associated with each other. Fig. 2 demonstrates

ISSN: 2688-8645

the proximity and thematic relevance of the top-ranked high-frequency keywords to the core keywords, revealing the combinatorial relationship and structure of different themes in AI research. From the figure, it can be seen that AI, big data and modeling research are closely linked and are one of the core elements of AI research. Next, taxonomy, predictive behavior and performance are more closely linked. In addition, information technology, acceptability, and adoptability are the associated hotspots of AI research. Table 3 shows the top 5 keywords in terms of frequency of occurrence included under the three core keywords.

Table 3. Frequency of core keywords (Top 5)

Cluster-Label	Occurrences	Words
Cluster 1	100	prediction
	85	classification
	63	performance
	63	system
	55	neural-networks
Cluster 2	80	artificial-intelligence
	72	model
	67	big data
	57	technology
	55	challenges
Cluster 3	27	information-technology
	23	acceptance
	21	adoption
	19	user acceptance
	14	robots

4.2. Thematic Map

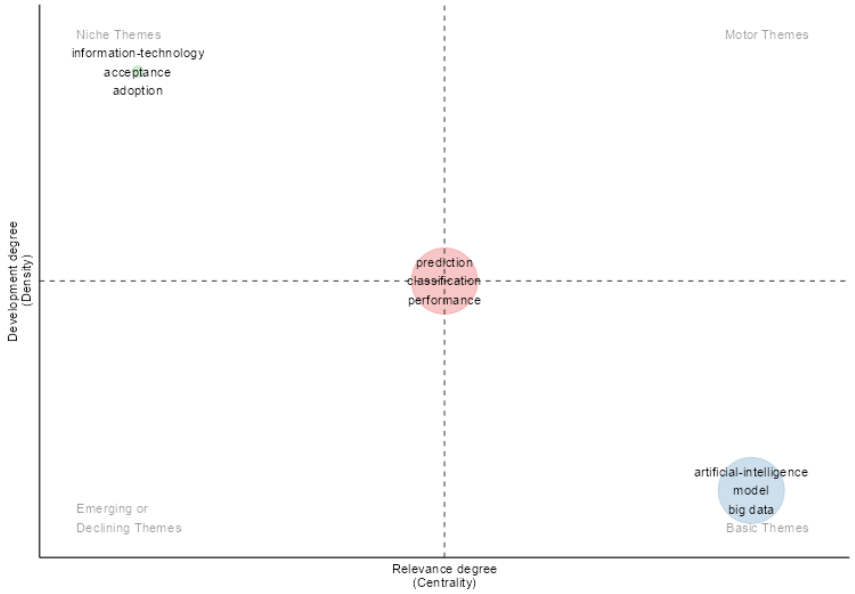

Fig 3. Thematic map

Thematic maps are based on keyword clustering, based on the density (vertical coordinate) and centripetal degree (horizontal coordinate) can draw a two-dimensional map of the development trend of different research topics in a certain field. This can help refine the

ISSN: 2688-8645

research hotspots and facilitate our inference on the future development direction. Specifically, density represents the strength of linkages between the research results of individual themes. The higher the density, the more mature the research. Centripetalism refers to the strength of linkages between thematic studies. The greater the value of centripetalism, the more likely the theme is to be at the center of the study. The first quadrant of the thematic map contains a well-developed motor theme, the second quadrant represents a well-developed niche theme, the third quadrant refers to an emerging or declining theme, and the fourth quadrant is a basic theme. The fourth quadrant is the basic theme, which may become a hot research topic or a research trend.

As can be seen in Fig. 3, the core themes include predictive behavior, taxonomies, and performance. Well-developed stand-alone themes mainly include information technology, acceptability and adoptability. Artificial intelligence, modeling and big data are basic research themes that still need to be fully developed.

By analyzing high-frequency keywords, keyword co-occurrence and thematic map, the core themes of AI research cover predictive analytics, taxonomies, performance.

(1) The research results of predictive analysis based on AI technology are the most fruitful and more maturely developed. It mainly includes medical imaging automatic diagnosis and prognosis prediction, predictive modeling research, risk prediction, behavioral prediction and so on. Van Royen et al. (2023) proposed five quality criteria to improve the quality of clinical Artificial Intelligence (AI) predictive modeling studies in cardiovascular health [8]. Niu and Feng (2021) reported evaluating the performance of five AI methods in predicting daily flow time series for sustainable water resource management [9]. Ouyang et al. (2023) combined artificial intelligence performance prediction modeling with learning analytics methods with the aim of improving student learning in a collaborative learning environment [10].

(2) The combination of artificial intelligence and classification involves several aspects, including the application of techniques such as machine learning, deep learning, and neural networks to classification problems. Machine learning techniques, especially support vector machines (SVM) and decision trees, have made significant progress in classification problems [11, 12]. These methods are capable of handling large amounts of data and have been shown to be effective in specific domains such as text classification and book classification [13]. Junior and Yen (2019) proposed a new algorithm (psoCNN) based on particle swarm optimization (PSO), which is capable of fast convergence to automatically search for meaningful of deep convolutional neural network (CNN) architectures for image classification tasks [14].

(3) Artificial intelligence technologies can help managers model possible performance impacts and thus improve the quality of performance management decisions. Mikalef and Gupta (2021) developed and empirically validated a survey instrument to measure organizational artificial intelligence capabilities [15]. Their research suggests that by developing AI capabilities, companies can realize gains in organizational creativity and performance. Tian et al. (2023) found that AI has a significant positive impact on the innovation performance of firms' green technology development and its decomposition variables (green technology efficiency and progress) by constructing a multi-period double difference model [16].

5. Research Hot Spots and Trends in Artificial Intelligence

5.1. Research Hot Spots

Synthesizing the development of research topics in highly cited literature, high-frequency keywords, and keyword co-occurrence relationships, it can be found that the research hotspots of artificial intelligence are as follows.

ISSN: 2688-8645

(1) Data mining aspects. The algorithmic search mines useful information from the knowledge base, which is applied to market analysis, scientific exploration, disease prediction [17, 18, 19]. The main research hotspots include Prediction, Classification and so on. Kose and Arslan (2019) introduced an artificial intelligence-based artificial neural network approach and cognitive developmental optimization algorithm to predict different types of time series to discuss the potential of hybrid systems for applications [20]. Jiang and Chen (2021) proposed a novel artificial intelligence-based symmetry detection algorithm for detecting edges of tea images for more accurate categorization [21].

(2) Pattern recognition aspects. The process of processing and analyzing various forms of information that characterize things or phenomena, as well as the process of describing, analyzing, classifying and interpreting things or phenomena. Esteva et al. (2017) verified by examples that deep convolutional neural networks with their high fault tolerance, robustness and self-organization can mimic or replace human thinking, and their performance in the classification of skin diseases is on par with that of human experts [22]. Yao et al. (2019) designed and proposed a method for detecting and identifying the corrosion damage of structural plates of ship hulls based on convolutional neural network of artificial intelligence [23]. It can accelerate the application of artificial intelligence technology in the field of shipbuilding and ocean engineering.

(3) Intelligent algorithmic aspects. As the foundation of artificial intelligence, algorithms can flexibly cope with complex and changing practical problems only if they are deeply rooted. Yi et al. (2020) introduced the quantum-inspired MBO algorithm (QMBO) for the unmanned combat aerial vehicle (UCAV) path planning navigation problem [24]. The use of quantum operators is to update some of the worst individuals. Experimental results show that QMBO can find much shorter UCAV paths than the original MBO. Zhao et al. (2022) proposed the Artificial Hummingbird Algorithm (AHA) to solve the optimization problem and validated the AHA using two sets of numerical test functions, comparing the results with various other algorithms [25]. The comparison results show that AHA is more competitive than other metaheuristic algorithms and identifies high quality solutions with fewer control parameters and that AHA has higher effectiveness in terms of computational burden and solution accuracy.

(4) Machine learning aspects. The study of how computers can simulate or implement human learning behaviors to meet the specific requirements of operators by continuously improving their performance. Deep learning is an emerging branch of the machine learning field, as well as one of the key factors driving the third boom in artificial intelligence. At its core lies the construction and simulation of neural networks for analysis and learning, attempting to mimic the workings of the human brain in interpreting data. Dong et al. (2021) summarized the global development and current status of deep learning, describing the structural principles, features and some classical models of deep learning [26]. It also describes the recent developments and applications of deep learning in various fields such as language processing, computer vision and medical applications, and points out the problems and future research directions that deep learning has catalyzed. Zhang et al. (2017) summarizes the history of machine learning and provides insights into recently developed deep learning methods and their applications in rational drug discovery methods [27]. Baduge et al. (2022) provide a state-of-the-art review of the application of artificial intelligence (AI), machine learning (ML), and deep learning (DL) to building design and visualization in the building and construction industry 4.0 [28].

5.2. Development Trend

Combining high-frequency keywords, keyword co-linearization, etc., it is believed that the development trend of artificial intelligence mainly includes the following aspects.

(1) Natural Language Processing (NLP). Natural Language Processing (NLP) is one of the hot directions in the research of AI technologies, which focuses on enabling computers to

ISSN: 2688-8645

understand human expressive language and to realize natural language-mediated human-computer communication. For example, Bauer et al. (2023) propose an interdisciplinary framework aimed at facilitating the development of NLP-based adaptations to support peer feedback processes in digital learning environments [29]. Zhou et al. (2022) detailed the key role played by natural language processing technology in smart healthcare, and pointed out the shortcomings of current research and future directions [30]. Natural language processing is powerful and widely used, not only limited to speech recognition, but also machine translation, etc., and has a broad application prospect.

(2) Machine learning and deep learning are still one of the important directions of research. Deep learning is an important branch of machine learning, and high-frequency keyword analysis shows that the frequency of deep learning citations is still high, which indicates that deep learning is still a research direction that needs attention. Deep learning algorithms have shown breakthrough performance in a variety of complex tasks, especially image-related tasks, such as radiology in the medical field [31]. Effective models such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) have emerged during the development of Deep Learning and have had a significant impact in the fields of Natural Language Processing, Speech Recognition, and Computer Vision. Deep reinforcement learning has shown great potential in dealing with complex, multifaceted and decision-making aspects and is considered a path to "general artificial intelligence", which will become a hot topic in the field of artificial intelligence.

(3) Explainable artificial intelligence. In recent years, the exploration of open black box Artificial Intelligence (AI) systems has become an emerging phenomenon of academic, business and societal interest and has brought about the rise of the field of Explainable Artificial Intelligence (XAI) research. Explainable AI (XAI) aims to capitalize on the potential of AI and reduce its risks by increasing the explainability of AI. XAI aims to enable human stakeholders to understand, appropriately trust, and effectively manage AI [6, 32].

(4) Artificial intelligence + X. With the support of information technology, the innovation model of "artificial intelligence + X" has become a new round of research hotspot. At present, AI has begun to penetrate in industries such as cities, healthcare, logistics, automotive and finance. For example, AI technologies ranging from machine learning to deep learning are prevalent in healthcare for disease diagnosis, drug discovery and patient risk identification. Artificial intelligence can enhance the medical office experience and accelerate the readiness of patients to continue their recovery at home, and the use of AI enables early prediction of different types of diseases [33].

(5) Interdisciplinary research. The convergence of AI technologies with other fields (e.g., biology, psychology, sociology, and economics) will lead to new research trends. For example, insights from cognitive science can help design more natural AI interfaces, while economic principles can be used to optimize the use of AI in resource allocation.

5.3. Research Limitations

In summary, the current research in the field of artificial intelligence still suffers from the following shortcomings.

(1) Lack of Explainable AI. Despite the increasing research on explainable AI in recent years, explainable AI is still not widely adopted in practical applications and lacks universally accepted standards and guiding principles.

(2) Lack of interdisciplinary cooperation. Advances in AI require knowledge from multiple fields, such as computer science, mathematics, statistics, cognitive science, and psychology. Current research is often limited to a single field and lacks interdisciplinary perspectives and cooperation.

ISSN: 2688-8645

(3) Data Privacy and Ethics. The large-scale datasets on which much research relies are often characterized by privacy risks, as well as a lack of clear ethical norms, which can lead to violations of individual privacy. And with the pace of development of AI technology far outpacing the understanding and regulation of its social impact, existing research often ignores the potential impact AI technology may have on the social fabric, the job market, and individual rights.

(4) Generalization ability and robustness. Many AI systems perform well on specific tasks, but their performance drops significantly when faced with slightly different contexts or data. Existing research often focuses on specific datasets or tasks rather than the generalization ability and robustness of the system.

References

[1] Webb T, Holyoak K J, Lu H. Emergent analogical reasoning in large language models. Nature Human Behaviour, 2023, 7(9): 1526-1541.

[2] Huang J, Tan M. The role of ChatGPT in scientific communication: writing better scientific review articles. American journal of cancer research, 2023, 13(4): 1148.

[3] Dergaa I, Chamari K, Zmijewski P, et al. From human writing to artificial intelligence generated text: examining the prospects and potential threats of ChatGPT in academic writing. Biology of sport, 2023, 40(2): 615-622.

[4] Meske C, Bunde E, Schneider J, et al. Explainable artificial intelligence: objectives, stakeholders, and future research opportunities. Information Systems Management, 2022, 39(1): 53-63.

[5] Van Griethuysen J J M, Fedorov A, Parmar C, et al. Computational radiomics system to decode the radiographic phenotype. Cancer research, 2017, 77(21): e104-e107.

[6] Arrieta A B, Díaz-Rodríguez N, Del Ser J, et al. Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. Information fusion, 2020, 58: 82-115.

[7] Adadi A, Berrada M. Peeking inside the black-box: a survey on explainable artificial intelligence (XAI). IEEE access, 2018, 6: 52138-52160.

[8] Van Royen F S, Asselbergs F W, Alfonso F, et al. Five critical quality criteria for artificial intelligence-based prediction models. European Heart Journal, 2023, 44(46): 4831-4834.

[9] Niu W, Feng Z. Evaluating the performances of several artificial intelligence methods in forecasting daily streamflow time series for sustainable water resources management. Sustainable Cities and Society, 2021, 64: 102562.

[10] Ouyang F, Wu M, Zheng L, et al. Integration of artificial intelligence performance prediction and learning analytics to improve student learning in online engineering course. International Journal of Educational Technology in Higher Education, 2023, 20(1): 4.

[11] Huang S, Cai N, Pacheco P P, et al. Applications of support vector machine (SVM) learning in cancer genomics. Cancer genomics & proteomics, 2018, 15(1): 41-51.

[12] Sagi O, Rokach L. Approximating XGBoost with an interpretable decision tree. Information sciences, 2021, 572: 522-542.

[13] Goh Y M, Ubeynarayana C U. Construction accident narrative classification: An evaluation of text mining techniques. Accident Analysis & Prevention, 2017, 108: 122-130.

[14] Junior F E F, Yen G G. Particle swarm optimization of deep neural networks architectures for image classification. Swarm and Evolutionary Computation, 2019, 49: 62-74.

[15] Mikalef P, Gupta M. Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. Information & management, 2021, 58(3): 103434.

[16] Tian H, Zhao L, Yunfang L, et al. Can enterprise green technology innovation performance achieve "corner overtaking" by using artificial intelligence?—Evidence from Chinese manufacturing enterprises[J]. Technological Forecasting and Social Change, 2023, 194: 122732.

[17] Jian Z, Qingyuan Z, Liying T. Market revenue prediction and error analysis of products based on fuzzy logic and artificial intelligence algorithms. Journal of Ambient Intelligence and Humanized Computing, 2020, 11(10): 4011-4018.

[18] Awais M, Li W, Ajmal M, et al. Using IoT Innovation and Efficiency in Agriculture Monitoring System. Journal of Botanical Research, 2020, 2(2): 14-20.

[19] Piliuk K, Tomforde S. Artificial Intelligence in Emergency Medicine. A Systematic Literature Review. International Journal of Medical Informatics, 2023: 105274.

[20] Kose U, Arslan A. Time series prediction with a hybrid system formed by artificial neural network and cognitive development optimization algorithm. Scientia Iranica, 2019, 26(2): 942-958.

[21] Jiang M, Chen Z. Symmetry detection algorithm to classify the tea grades using artificial intelligence. Microprocessors and Microsystems, 2021, 81: 103738.

[22] Esteva A, Kuprel B, Novoa R A, et al. Dermatologist-level classification of skin cancer with deep neural networks. nature, 2017, 542(7639): 115-118.

[23] Yao Y, Yang Y, Wang Y, et al. Artificial intelligence-based hull structural plate corrosion damage detection and recognition using convolutional neural network. Applied Ocean Research, 2019, 90: 101823.

[24] Yi J H, Lu M, Zhao X J. Quantum inspired monarch butterfly optimisation for UCAV path planning navigation problem[J]. International Journal of Bio-Inspired Computation, 2020, 15(2): 75-89.

[25] Zhao W, Wang L, Mirjalili S. Artificial hummingbird algorithm: A new bio-inspired optimizer with its engineering applications. Computer Methods in Applied Mechanics and Engineering, 2022, 388: 114194.

[26] Dong S, Wang P, Abbas K. A survey on deep learning and its applications. Computer Science Review, 2021, 40: 100379.

[27] Zhang L, Tan J, Han D, et al. From machine learning to deep learning: progress in machine intelligence for rational drug discovery. Drug discovery today, 2017, 22(11): 1680-1685.

[28] Baduge S K, Thilakarathna S, Perera J S, et al. Artificial intelligence and smart vision for building and construction 4.0: Machine and deep learning methods and applications. Automation in Construction, 2022, 141: 104440.

[29] Bauer E, Greisel M, Kuznetsov I, et al. Using natural language processing to support peer-feedback in the age of artificial intelligence: A cross-disciplinary framework and a research agenda. British Journal of Educational Technology, 2023, 54(5): 1222-1245.

[30] Zhou B, Yang G, Shi Z, et al. Natural language processing for smart healthcare. IEEE Reviews in Biomedical Engineering, 2022.

[31] Mazurowski M A, Buda M, Saha A, et al. Deep learning in radiology: An overview of the concepts and a survey of the state of the art with focus on MRI[J]. Journal of magnetic resonance imaging, 2019, 49(4): 939-954.

[32] Langer M, Oster D, Speith T, et al. What do we want from Explainable Artificial Intelligence (XAI)?–A stakeholder perspective on XAI and a conceptual model guiding interdisciplinary XAI research. Artificial Intelligence, 2021, 296: 103473.

[33] Kumar Y, Koul A, Singla R, et al. Artificial intelligence in disease diagnosis: a systematic literature review, synthesizing framework and future research agenda. Journal of ambient intelligence and humanized computing, 2023, 14(7): 8459-8486.