

Analysis of Scientific Research Hotspots in the Field of Artificial Intelligence

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Abstract. [Objective] This paper discusses the development trends and research hotspots in the field of artificial intelligence in China. [Methods] Take the papers in the Web of Science Core Collection database as the research object, and use the methods such as the statistics of the number of documents issued, the statistics of keyword word frequency, and keyword co occurrence analysis to identify research hotspots in the field of artificial intelligence. [Results] According to the results of data analysis, the research focuses in this field mainly focus on four aspects: neural network, algorithm optimization, classification technique and deep learning. [Conclusions] Using bibliometric methods to analyze the relevant literatures in the field of artificial intelligence can reveal the research hotspots in this field, thus providing guidance for relevant researchers.

Keywords: Bibliometrics analysis; Keyword co-occurrence; Artificial Intelligence.

1. Introduction

Artificial intelligence was first proposed in 1956. It is a new discipline that analyzes and studies the laws of human intelligence activities, simulates and expands human intelligence through computer technology. After more than 60 years of development, the discipline of artificial intelligence has received more and more attention and is now widely used in education, medical care, environmental protection and other fields [1].

This research conducts a bibliometric analysis of papers in the field of artificial intelligence in China, revealing research hotspots in this field from three aspects: number of publications, keyword frequency statistics and keyword co-occurrence network, so as to provide guidance for relevant researchers.

2. Research Methodology

2.1. Data resource

The Web of Science database of Clarivate is a comprehensive academic information resource covering the most disciplines in the world at present. It covers the literature data of Artificial Intelligence research in a relatively comprehensive way, and is suitable as a data source for basic research and analysis.

The research takes the scientific and technological papers in the field of artificial intelligence published by Chinese scientific research institutions as the research object. The retrieval format is WC = "Computer Science, Artificial Intelligence" AND AD = "China". A total of 257269 pieces of literature data from 1996 to 2021 were obtained from the Web of Science Core Collection database.

2.2. Method

The research focuses on the identification of research hotspots in the field of artificial intelligence in China from three aspects: the number of publications, keyword frequency statistics and keyword co-occurrence analysis. The number of publications can measure the research scale of a country, and it can also show the change trend of research enthusiasm in combination with the time dimension. The key words of the scientific and technological papers are a high summary of the information in

the papers, expressing the theme of the papers. The word frequency statistics of the key words can reveal the overall content characteristics of the research in the field of artificial intelligence to a certain extent, and understand the development context and direction of the research[2]. Keyword co-occurrence means that two or more papers often use the same keyword in journals, dissertations and other documents. It is generally believed that the more frequently keywords appear in pairs in the same document, the more closely they represent the thematic relationship represented by the two keywords. Therefore, the statistics of the frequency of keyword co occurrence can form a co word network in which these words are related to each other. The connection between nodes in the network can reflect the closeness of the subject content[3].

The research mainly uses Bibexcel and VOSViewer as research tools to make statistics and analysis of relevant literature. Bibexcel is a tool for bibliometric analysis, which can generate a co-occurrence matrix of knowledge units from literature data [4]. VOSviewer is a document measurement network visualization tool, which can visually display the knowledge unit co occurrence network and cluster it into different clusters [5].

3. Empirical research

3.1. The distribution trend of the publications

The amount and change of the statistical data in different years are shown in Figure 1. From the change trend of the number of publications, China's research on Artificial Intelligence can be divided into the following five stages.

The period from 1996 to 2000 was an exploration stage. Research in the field of artificial intelligence was just starting. Although the number of papers published was small, it also increased slowly over time. 2001-2006 is a period of rapid development. The number of papers published has increased significantly, and research in the field of artificial intelligence has been vigorously developed. The period from 2007 to 2011 was a mature stage, with the number of papers published gradually decreasing and reaching a low point. From 2012 to 2017, the number of papers published steadily increased year by year, and research in the field of artificial intelligence rose again. After 2017, the number of papers published rose sharply again, and research in the field of artificial intelligence ushered in a new development boom.

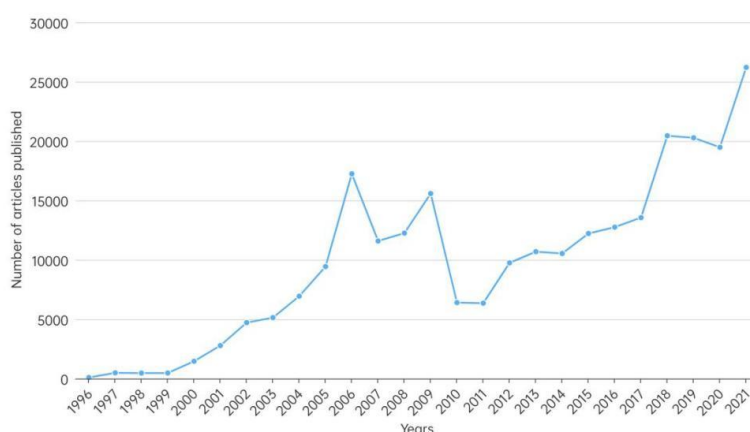


Fig 1. The distribution trend of the publications

3.2. Keywords frequency statistics

Table 1 shows some results of keyword frequency statistics in papers in the field of artificial intelligence. Artificial intelligence research mainly focuses on neural networks, deep learning, genetic algorithms and other topics. The research content in this field involves the basic theories and methods of artificial intelligence, data mining research, intelligent algorithms and optimization, image processing and face recognition.

Table 1. High-frequency keywords

id	keywords	frequency	id	keywords	frequency
1	neural network	3015	11	feature selection	1135
2	deep learning	1974	12	clustering	1122
3	genetic algorithm	1845	13	image segmentation	1089
4	convolutional neural network	1485	14	machine learning	1014
5	feature extraction	1443	15	optimization	891
6	support vector machine	1368	16	fault diagnosis	823
7	data mining	1364	17	simulation	777
8	classification	1328	18	sparse representation	770
9	particle swarm optimization	1266	19	multi-agent system	684
10	face recognition	1258	20	extreme learning machine	680

3.3. Keywords co-occurrence network

In the research, with the help of VOSViewer software, the co-ccurrence network was generated and visualized using the top 500 keywords of word frequency statistics. The results are shown in Figure 2. In the figure, nodes represent keywords, node size represents the frequency of keywords, lines between nodes represent the co occurrence relationship of keywords, and nodes with the same color belong to the same cluster.

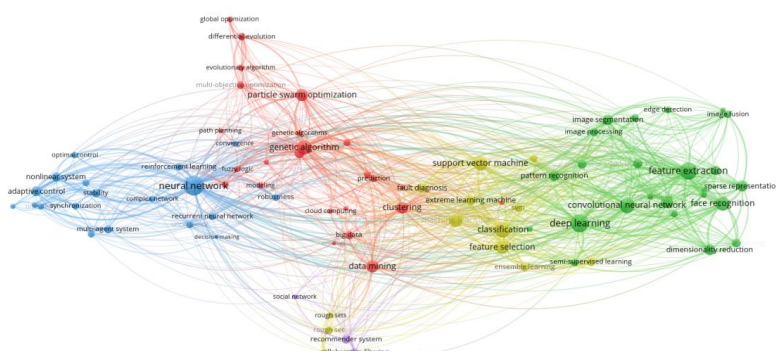


Fig 2. High frequency keyword co-occurrence network

From the perspective of prominent nodes, neural network, genetic algorithm, data mining, particle swarm optimization, support vector machine, feature selection, deep learning Feature extraction, convolutional neural network and other key word nodes are large, which can be regarded as the research hotspot in the field of artificial intelligence in China.

From the clustering results, the figure is mainly divided into four clusters of different colors, so the research hotspots in China's AI field can be summarized into the following four aspects.

Hotspot 1: Neural network. The cluster mainly includes complex network, reinforcement learning, nonlinear system, adaptive control and other related researches. Neural network is an algorithm mathematical model for distributed and parallel information processing by imitating the behavior characteristics of animal neural network. This kind of network relies on the complexity of the system, and achieves the purpose of processing information by adjusting the interconnection between a large number of internal nodes. At present, neural networks are widely used in automation technology [6], medicine [7], environmental protection [8] and other fields.

Hotspot 2: Algorithm optimization. The cluster mainly includes genetic algorithm, particle swarm optimization, evolutionary algorithm and global optimality, which are helpful to the exploration of optimization problems. As the core of the field of artificial intelligence, intelligent algorithms have received extensive attention from scholars from all walks of life with the development of computer technology[9].

Hotspot 3: Classification technique. The cluster mainly includes feature selection, support vector machine, extreme learning machine, machine learning and other related researches. The application of Classification in the field of artificial intelligence involves many fields, and is most often used to classify images and texts, so as to analyze and predict data[10].

Hotspot 4: Deep learning. The cluster mainly includes convolutional neural network, feature extraction, face recognition and other research on computer vision. In the field of people's life, the application of computer vision technology based on deep learning is more and more extensive, and it plays an increasingly important role in medical treatment, transportation and other fields[11].

4. Conclusion

The research takes the papers in the field of Chinese artificial intelligence in the Web of Science Core Collection database as the research object. Through bibliometric analysis, we get the changes of research in the field of artificial intelligence over time and research hotspots in this field.

Through word frequency statistics and co-occurrence clustering analysis of keywords in papers in the field of artificial intelligence, four research hotspots in this field are finally summarized, namely, neural network, algorithm optimization, classification technique and deep learning. Through the above analysis, this study can provide reference for relevant personnel, guide scientific research direction, find research hotspots in the field of artificial intelligence, and promote the development of artificial intelligence discipline.

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