Retraction

Retraction: Analysis on the Competitiveness of Global Agricultural Remote Sensing Research Based on Artificial Intelligence Technology (J. Phys.: Conf. Ser. 1852 032046)

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The authors of the article have been given opportunity to present evidence that they were the original and genuine creators of the work, however at the time of publication of this notice, IOP Publishing has not received any response. IOP Publishing has analysed the article and agrees there are enough indicators to cause serious doubts over the legitimacy of the work and agree this article should be retracted. The authors are encouraged to contact IOP Publishing Limited if they have any comments on this retraction.

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Analysis on the Competitiveness of Global Agricultural Remote Sensing Research Based on Artificial Intelligence Technology

Bing Bai1, Jianjun Wang1, Shujiao Tian1, Xiuyuan Peng1,*
1Institute of Information, Liaoning Academy of Agricultural Sciences, Shenyang 110161, Liaoning

*Corresponding author email: pengxiuyuan@lnas.org

Abstract. In order to accelerate the overall progress of digital agriculture, fully grasp the global agricultural remote sensing research, and support the basic application research of global agricultural remote sensing, this paper uses Web of Science as the data resource, adopts bibliometrics and artificial intelligence methods, and Excel, VOSviewer and other tools are used to provide a comprehensive analysis of SCI journal articles on global agricultural remote sensing research in terms of the overview of article publication, institutions, authors, and topics.

keywords: Agricultural remote sensing, Cooperation analysis, Competitive Analysis

Agricultural remote sensing refers to the use of sensors mounted on different remote sensing platforms such as aerospace, aviation, and ground to obtain electromagnetic spectrum signals of agricultural objects, and the use of computer, geography, agronomy and other multi-disciplinary theories and technical methods, reveal the quantity, attributes and temporal and spatial characteristics of agricultural features, ecological environment and production processes[1].

In recent years, with the emergence of various civil satellites with high-space, temporal, and spectral resolution satellites, quantitative remote sensing technology has further developed. Agricultural remote sensing and geographic information system, global navigation technology and Internet of Things technology continue to integrate. The breadth and depth of remote sensing applications in agriculture continues to expand. And played an important role in agricultural resource survey, biological yield estimation, agricultural disaster monitoring, etc. The application of remote sensing is gradually becoming the basic key technology of agricultural science[2-5]. Judging from the increasing of the number of relevant papers included in SCI databases, in recent years, the global research on agricultural remote sensing has continued to deepen. This phenomenon can provide an in-depth understanding of the development status of the global agricultural remote sensing research field, and provide guidance for relevant scientific researchers and management decision makers.

1. Data sources and research method

1.1. Data sources
Web of Science database has been selected as this paper's data source. And the types of papers involved are ARTICLE and REVIEW. Search formulas are constructed to obtain 16552 papers of relevant core journals. After manual screening and data cleaning by software, irrelevant and incomplete papers were removed, and 4436 papers were finally included as the final research data set. The retrieval time is September 15, 2020.

1.2. Research method
This paper comprehensively uses the methods of bibliometrics, as well as the methods of data mining, social network, visual display, and information analysis. With the help of tools such as VOSviewer\cite{6}, HistCite Pro and Excel, the total annual distribution of the total number of documents, national competitiveness, institutions, authors, and research directions of all agricultural remote sensing documents included in Web of Science are analyzed. Especially for the topic analysis, the keywords such as title, abstract and authors are used to get core keywords, and perform keyword map analysis to reveal information about research hotspots, topic structure changes and transfer trends in related fields.

2. Results and analysis

2.1. Overview of global publications
Global research in the field of agricultural remote sensing began in the 1960s and 1970s. According to the selected papers, the global publication profile analysis has been carried out. Since 1991, relevant research has gradually increased. As of today, it can be roughly divided into three stages: budding stage, growth stage, and fluctuating growth stage. It has reached a rapid development state, as shown in Fig 1.

![Figure 1. Annual distribution of global number of papers, authors and institutions](image)

2.2. Analysis of national competitiveness

2.2.1 Analysis of National Productivity
The number of papers issued by countries in the field of agricultural remote sensing can intuitively reflect the country's development in the field of agricultural remote sensing. Global agricultural remote sensing research papers are distributed in 129 countries, of which the countries with a large amount of papers are mainly concentrated in Asia, Europe, and South America, North America, Oceania and other places. In this study, the top 20 countries in the field of agricultural remote sensing are the research objects of high-productivity countries. And the total number of posts and the proportion of the first/corresponding author posts are analyzed. As shown in Figure 2, there is a huge gap in productivity between countries. Agricultural remote sensing research is small-scale clustered. The United States, China, India, Germany, and Italy are important producers in this field, while China, India, Germany, South Korea, Italy, Brazil, and Turkey Other countries have strong independent
research capabilities in the field of agricultural remote sensing.

2.2.2. Analysis of national cooperation

65 countries with more than 10 papers in the field of agricultural remote sensing are used as research objects in this paper. As shown in Figure 3, VOSviewer software is used to analyze the cooperation network between various countries. It can be found that the national cooperation network has formed two types of academic communities, they are: (1) The academic community with the United States, China and India as the core, including Australia, the Netherlands, France, Brazil, Iran, Malaysia, Egypt, South Korea and other countries. These countries are mainly concentrated in North America, Asia, Europe, Oceania, Africa and other regions. (2) The academic community with Italy, Germany, Spain as the core, including Japan, Britain, Belgium, Israel, Switzerland, Austria and other countries, these countries are mainly concentrated in Europe, Asia and other regions.

Figure 3. Country partnership chart
2.3. Analysis of Institutional Competitiveness

2.3.1. Analysis of Institutional Productivity
Research the agricultural remote sensing field with more than 40 high-production institutions, and conduct statistical analysis on the total number of papers published, the number of first/corresponding authors and their proportions, and their country distribution. As shown in Figure 4, there is a large gap in productivity among various institutions. The Chinese Academy of Sciences and the Italian National Research Council are important output institutions in the field of agricultural remote sensing. The United States Department of Agriculture, the Italian National Research Council and the Canadian Department of Agriculture and Agri-Food and other institutions have strong independent research capabilities in the field of agricultural remote sensing. The United States has a large number of high-productivity institutions.

![Figure 4. Comparison chart of various publication volumes of high-productivity institutions](image)

2.3.2. Analysis of Institutional Cooperation
Top 20 institutions are taken with the largest number of publications as the research objects, the frequency of inter-institutional cooperation as an indicator, a matrix of institutional cooperation relationships are established in this paper. According to the matrix, the cooperation network between various institutions was constructed with VOSviewer software. As shown in Figure 5, there is close cooperation between institutions in the field of agricultural remote sensing. The institutional cooperation network can be divided into four major academic communities, namely, the academic community with the University of Science and Technology of China as the core, the academic community with the USDA as the core, the academic community with the University of Putra Malaysia as the core, and the academic community with the Indian Institute of Technology as the core. It can be seen from the results that institutions in the field of global agricultural remote sensing research have close cooperation and strong cooperation.
2.4. Analysis of Scholars' Competitiveness

2.4.1. Analysis of Scholar Productivity

Taking the top 18 scholars with 15 papers or more in the field of agricultural remote sensing as the research objects of high-productivity scholars, a statistical analysis of the number of articles published, the amount and proportion of first/corresponding authors, and the distribution of institutions and countries is carried out. It can be seen from Table 1 that China has the largest number of highly productive scholars, but the productivity gap between scholars is obvious. Among all the research objects, Pradhan Biswajeet has the highest productivity, and scholars such as Lobell De, Pourghasemi Hr, and Zhang Ying have strong independent research capabilities in the field of agricultural remote sensing.
**Table 1.** List of high productivity scholars

| Author                  | Total number of posts | Number of first/corresponding authors | Percentage of first/corresponding author papers | Mechanism                          | Country       |
|-------------------------|-----------------------|---------------------------------------|-------------------------------------------------|-----------------------------------|---------------|
| Pradhan, Biswajeet      | 84                    | 20                                    | 23.8                                            | University of Technology Sydney   | Australia     |
| Wang, Jing              | 28                    | 8                                     | 28.5                                            | Zhe Jiang Univ                    | China         |
| Huang, Wenjiang         | 26                    | 3                                     | 11.5                                            | Chinese Acad Sci                  | China         |
| Zhang, Ying             | 24                    | 9                                     | 37.5                                            | Nanjing Normal University         | China         |
| Lopez-Granados, Francisca | 22                  | 2                                     | 9                                               | CSIC                              | Spain         |
| Bareth, Georg           | 20                    | 2                                     | 10                                              | Univ Cologne                      | Germany       |
| Li J                    | 19                    | 2                                     | 10.5                                            | Nanjing Normal University         | China         |
| Pourghasemi Hr          | 19                    | 8                                     | 42.1                                            | Shiraz University                 | Iran          |
| Liu Y                   | 18                    | 2                                     | 11.1                                            | Chinese Acad Sci                  | China         |
| He Y                    | 17                    | 1                                     | 5.8                                             | Zhe Jiang Univ                    | China         |
| Lobell Db               | 17                    | 10                                    | 58.8                                            | Stanford University               | USA           |
| Schmidhalter U          | 17                    | 0                                     | 0                                               | Technische Universität München    | Germany       |
| Huang Jf                | 16                    | 0                                     | 0                                               | Zhe Jiang Univ                    | China         |
| Wang Jh                 | 16                    | 0                                     | 0                                               | Chinese Acad Sci                  | China         |
| Wang Y                  | 16                    | 1                                     | 6.2                                             | Beijing Normal University         | China         |
| Yang J                  | 16                    | 5                                     | 31.2                                            | Wuhan University                  | China         |
| Miao Yx                 | 15                    | 0                                     | 0                                               | China Agr Univ                    | China         |
| Wang L                  | 15                    | 4                                     | 26.6                                            | Zhejiang Academy of Agricultural Sciences | China         |

2.4.2. Analysis of Scholar Cooperation

163 scholars who published more than 5 papers in the field of agricultural remote sensing are used as the research objects, and the cooperation frequency between scholars is used as an indicator to establish a matrix of scholar cooperation relations. According to the matrix, the VOSviewer software is used to build a cooperation network among scholars. As shown in Figure 6, the cooperation network in this field can be divided into 14 cooperation groups, among which there are 3 teams with less than 10 scholars, namely: (1) A cooperative team of the University of Technology Sydney in Australia and Shiraz University in Iran with Pradhan Biswajeet and Pourghasemi Hamd Reza as the core, (2) The cooperation team of the German Institute of Geology with Bareth Georg and Schmidhalter Urs as the core and the team of the Technical University of Munich in Germany, (3) A cooperative team of the Chinese Academy of Sciences and Beijing Academy of Agriculture and Forestry with Huang Wen Jiang, Yang Gui Jun and Wu Bing Fang as the core.
2.5. Analysis of research topics

As shown in Figure 7, the VOSviewer software is used for cluster analysis. Research in the field of global agricultural remote sensing is mainly divided into three themes, namely crop monitoring (green), resource monitoring (red) and disaster monitoring (blue).

Figure 6. Analysis of scholar cooperation

Figure 7. Global agricultural remote sensing keyword clustering
Separately extract the keywords of the above three topics, construct and analyze the topic data sets respectively. According to the analysis results, in terms of crop monitoring research, the researcher mainly studies crop planting area monitoring, crop condition monitoring, crop yield estimation, soil moisture monitoring, crop disease and insect pest monitoring and forecasting. In addition, research on resource monitoring and disaster monitoring topics is also carried out.

3. Conclusion
In this paper, the bibliometric method and the knowledge graph method of artificial intelligence are used to study the research overview, object competitiveness and cooperation, authors, and research topics in the field of global agricultural remote sensing. The main conclusions are as follows:

From the perspective of global development, agricultural remote sensing research can be divided into three stages of development: the eruption period, the growth period, and the volatile growth period. The academic community can be divided into the academic community centered on the United States, China and India, and the academic community centered on Italy, Germany, and Spain.

From an institutional perspective, the Chinese Academy of Sciences, the United States Department of Agriculture, the Italian National Research Council, the Indian Institute of Technology, Canadian Agriculture, the Department of Agriculture and Food, and the United States Academy of Agricultural Sciences are important output institutions in the field of agricultural remote sensing. The entire institutional cooperation network can be divided into an academic community centered on the University of Science and Technology of China, an academic community centered on the USDA, an academic community centered on Putra University Malaysia, and an academic community centered on the Indian Institute of Technology.

From the perspective of scholars, China has the largest number of highly productive scholars, and the productivity gap between scholars is obvious. Scholars such as Lobell De, Pourghasemi Hr and Zhang Ying have strong independent research capabilities in the field of agricultural remote sensing. 14 author cooperation networks have been formed in this field.

From the perspective of themes, there are three main themes in the field of agricultural remote sensing, namely crop monitoring, resource monitoring and disaster monitoring. These three themes have always been important research objects in the field of agricultural remote sensing.

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