

Comparative Analysis of Chinese and British AI Research

—Based on the Bibliometric Perspective

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Abstract: The development of artificial intelligence technology has increasingly attracted the attention of Chinese and British scholars and become a hot research topic in the academic circles. In order to better understand the current situation and development trend of China and the U.K. in the field of AI, bibliometric methods are adopted to sort out and analyze the basic characteristics and research topics of AI research in China and the U.K.. The study found that the theme of domestic AI research focuses on biology, medicine, materials and internet. The theme of artificial intelligence research in the British academic field focuses on management, medicine, algorithm and chemistry. Further, the commonness and differences of British and Chinese AI research are analyzed from the aspects of research content, research type and theoretical basis.

1. Introduction

Since the 21st century, artificial intelligence(AI) has developed rapidly, with more and more applications in various fields. For example, artificial intelligence has been widely used in the fields of justice, nuclear energy and biotechnology.

The value function of artificial intelligence is not limited to the technical level, but also is a factor of production and a means of governance. The study of artificial intelligence is an indispensable link in the current productivity transition period.

Both China and the U.K. are the world's great powers, and both have conducted extensive research on artificial intelligence. At the end of 2017, the UK's white paper titled Industrial Strategy: Building a Future UK pointed out that artificial intelligence, clean growth, future transportation and aging society are the four challenges facing the UK in the future, and the development of future industries. China continues to standardize AI governance related guidance documents and laws and regulations at the national and local levels. In 2019, the National Committee for New Generation AI Governance released the Principles of—Responsible for ARTIFICIAL Intelligence, which put forward eight governance principles: harmony, friendship, fairness, inclusiveness and sharing, respect for privacy, security and control, shared responsibility, open cooperation, and agile governance.

Tracking the development direction of artificial intelligence in China and the UK can grasp the development prospects of artificial intelligence and find out the shortcomings of artificial intelligence research in both countries. In order to better understand the current situation and development trend of China and the U.K. in the field of artificial intelligence, bibliometric methods are adopted to sort out and analyze the basic characteristics and research topics of artificial intelligence research in China and the U.K..

2. Data and Methods

2.1. Data Source and Research Methods

The search takes the Web of Science core collection as the database, SCI and SSCI as the citation index, and uses artificial intelligence as the theme, then uses “ENGLAND” as search condition in the WOS database. The time of searching is November 10, 2022. Since the time unit of this study is year, 2022 is chosen as the year. The time end point of the comparative analysis (the year was the most recent before the study was conducted).

The advantage of using bibliometric research method is that it can be through mathematics statistical and visual knowledge maps to show the knowledge knots of a research field construction and development process, from the macro level to grasp the research field panorama, from the micro view level to explore the current hot topics in this research field for future.

2.2. Characteristic of Data

2.2.1. Annual Distribution of Sample Literature

Artificial Intelligence has been around for a while. The term was coined by John McCarthy at a lecture at Dartmouth College in 1956. Since then, the idea of sentient computers has captured and terrorized our collective imagination. [1] But the search of Artificial Intelligence’s beginning was a little late in these two countries. England’s first paper appeared in 1991, and China appeared in 1994. Besides, before 2000, there are only 41 papers in England and 19 papers in China. In the last century, the research on artificial intelligence was relatively slow in both China and the UK. However, after 2000, the speed of the research is especially faster. We can see that the field of artificial intelligence has flourished since the 21st century.

2.2.2. Discipline Distribution (Research Direction)

Then using “ENGLAND” as search condition. There were 4000 papers left. The document type “paper” is the search condition. There were 3081 papers left. In these papers, there were ten domains that has over 100 papers. The domains respectively are: Computer Science, Engineering, Business Economics, Science Technology Other Topics, Chemistry, Oncology, Materials Science. Telecommunications, Neurosciences Neurology, Physics. Using “PEOPLES R CHINA” as search condition. There were 9519 papers left. The document type “paper” is the search condition. There were 8588 papers left. There were fourteen domains that has over 100 papers. The domains are: Computer Vision& Graphics, Telecommunications, Metallurgical Engineering, Bacteriology, Robotics, Artificial Intelligence & Machine Learning, Catalysts, Security Systems, Crop Science, Oceanography, Meteorology& Atmospheric Sciences, Virology - General, Management and Phytochemicals. In contrast, the subject distribution of artificial intelligence research in England is more concentrated, about half of the sample literature mainly from the perspective of Computer Science and Engineering research artificial intelligence. And the China artificial intelligence research involved subject "scattered" trend is more obvious, related research more diversified and comprehensive.

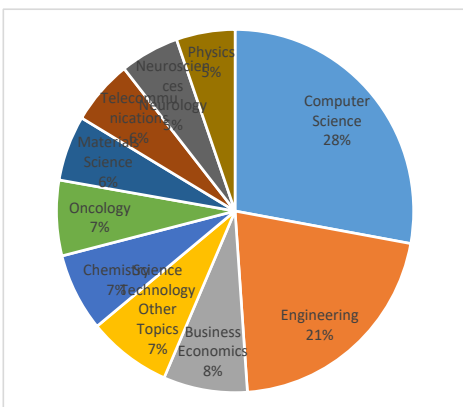


Figure 1 ENGLAND subject distribution.

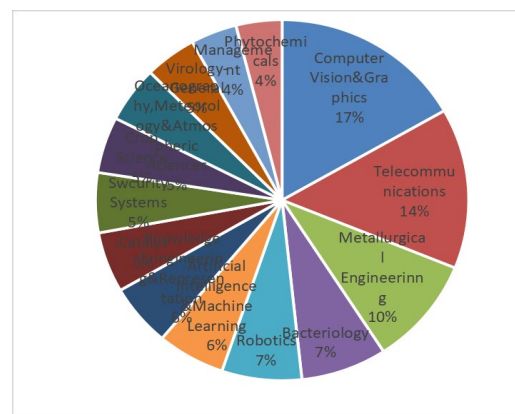


Figure 2 CHINA subject distribution.

2.2.3. Journal Source Distribution

According to statistics, after 2000, Domestic sample literature citations on artificial intelligence research come from 8780 publications, UK sample literature references on artificial intelligence research comes from 3135 publications. Both China and the UK have a wide range of research fields. This feature is particularly prominent in Chinese academic studies.

What's more, It can be found that according to the derived citation report, artificial intelligence research in both countries grew exponentially, and both showed "explosive growth" around 2020. The reasons for the rapid rise in artificial intelligence research in China and the UK are closely related to the formulation of artificial development strategies and policies in both countries in recent years. Recently, a new avenue for public value creation has been identified in the growing field of IT-enabled innovations in the context of digital government. At the same time, achieving smartness in government depends on IT-enabled innovations which, in turn, require profound knowledge of certain key technologies such as mobile phone services, artificial intelligence, wireless technologies, power grids, a multitude of different (IoT-)sensors, broadband, wide-area networks, data management and analytics and RFID tags.[2]

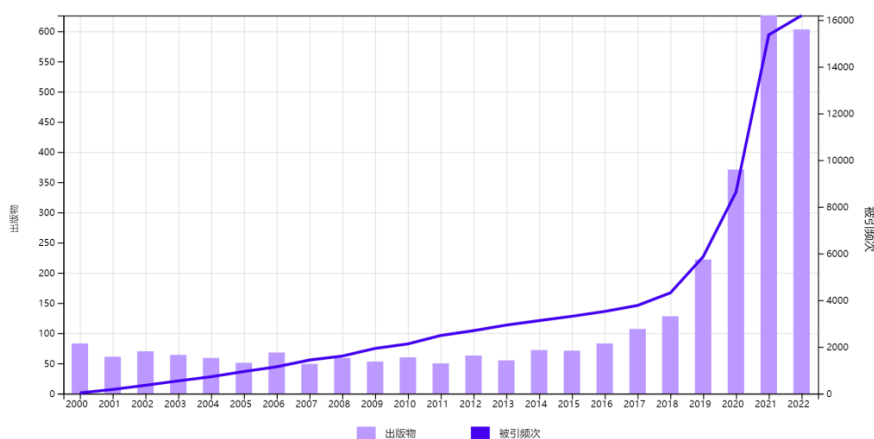


Figure 3 ENGLAND Journal Citation Reports.

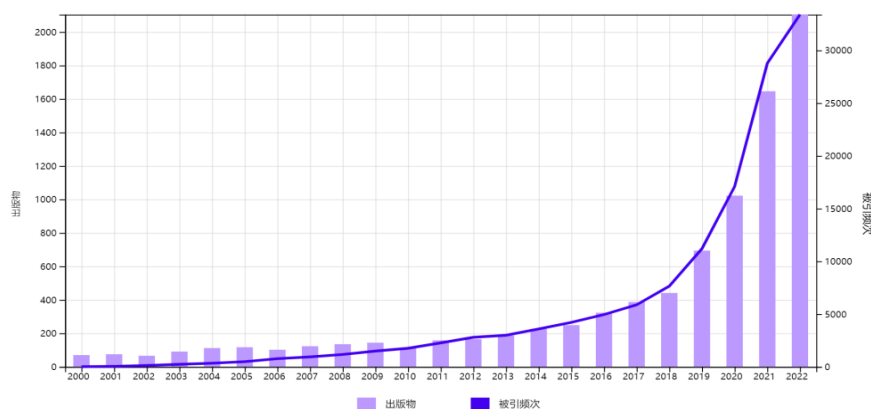


Figure 4 CHINA Journal Citation Reports.

3. Analysis of Chinese Artificial Intelligence Research Hot Topic

The key words in the literature are a high summary and concise summary of the literature topic. Through the analysis of the co-occurrence map of the keywords, we can clearly grasp the research hot spots and key content in a certain field. This article collected literature and conducted statistics. Then gets 155 effective keywords. In order to more accurately and intuitively reveal the hot spots distribution of domestic artificial intelligence research topics, this paper uses VOS viewer software to draw the keywords co-occurrence analysis knowledge map. The minimum frequency of associated words was set to 40. The knowledge map of keywords co-occurrence drawn using VOS

viewer software is shown in Picture5. Domestic research on artificial intelligence can be divided into four themes: artificial intelligence+biology, artificial intelligence+medicine, artificial intelligence+materials and artificial intelligence+internet.

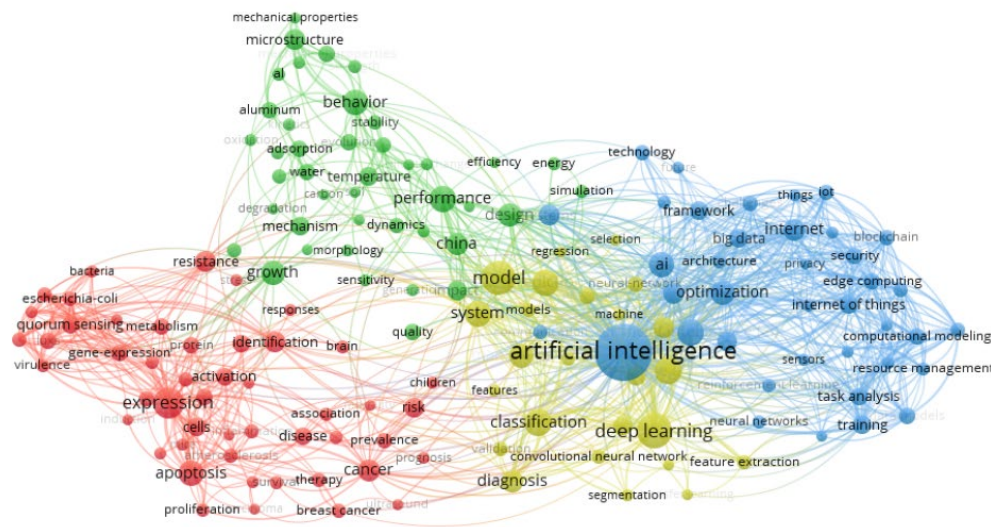


Figure 5 PEOPLES R CHINA Knowledge Map of Keywords Co-occurrence.

3.1. Artificial Intelligence+Biology

Take flow cytometry data analysis for example. More attempts have been made to solve the flow cytometry data analysis problem.[3-4] Many FCM-specific algorithms, such as SPADE, FlowSOM, and PhenoGraph, have also been developed for MFC data processing.[5-6] However, clinical MFC data analysis still heavily depends on the manual logic gate strategy with conventional flow cytometry analysis software, and the detection efficiency is highly reliant on the examiners' experience.[7] In addition, it is difficult to separate and set the gate for cells with high-dimensional data because the manual logic gating is limited to two-dimensional scattered plot combinations. Moreover, it is difficult to consistently measure the numerical expression levels of various antigens in the multidimensional space of the target cell group.[8] Therefore, there is a strong need for a flow cytometry analysis methodology that is exempt from the human factor and can simultaneously analyze multiple cell groups and their antigen expression levels in a multidimensional space so that leukemia cells can be detected more consistently and objectively. With the fast evolution of artificial intelligence technology and its applications in medicine in recent years, this goal has become possible.

As reported, artificial intelligence has been used in the prognosis of breast cancer and gastric cancer, as well as the diagnosis of colorectal cancer and the differential diagnosis of malignant or benign masses in the breast.[9] Moreover, the accuracy measure for the classification task has improved, owing to the use of the automatic analysis of hematoxylin- and eosin stained histological images.[10] Therefore, artificial intelligence-based clinical cancer research has resulted in a paradigm shift in cancer treatment. It is logical to expect that such advances of artificial intelligence technology will help solve the challenges of cancer prognosis and diagnosis. A clinic-orientated artificial intelligence-assisted diagnosis workflow can perform automatic data analysis with not only the final diagnostic results, but also human-understandable and editable intermediate steps. [11]

3.2. Artificial Intelligence+Medicine

How to efficiently organize, integrate, understand and analyze these big data to provide help for medical professionals is a current scientific problem, and the emergence of artificial intelligence has solved this difficulty well. [12] With the advancement of machine learning techniques, particularly deep learning and neural networks, for example, artificial intelligence has shown promise in the diagnosis, treatment, and prognosis of pancreatic cancer.[13] Support vector machine (SVM) algorithm was used to analyze RNA-SEQ data to identify biomarkers for early diagnosis of

pancreatic ductal adenocarcinoma (PDAC) .[14]

Endoscopic ultrasonography (EUS) and computerized tomography (CT) images were analyzed by artificial neural network (ANN), convolutional neural network (CNN), and other artificial intelligence techniques in imaging diagnosis, which can better predict the diagnosis of pancreatic cancer and effectively reduce the influence of experience and subjective factors on accuracy.[15-17] Furthermore, an artificial intelligence model based on preoperative CT was able to accurately predict the occurrence of postoperative pancreatic fistula (POPF) clinical complications following pancreaticoduodenectomy (PD) surgery, especially at the intermediate risk level.[18] The artificial intelligence system could help surgeons optimize their preoperative strategies. artificial intelligence is rapidly changing the field of medicine.

3.3. Artificial Intelligence+Chemistry

Recent years have seen great success in developing artificial intelligence methods for organic retrosynthesis; second, the general validity of the octet rule in describing elementary organic transformation. It is thus possible to relate an organic reaction to the reactant and product using numerical descriptors, such as Simplified Molecular Input Line Entry Specification⁵⁷ (SMILES) and Extended-Connectivity fingerprints⁵⁸ (ECFP) where the bond order matrix can be used to detect the structural change. On the other hand, the situation in heterogeneous catalysis is rather different. The reaction steps occurring on surfaces are numerous and generally not separable until the final products are obtained. It is no wonder that the reaction database for heterogeneous catalysis is not established from experiment, not even mentioning the artificial intelligence-based reaction prediction based on the heterogeneous reaction database. Herein we propose a general artificial intelligence framework for predicting heterogeneous catalysis activity, namely the artificial intelligence-Cat method. This method which uses artificial intelligence provides a one-go solution, from the building of a heterogeneous catalytic reaction database, to the end-to-end activity prediction using machine learning.

3.4. Artificial Intelligence+Internet

Emerging information technology has become the key to promoting the modernization of network governance capacity. The application and development of artificial intelligence technology will bring the human society from the era of mobile Internet to the era of intelligent Internet. In terms of the application and influence of artificial intelligence technology in the development of the Internet, some scholars have proposed to study the basic composition of the network governance system from the perspective of intelligent ecology, and believe that artificial intelligence plays an important role in providing technical support and building an Internet credit environment.[19] There are scholars for the application of artificial intelligence in the field of network communication, explore big data, algorithm technology, intelligent identification technology in the network social emotional guidance and network public opinion advantages and the existing problems in the ecological governance of[20], from technology, open source, classification, location and data dimension analysis of artificial intelligence social media information application in the process of the processing of.[21] In addition, some scholars have carried out research on the construction of[22] intelligent ecological network comprehensive management system, the promotion of media convergence with artificial intelligence technology, and the construction of emerging media ecological.[23] Scholars generally believe that the development of artificial intelligence will lead to the advent of the intelligent Internet era. It is necessary to establish a new era of laws, legal concepts and legal system, and promote the transformation and upgrading of the existing Internet legal system and rules of .[24-25]

4. Analysis of British Artificial Intelligence Research Hot Topic

This article collected literature and conducted statistics. Then gets 41 effective keywords. In order to more accurately and intuitively reveal the hot spots distribution of domestic artificial intelligence research topics, this paper uses VOS viewer software to draw the keywords co-

4.3. Artificial Intelligence+Algorithm

Scholars generally believe that the ethics of artificial intelligence will play an important role in the sustainable development of artificial intelligence in the future, restricting its development of.[31]Artificial intelligence ethical issues arise from algorithms and technology applications. Some scholars believe that the machine deep learning of artificial intelligence is a "black box", and the opacity and complexity of the algorithm will produce ethical problems.[32]Algorithms are also value-oriented. The problem lies in how to embed the value orientation and ethical norms advocated by people. In the algorithm, only algorithmic governance can ensure that the future of human beings is not threatened by the acceleration of technological innovation.[33]With the development of artificial intelligence technology, the ethical issues of algorithms receive increasing attention by legal scholars and social scientists.

4.4. Artificial Intelligence+Chemistry

From medicines to materials, small organic molecules are indispensable for human well-being. To plan their syntheses, chemists employ a problem solving technique called retrosynthesis. In retrosynthesis, target molecules are recursively transformed into increasingly simpler precursor compounds until a set of readily available starting materials is obtained. Computer-aided retrosynthesis would be a highly valuable tool, however, past approaches were slow and provided results of unsatisfactory quality. Here, we employ Monte Carlo Tree Search (MCTS) to efficiently discover retrosynthetic routes. MCTS was combined with an expansion policy network that guides the search, and an "in-scope" filter network to pre-select the most promising retrosynthetic steps. These deep neural networks were trained on 12 million reactions, which represents essentially all reactions ever published in organic chemistry. Our system solves almost twice as many molecules and is 30 times faster in comparison to the traditional search method based on extracted rules and hand-coded heuristics. Finally after a 60 year history of computer-aided synthesis planning, chemists can no longer distinguish between routes generated by a computer system and real routes taken from the scientific literature. We anticipate that artificial intelligence method will accelerate drug and materials discovery by assisting chemists to plan better syntheses faster, and by enabling fully automated robot synthesis.

5. Conclusion

The Chinese academic community carries out a wider range of research topics and a more detailed and in-depth research perspective. In terms of the relevant theoretical basis involved, although the Chinese-British artificial intelligence research mainly focuses on governance theory and technology ethics theory. But by comparison, Chinese artificial intelligence governance research involves more diverse theories, in addition to the governance theory and technology ethics, it is found from the analysis of the literature content that the relevant research in the China also involves the cognitive theory, the multi-disciplinary theories, such as responsible innovation and technical sociology, can be reversed, reflecting that the research of artificial intelligence governance in the China has involved a wider range of theoretical basis and disciplinary scope.

In this study, the bibliometric method took the Web of Science core set database as the data sources, measured and visually analyzed the sample literature collected by Chinese and British scholars on artificial intelligence governance research, and summarized and summarized the relevant knowledge. The main conclusions are summarized as follows: First, through the analysis of the characteristics of the collected sample literature data, it is found that: the number of research literature on artificial intelligence governance in China and the England is on an increasing trend, especially in the past two years, the research heat has increased significantly in the past two years. Second, In terms of research types, most of the artificial intelligence governance studies in China and the England are normative studies, but relatively speaking, there are many empirical studies carried out in the China, and the selection of research methods shows a diversified development

trend. In contrast, the research on artificial intelligence governance in the British involves a wider range of theoretical bases and disciplines.

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