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A Support System for Research Trend Survey of Scientific Literature

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Abstract: We constructed a support system for research trend surveys not only to accelerate the preliminary step but also to let students have a better grips of trend progresses and keyword transitions. Our system dynamically searches relevant words that are frequently used in the targeted academic field and gives users effective visualizations to understand trend transitions.

Keywords: Research trend survey, Searching engine, Scientific literature

Introduction

This paper targets on students who are just beginning to engage in research. In order to help students complete a scientific literature survey, with data-mining technologies, using the data of KAKEN[1] (Grant-in-Aid for Scientific Research of Japan), we propose create a search engine to help students to do a scientific research survey.

In 1775, Samuel Johnson said: Knowledge is of two kinds, we know a subject ourselves, or we know where we can find information upon it [1]. This search engine suggests students where to look for solutions to practical problems. At the same time, our system proposes to enable the students to master some of the basic concepts and methods of scientific literature survey during the process of document retrieval. Students can master research trends through the retrieval results and its analysis.

This research is advocated by pedagogical theories such as discovery learning. Discovery learning is an inquiry-based, constructivist learning theory that takes place in problem solving situations where the learner draws on his or her own past experience and existing knowledge to discover facts and relationships and new truths to be learned. Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments [2].

Bruner suggested that students are more likely to remember concepts if they discover them on their own. This search engine realizes discovery learning and help students learning by themselves. Utilizing this search engine, students can carry out some relevant scientific literature surveys, which broadens their sources of knowledge, and improves their self-learning ability. The role of the instructors is changed from givers of information to facilitating student learning.

[1] http://kaken.nii.ac.jp/ja/searchk.cgi

1. Related Works

Previous studies have used content analysis method to identify research trends in e-learning field [3]: Based on the methodology of content analysis, the research topics were first categorized into several tentative categories and sub-categories, and refined manually and continually by using constant-comparative method. By employing scientific papers (abstracts and information) from the five major educational SSCI journals, all those articles are then coded manually to different types of categories referring to its abstract. In addition, highly cited papers are further selected to analyze their research participants, research setting, research design and methods. Moreover, some researchers used bibliometric methodology to analyze the trends and forecasts in different domains, such as e-commerce, supply chain management and knowledge management [4,5,6].

As mentioned above, these researches require a lot of time to carry out a relevant scientific literature survey. According to statistics, it often costs one-third of the entire time to consult the scientific literature survey in the research process. Doing a research survey is essential, especially for the students who are just beginning to engage in research.

This search engine provides students with a literature survey tool, which not only shows the retrieval results, but also the analysis. Our system does not assume manual keyword registration or any other heuristic preprocesses: with an associative search module, it dynamically searches relevant words that are frequently used in the targeted academic field and gives users effective visualizations to understand trend transitions. This search engine provides a new method to visualize the research trends as "bundles of keywords". We refer to the bundles as "trend milky way".

2. The implementation of the "trend milky way" system.

We used Apache as the server and ran it on Linux, and used Perl to develop the "trend milky way" search engine. As shown in Figure 2, it is the interface of the system. The learner enters the keywords about his research field and searches for it on the system. A list of the search results will be displayed on the page. The "Research Trend Milky Way" system allows you to search either by “Research Field” or by “Time Range” or by “Sort Key”.

2.1 System Description

1) Advanced Setting. Advanced Setting allows you to change the following features categorized as :

- Search condition: “Research Field”, “Time Range”, “Sort Key”.
- Display Option: “Increase/Decrease Graph”, “OR Search”, “Time Series”, “Left Top->Right Bottom”, “Top ? feature words for each year”, “Total number of results”.

2) Research Field. You can select a research area from the pull-down menu next to the “Research Field”, such as "e-learning", "Text mining". Next to this pull-down menu, there are two time range options. With these two time range options, you can customize the set of time ranges that you view and select from the drop down menu when you search.

3) Sort Key. You can select a sort keyword from the pull-down menu next to the “Sort Key”. There are two sort keywords. One is “weight”, another one is “Frequency” .

4) OR Search. There is a "OR Search" option. OR Search collates the results to retrieve all the unique records containing one term, the other term, or both of them. The more terms or concepts we combine in a search with OR Search, the more results we will retrieve.

5) Time Series. There is a "Time Series" option, when you choose this option. The following will display a time series analysis graphics.

6) Search. Type the research area of your interest in the textbox next to “Research Field” and click Search Button. The “Research Trend Milky Way” System will display a feature keyword list of related research areas. They are the top slice by keywords frequency or weight. The "Research Trend Milky Way" system allows you to search either by “Research Filed” or by “Time Range” or by “Sort Key”.
7) The number of top ranked feature words for each year. This option means how many top ranked feature words are shown for each year. You can select a number form the pull-down menu next to the “The number of top ranked feature words for each year”.

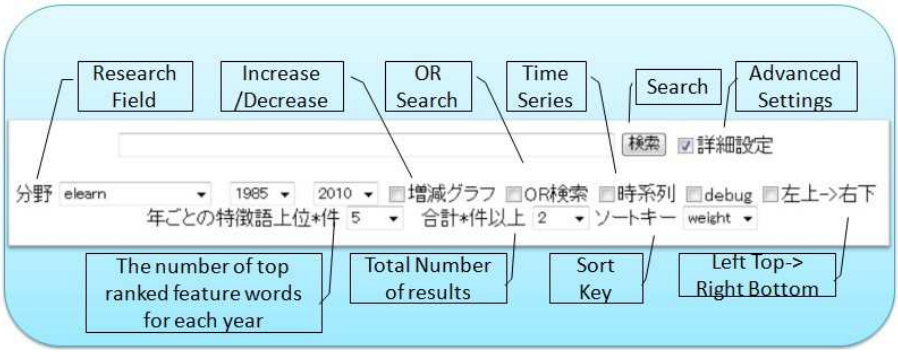

Figure 2, the interface of “Research Trend Milky Way”

2.2 System Features

There are 3 features of this literature survey system:
1) This system can help learn literature retrieval and analysis of knowledge and methods.
2) This system can help train independent study and build survey literature ability.
3) This system helps students speed up their pace of scientific research and get scientific research achievements early.

3. Conclusion and Future Works

For the students who are just beginning to engage in research, it is essential for the students to carry out a academic literature survey. In this paper, we propose a system for a research trend survey of scientific literature. With this system, students can perform trend analysis, automatically extract the outline from literature, and analyze project documents as time-series.
This is just a prototype system. In the future, we are planning to improve our system to help trend analysis more easily. We plan to analyze other research areas such as data mining, search engines, and then evaluate the results of the analysis by experts/ professors.

References

[1] Johnson S. (1775), Boswell's Life of Johnson, 18th April 1775.
[2] Bruner, J.S. (1967). On knowing: Essays for the left hand. Cambridge, Mass: Harvard University Press.
[3] Shih, M., Feng, J., and Tsai, C.C. (2007). Research and trends in the field of e-learning from 2001 to 2005: A content analysis of cognitive studies in selected journals [J]. Computers & Education. 51(2): 955-967.
[4] Tsai, H.H. (2011). Research trends analysis by comparing data mining and customer relationship management through bibliometric methodology. Scientometrics. Published online.
[5] Tsai, H. H., & Chi, Y. P. (2011). Trend analysis of supply chain management by bibliometric methodology. International Journal of Digital Content Technology and its Applications, 5(1), 285–295.
[6] Tsai, H. H., & Chiang, J. K. (2011). E-commerce research trend forecasting: A study of bibliometric methodology. International Journal of Digital Content Technology and its Applications, 5(1),101–111.