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Research Trend Analysis – A sample in the Field of Information Systems

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***Abstract*—**As research performance in academia is treated as one of indices for national competency, many countries devote much attention and resources to increasing their research performance. Understand the research trend is the basic step to improve the research performance. The goal of this research is to design an analysis system to evaluate research trends from analyzing data from different countries. In this paper, information system researches in Taiwan and other countries, including Asian countries and prominent countries represented by the Group of Eight (G8) is used as example. Our research found the trends are varied in different countries. Our research suggested that Taiwan's scholars can pay more attention to interdisciplinary applications and try to increase their collaboration with other countries, in order to increase Taiwan's competency in the area of information science.

***Keywords*—**Bibliometric Analysis, Research trend, Scientometric Analysis

I. Introduction

WITH the growth of worldwide dissemination of research and global competition, academic research performance was treated as one of the indexes of national competency, so countries are paying more attention to their academic research performance [1]. Nevertheless, scholars within specific disciplines are sometimes confused with more popular subjects. A comprehensive method of analysis would help scholars who are already involved in this area or who wish to get involved this new area to evaluate and understand the research performance in a given discipline. To evaluate a country's research performance within a specific discipline can give scholars a point of reference for their research performance. There are two ways to assess a country's academic research performance. First, observe the numbers of papers produced and the overall contribution in the discipline; second, observe their impact on the discipline or refer to citation counts or index such as the impact factor [2].

Bibliometric Analysis [3],[4] is a mathematical or statistical method to organize, classify and quantize any kind of publication[5]. Similar to Bibliometric analysis, Scientometric Analysis [6][7] is a process to evaluate research performance[8]. Scientometric analysis classifies disciplines and compares the quantity and characteristics of research performance in one country with those of other countries. Therefore, both bibliometrics and scientometrics are methods of analysis that use publication to evaluate scientific output. They can examine research performance within specific discipline and also compare different countries' scientific production.

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This paper discusses popular topics that can help scholars understand research trends. Our analysis targets the academic research performance for a country or regional groups in a discipline, observes its development over the years, and compares it with prominent countries that serve as examples of strength and weakness in this area.

II. Data Source

This paper used data abstracted from the Institute for Scientific Information (ISI) database. ISI offers a large amount of scholarly literature in the sciences, social sciences and humanities; most of the articles are presented in English. Our research accessed the raw material, sorted by nations, and gathered articles accepted by SCI or SSCI. The literature categories follow the ISI definition, and the analysis covers the period of five years (2002~2006). This paper focuses on Taiwan and compares it with neighboring countries. In East Asia, we took China, Japan, Korea and Singapore. We separated Hong Kong from China for historical reasons. We considered India because of its potential in computer science. Our research supposed that prominent countries demonstrate research trends and we took the Group of Eight (G8) as prominent representatives. The G8 countries are England, USA, Germany, France, Japan, Russia, Italy and Canada. Therefore, we have a total of 14 observations. We choose computer science as our target discipline for the following reasons. First, Taiwan's government has placed a high priority on the development of computer science, and the discipline requires many hi-tech talents. Thus, there are many computer science-related departments in colleges and universities. According to Taiwan's Ministry of Education, most students in Taiwan major in science or related subjects rather than the humanities and social sciences. Second, the production in many areas in Taiwan is growing, and the growth rate in computer science is constantly rapid. So we are interested in the development of computer science in Taiwan.

III. Methodology

This method uses the frequency of keywords in each paper to observe the trends. The keywords are proposed by the article authors, and we observe the most popular topics of discussion over the years. After filtering the keywords from papers, we stem and sort the frequencies. There are many sub categories in computer science; in our research we collect them all, and show the 20 most common ones in the lists.

We divide our observations into the following sections

1) Trends within a given country: abstract keywords from the specific country over the years to discuss its research trends.
2) Regional trends: abstract the trends from a specific country and compare with neighboring countries to discuss regional research trends.

3) Trends in advanced countries: abstract keywords from the papers produced in developed countries to discuss the research trends.

IV. Results And Discussion

Keywords analysis can reveal the popular research topics in different countries, and our study abstracts the top 10 keywords in Taiwan from 2002 to 2006. Fig. 1 shows the top 10 keywords from every year in Taiwan, and we and see that recently Taiwan has been focused on cryptography, data mining, fuzzy sets, genetic algorithms, neural networks. Algorithms, clustering, knowledge management, wireless network, association rules, and fault tolerance are perpetually common topics.

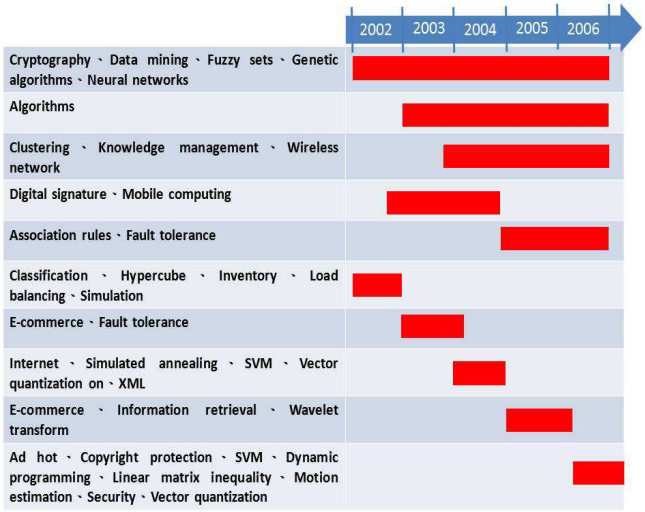

Fig. 1 Popular subjects in Taiwan

Digital signature, mobile computing, association rules, and fault tolerance continue to appear in recent years. E-commerce and SVM are also common topics appearing in Taiwan. Furthermore, new topics like copyright protection have become popular because of the copyright issue in Taiwan.

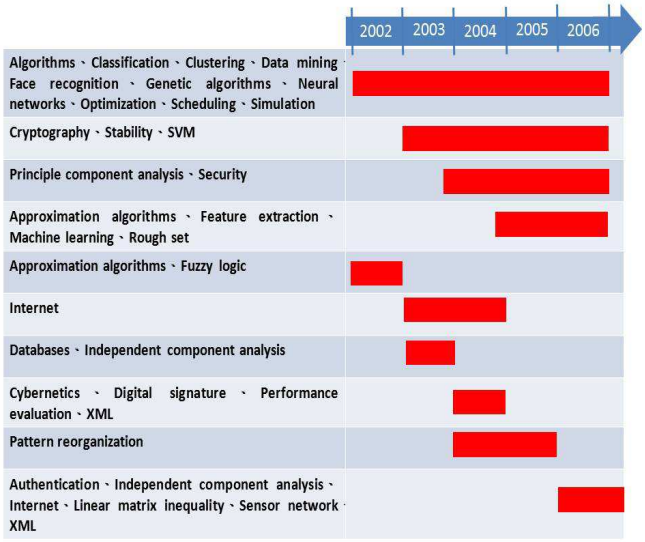

Fig. 2 Popular subjects in comparable Asian neighbors

Fig. 2 shows popular subjects appearing in comparable Asian neighbors over the years. We can see, for example, that algorithms, classification, clustering, data mining, face recognition, genetic algorithms, neural networks, optimization, scheduling, simulation are the most common discussion issues. Cryptography, stability, SVM, principle component analysis, and security appear as common topics in many years.

In the year 2005-2006, research in neighboring Asian countries has focused more on approximation algorithms, feature extraction, machine learning and Rough sets. Other issues, like the internet, pattern reorganization, XML, independent component analysis, have also appeared recently.

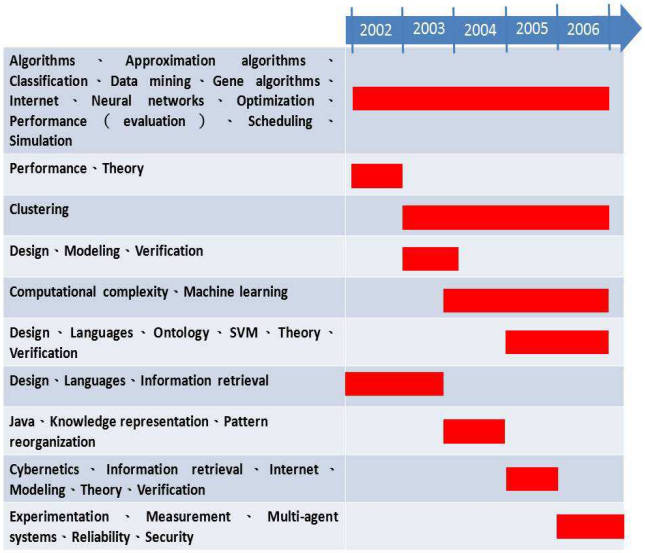

Fig. 3 Popular subjects in G8 countries

Fig. 3 shows popular research topics in the G8 countries. Algorithms, approximation algorithms, classification, data mining, genetic algorithms, the Internet, neural networks optimization, performance (evaluation), scheduling, and simulation are among the topics that have appeared over the five years. Clustering, computational complexity, machine learning, design, languages, and information retrieval have been popular topics of discussion for three to four years in a row. Other issues like ontology, SVM, theory, and verification appear in two of the five years.

V. Conclusion

In summary, we draw the following conclusions

1) The research model in Taiwan is similar to those of its Asian neighbors; however, some issues are discussed later in Taiwan than in other Asian countries, for example clustering, algorithms, security, SVM, and information retrieval. Some topics, such as classification, are discussed less here than in other countries. Taiwan paid more attention to knowledge management, wireless networking and E-commerce from 2004 to 2006, but other Asian countries were more focused on principle component analysis, security, and SVM.

2) The research model of the comparable Asian neighboring countries is similar to that of the G8. From the common topics over the five-year period, algorithms, classification, data mining, neural networks, scheduling, simulation, and genetic algorithms are overlapping. Asian countries paid more attention to face recognition and G8 focuses on research related to the Internet. Generally speaking, each group is ahead on some issues. For example, Asian countries tend to discuss SVM, security, cybernetics earlier; whereas the G8 countries reacted early to the popular trends in performance evaluation, machine learning, information retrieval, and languages.
3) Some of the topics were only recently adopted in Taiwan compared to other regions in Taiwan; nevertheless, we are still ahead in some areas such as cryptography.

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