

# Analysis of Scientific Papers Research Trend Based on Granular Computing

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## *Abstract*

*The purpose of this paper is to deal with the data in large document databases, analyzes the research trend of scientific papers and research hot spots. There is practical significance to promote the development of science and technology in China in order to provide effective methods and tools for the researchers.*

**Keywords:** *Granular Computing, Scientific Papers Research, Research Trend*

## **1. Research Status on Analysis of the Research Trend of the Scientific Paper**

Scientific thesis embodies the research results of various disciplines in the field, is a scientific summary of various theories and methods. With the popularization and ripeness of the internet, the era of the great explosion of the information has already come. With the growing of the number of scientific papers at an alarming rate, that leads to the emergence of various digital libraries and literature database (such as Chinese science paper online). Mining and analysis related to these massive data has been the focus of many scientific researchers. [15] The literature from a variety of database, the analysis of dynamic interdisciplinary science paper changed in each historical period (research trends) over time.

At present, it is well known that America ITDT (Interactive Topic Detection and Tracking) is a research project in the field of analysis and discovery [1], in order to deal with the increasingly severe for Internet information explosion problem. The domestic good system is that public sentiment warning assistant decision Support System (ZHISI) in Beijing University FANGZHENG Institute of technology. It successfully realizes automatic and real-time monitoring for Internet public sentiment. This aspect of the theory and technology is mainly applied in the hot news, hot network information finding and tracking, but applied in the analysis of technology research hot spot and trend of research on the less.

## **2. The Significance of the Research Trend Analysis of Scientific Papers**

According to domestic and foreign literature research, the analysis of the literature research trend mainly based on keywords frequency statistics of literature metrology. The Metrology is an important theoretical tool [16] to analyze the literature trend, which uses mathematical and statistical methods to describe the current situation and development trend, evaluation and forecast of science and technology.

At present, the research trends of scientific papers have many problems at home and abroad. It mainly includes the following aspects:

1. Somewhat lacking in large-scale data processing;
2. Can not be effective for large-scale literature database processing;

3. Limited to specific fields;
4. The lack of interdisciplinary collaboration in research theory and method;
5. The analysis method is single, the more based on keywords, the less for the content.

In the development of science and technology, the traditional natural science has been further subdivision and development, the new disciplines constantly produce. The integration trend of interdisciplinary gradually increase, the discipline development tends to be integration. In this paper, it is based on the granular computing [2] technology, we adopted the related technologies (such as automatic keyword extraction, text clustering[3], text classification [4] and so on) in text mining and processed data for all kinds of large-scale science and technology literature database (such as Chinese science paper online). Thus found the prediction of hot research topics of scientific papers, and the formation of automatic analysis and forecasting system.

### **3. The Research Content of the Research Trend Analysis of Scientific Papers**

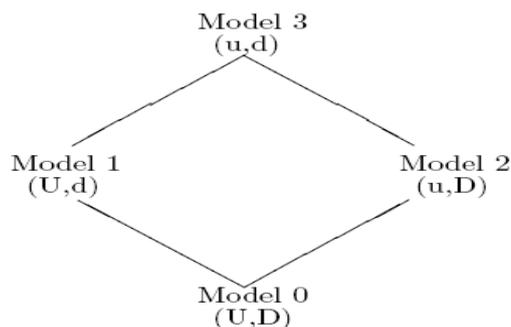
This research intends to combine theory with experiment, which based on granular computing, adopted the idea of modularization. We constructed test knowledge base based on the electronic resources of Harbin Institute of Technology library, which contains all the metadata including the title, source, author, keywords, abstract, text, references, *etc.* The foundation based on the metadata of the knowledge base, which research the papers of development trend and hotspot detection

#### **3.1. Granular Computing (GrC)**

As Granular computing (GrC) is a newly developed technique which has been drawn attention by researchers. [5] It is an umbrella term to cover any theories, methodologies, tools and techniques that make use of granules in problem solving. [17] Basic ingredients of granular computing, *i.e.*, granules, are subsets, classes, and clusters of a universe. They have been considered either explicitly or implicitly in many other fields, such as data and cluster analysis, database and information retrieval, concept formation, and machine learning. [5-6] in data mining and classification problems, we can view equivalence classes as granules [18].

#### **3.2. The Four Models of Information Retrieval Systems**

Following the study of probability of relevance information retrieval can be formalized into four models as shown in Figure 1. [19] Let  $u$  be a single user,  $U$  a class of users,  $d$  a document and  $D$  a class of documents, these four models and relationships among them can be depicted as in Figure 1. [19] Granulation of a universe involves the decomposition of the universe into parts, or the grouping of individual elements into classes, based on available information and knowledge. Elements in a granule are drawn together by in distinguishability, similarity, proximity or functionality. [6] Using techniques and principles of granular computing, one can study these models from granulation point of view, *i.e.*, grouped and personalized views should be also studied. Model 1 and Model 2 are considered as finer granulation than Model 0. The elements of these two models are granules of the elements of Model 0. The same principle applies to other models. Model 3 is the finest granulation; Model 0 is the coarsest granulation.



**Figure 1. Information Retrieval Models**

### **3.3. The Keyword Extraction of Scientific Papers**

In a variety of scientific paper database, there are large amounts of data to be managed by order. Wherein the absence of a certain amount of paper keyword, so that the data is not complete, and cannot carry on the statistical analysis based on keywords, then that affects the accuracy of the analysis result. At the same time, wherein also exist some noisy keywords or keywords quantities too small, so the paper characteristics are not well represented. For these cases, this paper will research papers trend based on keyword extraction techniques.

### **3.4. Scientific Papers Research Trend Analysis**

Each time the same disciplines have different hotspot of study. The paper will study about the automated analysis techniques of development trend of thesis. So forming an analysis report provides a useful reference for the analytical work of scientists. During the same period in various disciplines, the scientific papers will express in hotspot that a large number of published scientific papers similar research this time. In this period of discovery research papers hotspot, may be used text clustering techniques. The class which contains the number of documents can be considered the hotspot of this period, the appropriate category features express in the hotspots.

### **3.5. Technology Thesis Trend Analysis and Forecasting System**

We will accomplish the automatic analysis forecasting system of scientific papers research trends, this system has the following characteristics:

1. The system is stable and efficient;
2. The system can automatically run;
3. Suitable for a variety of literature database;

## **4. Analysis of Research Process**

This research project sets up a test knowledge base based on the electronic resources of the Harbin Institute of Technology library, which contains all the metadata including the title, source, author, keywords, abstract, text, references, etc. On the basis of the papers metadata in the knowledge base, we have studied the paper trend and hotspot detection. The automatic analysis system is based on the keywords. The system flow chat is as follows:

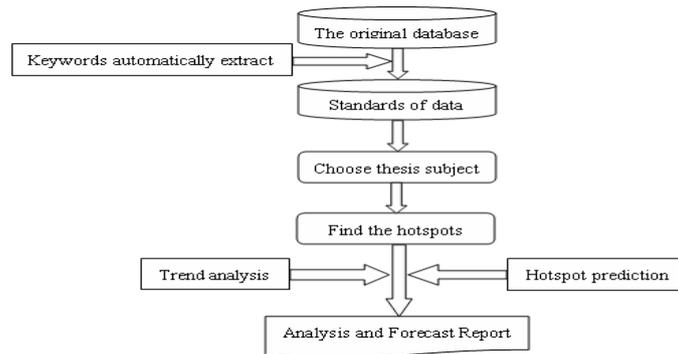


Figure 2. The System Flow Chat

#### 4.1. Create a Metadata Database of Papers

The all databases in have been integrated into a metadata knowledge base, the following is the management platform of knowledge base.

The knowledge base of HIT				
Database	Code	State	Supplier	
2011 Cambridge Journals Digital Archive - CJDA Full Collection	-2P	Subscribed		Cambridge University Press
Academic Search Premier	EAP	Subscribed		EBSCOhost
ACM Digital Library	ACM	Subscribed		ACM Digital Library
AIAA Conference Proceedings	AEL	Subscribed		American Institute of Aeronautics and Astronautics
Allen Press Journals	Y3D	Subscribed		Allen Press, Inc
American Chemical Society Web Editions	ACS	Subscribed		American Chemical Society
American College of Physicians	TPH	Subscribed		American College of Physicians
American Institute of Aeronautics and Astronautics Publications	RAA	Subscribed		American Institute of Aeronautics and Astronautics
American Institute of Physics (AIP) Publications	RIP	Subscribed		American Institute of Physics
American Physical Society Journals	3MX	Subscribed		American Physical Society
AMS Books Online (Freely Accessible)	9L9	Subscribed		American Mathematical Society
Annual Reviews 1996 - present	1KX	Subscribed		Annual Reviews
Arts & Humanities Citation Index	AKT	Subscribed		Thomson Reuters
arXiv Computer Science	AKY	Subscribed		Cornell University
arXiv Mathematics	AKZ	Subscribed		Cornell University
arXiv Nonlinear Science	ALA	Subscribed		Cornell University
arXiv Physics	ALB	Subscribed		Cornell University
arXiv.org	G0X	Subscribed		Cornell University
ASABE Technical Library	RAE	Subscribed		American Society of Agricultural and Biological Engineers
ASCE Conference Proceedings	RWO	Subscribed		American Society of Civil Engineers
ASCE Library	RAC	Subscribed		American Society of Civil Engineers
ASME Proceedings (Archives)	SDN	Under Review		American Society of Mechanical Engineers
ASME Transactions Journals (Current)	RAI	Subscribed		American Society of Mechanical Engineers
Bentham Science Journals	GH2	Subscribed		Bentham Science Publishers
BioOne Abstracts & Indexes	7QN	Subscribed		ProQuest

Figure 3. The Management Platform of Knowledge Base

#### 4.2. The Standard of Data Format

According to the norms format of the knowledge base, we automatically extract data from each database so that forming a metadata repository. When retrieving data, retrieve metadata repository directly, no longer access to the original database.

#### 4.3. Choose Thesis Subject

In the metadata repository, may select the corresponding discipline, then to retrieval metadata abased on the keywords.

#### 4.4. Research Trends and the Hot Spot Analysis

Analysis of the retrieval results, it is concluded that the analysis report.

#### 4.5. Examples

Such as the search key words in the field of computer: “Java and database”, the retrieval results as follows:

1. The retrieval results include 349 records. The retrieval time is from 1994 to 2014. Figure 4 shows the articles in each issue every year.

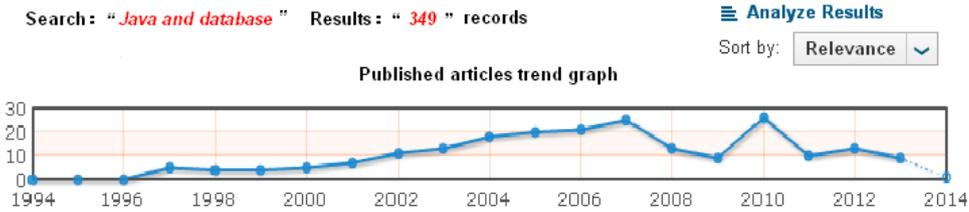


Figure 4. Published Articles Trend Graph

2. Through the analysis, the following analysis results are obtained. Figure 5 shows the knowledge related to the keywords "java and database". Figure 6 shows the article number in journal issue every year. Figure 7 shows the article in dissertation issue every year.

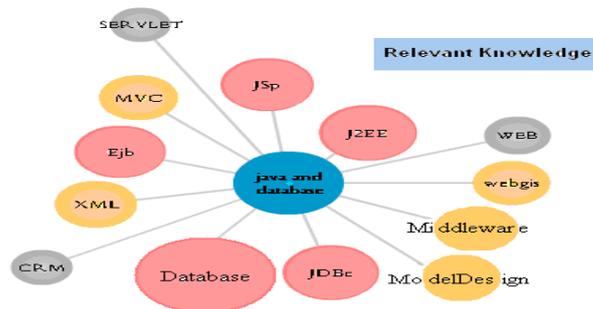


Figure 5. Relevant Knowledge

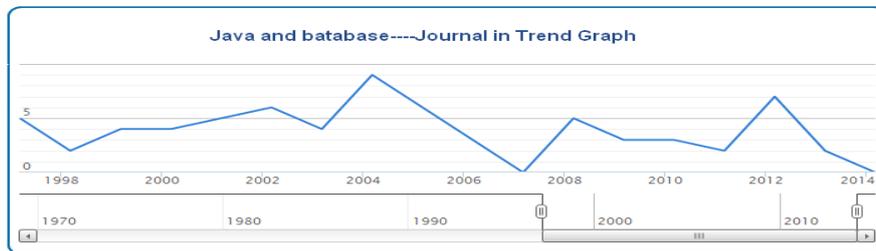


Figure 6. Journal in Trend Graph

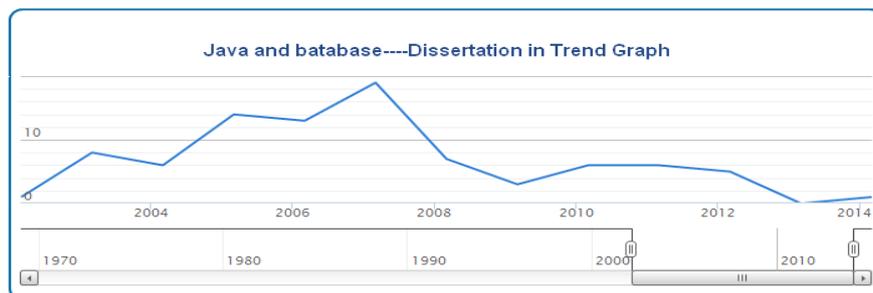


Figure 7. Dissertation in Trend Graph

## 5. Conclusion

In the paper, this project realizes the automatic extraction of keywords, automatically; get the retrieval results and automatic analysis of the retrieval results. Study on the trend of the research of this project can effectively analyze and predict

the various disciplines of a research trend, for scientific research workers to provide accurate basis for scientific research.

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