Enhancing On-Line Conferencing Ba with Human-Machine Interaction CorMap Analysis

Bin Luo, Chinese Academy of Sciences, China

Xijin Tang, Chinese Academy of Sciences, China

ABSTRACT

Recently, information is being used to enhance supporting technologies in conference management systems, which greatly improves the efficiency of conference organizing affairs and promotes extensive communication and cooperation between researchers. The on-line conferencing ba (OLCB) serves as a conference management system and provides an environment for knowledge creation. CorMap analysis is a technique for qualitative meta-synthesis, which can carry out series mining from qualitative data. The early OLCB system pushes the visualized results of CorMap analysis to users by images. In this paper, the authors introduce an interactive CorMap analysis to enhance the OLCB system, which enables users to conduct the conference mining process directly and acquire more clear and structured information. The working process of interactive CorMap analysis is shown with the application of the 7th International Workshop on Meta-synthesis and Complex Systems (MCS'2007).

Keywords: *Conference Mining, CorMap Analysis, Creativity Support, Human-Machine Interaction, On-Line Conference Ba (OLCB)*

1. INTRODUCTION

According to the statistics of organized meeting in 2008 by the International Congress & Convention Association (ICCA), there were 7,300 events organized by international associations (Sirk, 2009). These events took place on a regular basis and rotated between a minimum of three countries in the year 2008, a rise of approximately 800 over 2007. With the fast-growth in both scale and frequency of conferences and advances in communication and information technologies, digital revolutions are happening to conference management. As more ubiquitous computing technologies are applied, conference management systems are no longer limited to basic functions such as paper submission and information presentation, but extend well to in-depth analysis of conference data, which may help the conference

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organizers make appropriate programs and the participants find interesting topics and draw a rough scenario about the latest developments of the concerned topics (Pesenhofer, Mayer, & Rauber, 2006; Tang, Zhang, & Wang, 2007). Conference mining, which generates in-depth exploratory analysis results that are pushed to users for stimulating their further thinking and friends making, before, during and after formal conference activities, is now becoming the most valuable auxiliary feature of the conference management system (Matsuo, Tomobe, Hasida, et al., 2006; Tang, Zhang, & Wang, 2007).

The concept of on-line conferencing ba (OLCB) was firstly coined in 2006 during the interdisciplinary research of meta-synthesis system approach to complex problem solving and knowledge science, and then exhibited in organizing international conference with a demo system using some relevant technologies (Tang, 2006). OLCB system not only has the basic functions of information release, paper submission, paper review assignment and paper review, but also is expected to be considered as a creative support system by integrating a series of statistical methods to conduct the mining of the fundamental conference data such as submissions and registered authors, and post those visualized mining results to stimulate on-line discussions among participants and other target groups.

At the early OLCB system, users can drop their comments for discussion at the BBS area with the static pictures about the mining visualization which may stimulate imaginations and but also is incapable to meet the users' desire for further exploration themselves. In this paper, we report our endeavors of this improvement to enable interested people to manipulate the CorMap analysis directly by Web application. With recent studies on conference mining (Tang & Zhang, 2007; Tang, Liu, & Zhang, 2008), human-machine interaction of the CorMap analysis in OLCB system is greatly improved to exhibit human-machine interaction process of approaching the meta-synthesis from qualitative hypothesis to quantitative validation. Then the OLCB system may enhance the facilitation of knowledge sharing and creation, stimulation of participants' imagination and creativity to a greater extent, in short, provide better service for the conference participants.

2. ON-LINE CONFERENCING BA (OLCB)

Japanese Professor Nonaka has once adopted a Japanese word ba, to refer to a shared space which is of physical, virtual or even mental context, to achieve the spiral SECI process of knowledge conversion. An academic conference is a platform for information and knowledge exchange, through which the organizer actually provides a physical ba for dynamic knowledge sharing and new idea emergence. In adoption of the idea of ba, the on-line conferencing ba (OLCB) is designed for conferecing affairs as a supplementary virtual platform which is unhindered by time and space. OCLB engages in idea exchange, knowledge sharing and inspiration emergence by integrating the qualitative meta-synthesis technologies, CorMap and iView to conduct the conference mining for hidden patterns and setting up a forum for users discussion. CorMap and iView analysis are proposed by meta-synthesis and knowledge science research group in Academy of Mathematics and Systems Science, Chinese Academy of Sciences, have been applied to textual data analysis for diverse problems, such as group discussion process analysis, conference mining, experts' knowledge essence elicitation and social psychological analysis, etc. (Tang, 2007, 2008, 2009; Tang & Zhang, 2007; Tang, Zhang, & Wang, 2008). After carrying out both CorMap and iView analysis toward the fundamental conference data, OLCB pushes the visualized mining results in pictures to users.

Figure 1 shows the framework of OLCB. The system was firstly applied to the 7th International Symposium on Knowledge and Systems Sciences (KSS'2006). The visualized analysis results were posted at the virtual

conference board area and somewhat helpful to answer the basic questions for those people who are unfamiliar with knowledge science studies, such as "what are the current major topics?", "who are principal explorers in this field?", "who are the major research interest groups?" etc. Thus a knowledge conversion and upgrading environment may be generated for users' awareness and idea generation. Figure 2 shows an author network of KSS'2006 and users' comments on the mining results.

As a virtual conferencing environment, OLCB aims to be a creative support system. The idea of "ba" requires dynamic and interrelated knowledge and human involvement. The active human-machine interaction is the key to OCLB system. Then CorMap analysis is implemented as a Web-based application and integrated into OLCB directly instead of those selected CorMap images posted by the organizers. The Web-based CorMap analysis may attract more users to undergo the mining process and discuss with other people at the commenting area, and then may promote more information sharing and idea emergence. Next the details of such an improvement of OLCB are depicted.

3. CORMAP ANALYSIS TOOL

CorMap analysis tool is a qualitative modeling and visualization tool developed independently by meta-synthesis and knowledge science research group. The core technique of the analysis tool is CorMap analysis which is a technology for qualitative meta-synthesis using a series of statistic methods towards processing the qualitative (textual) data with the meta structure as <thesis, author, paper title, keyword set> (Tang, 2007, 2008a, 2009). Those statistic methods mainly include correspondence analysis and k-means clustering together with other techniques. The main functions of CorMap analysis tool are as follows.

(1) Open data set. The tool can read MS Excel and MS Access documents with data structure organized with the format as

Figure 1. Framework of OLCB

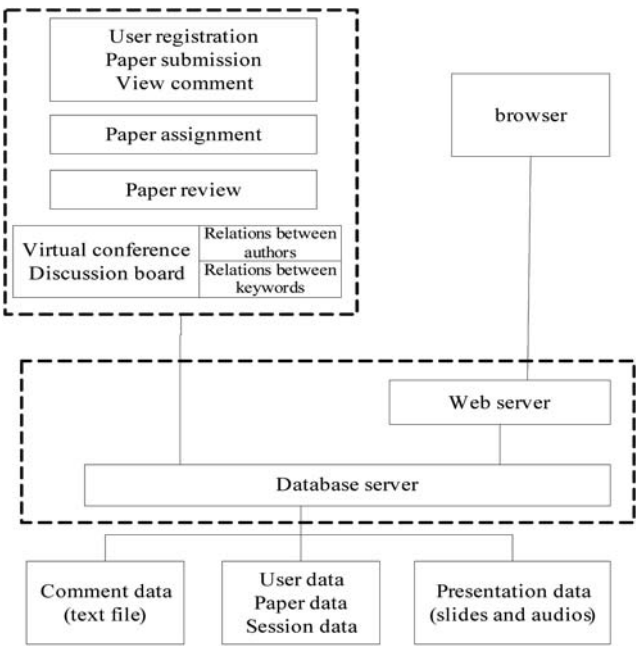
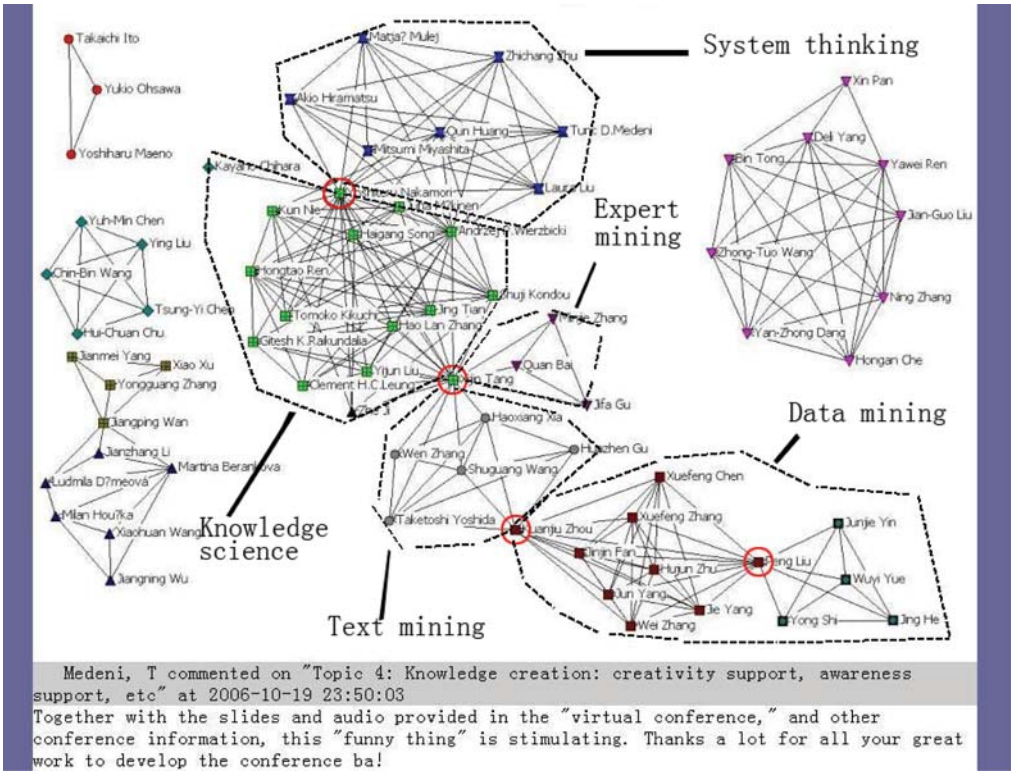


Figure 2. Author network of KSS'2006 and users' comments



<thesis, author, paper title, keyword set> . In a specified analysis, users can see all the processed qualitative data of the "thesis" such as the thesis MCS'2007, the first data is ("mcs'2007", "chtian", "Extensive Epidemic Spreading Model based on Multi-Agent System Framework", "epidemic spreading model, simulation, multi-agent system"). According to the data set dialog, we can also know the number of records, authors and keywords in the thesis.

(2) Conduct exploratory analysis (correspondence analysis). Use Correspondence Analysis algorithm to analyze data, and map all the authors and keywords and their corresponding relationships to the coordinate system of the same two-dimensional plane to show a visualization result. The keywords are articulated as attributes of authors and papers. A relation between authors and keywords may be acquired directly from the visualization results. People may easily find who may pay close attention to the same ideas (keywords) and then hold active communication and further discussion.

(3) Conduct idea clustering. Provide k-means clustering analysis with the authors and the keywords of conference data on the basis of the exploratory analysis. Then work out the distance between the keywords and center keywords (marked with larger font) among categories. Different categories are distinguished by different colors. With each cluster, the keyword which is close to the centroid is referred to as the representative of the affiliated cluster.

(4) Show the fittest clustering number: Use algorithms to calculate the best cluster number based on the current exploratory analysis where K corresponds to the maximum distance, it is the best cluster number.
(5) Show dominance, consistency and differences analysis. This function allows users to analyze the contributions or investigate the roles of the participants to the concerned topics or the conference, and thus serves as a variety of measures of the participants' behaviors. This function is especially useful to evaluate the human's performance during a divergent group discussion process.
(6) Select experts. Users can choose authors with a higher degree of correlation to analyze, to obtain a clearer visualization result and also can select the authors to analyze if he/she likes.
(7) Show/Hide authors or keywords. This function makes it easy for users to understand more structured information. Sometimes the visualization results are unharnessed because the authors and keywords in the visualization result are overlapped, and then users can hide the authors or keywords for a better vision.
(8) Save results. The user can save the visualized analytical results every step as they conduct the above-mentioned CorMap analysis into images in bmp or jpeg format.

4. IMPLEMENTATION OF INTERACTIVE CORMAP ANALYSIS FOR THE OLCB SYSTEM

In accordance with the idea of ba, CorMap on-line analysis tool is developed with the Web technology to achieve the Web-based human-machine interaction for OLCB, which is expected to help users conduct the CorMap analysis themselves with their own desires and then contribute more to the on-line discussion, which may trigger the emergence of a virtual ba for more association and deep thinking.

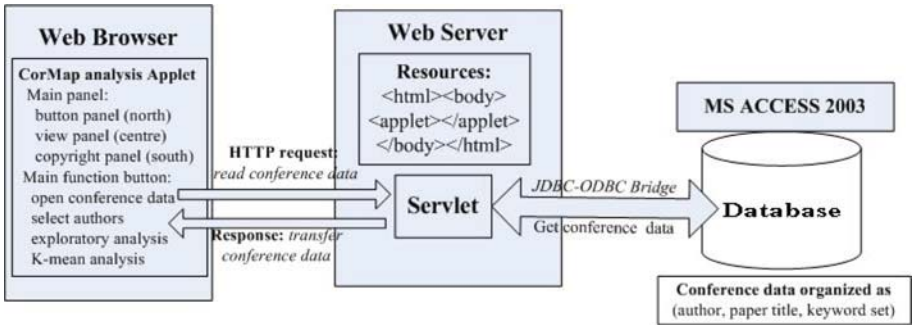
4.1 Enhancing the Human-Machine Interaction Feature of CorMap Analysis in the OLCB System

As a Web-based system, OLCB system is developed by JSP+Servlet+JavaBean technologies. Both Java applet and servlet technologies are applied to enable users to fulfill CorMap analysis interactively. Java applet is a small program written in Java language and usually is embedded in html document to run inside a Web browser. It is now designed to perform some tasks such as animated graphics and interactive tools (http://java.sun.com/applets/). Java servlet is a small program written in Java language, which can be thought of as an applet that runs on the Web server. Java servlet provides Web developers with a simple, consistent mechanism for extending the functionality of a Web server and for accessing existing business systems (http://java.sun.com/products/servlet). Both applet and servlet can communicate with each other to implement the data transfer.

To enable the human-machine interactive CorMap analysis at the OLCB system, the key point of implementing the Web-based CorMap analysis is to read data from the Web server to the browser. And so CorMap analysis applet is designed to access and exchange conference data from Java servlet, whose data come from the conference database by the JDBC-ODBC bridge. Figure 3 shows the main structure and work flow of interactive Web-based CorMap analysis application.

The main panel of applet includes three parts, the top panel includes the functional buttons; the central panel is designed to dynamically show the visualization results and the bottom panel displays the time of the conducted tasks and the copyright information. The function buttons correspond to program blocks that perform the function. Those buttons fulfill the functions addressed at Section 3, i.e. "*DataSet*" for open conference data, "*CorMap*" for exploratory analysis, "*Keyword Cluster*" for keyword clustering, "Fittest K" to acquire the fittest cluster number, "*Select Authors*" for

Figure 3. The work flow of interactive CorMap analysis



exploratory analysis of authors combination, "*Show/Hide Author*" and "*Show/Hide Keyword*" for better visions of CorMap analysis results. The interface is as shown in Figure 4(a). Usually the visualization results are soon acquired; the response of the server for the functional request, especially the displaying the visualized results depends on the quality of network and the client-side browser.

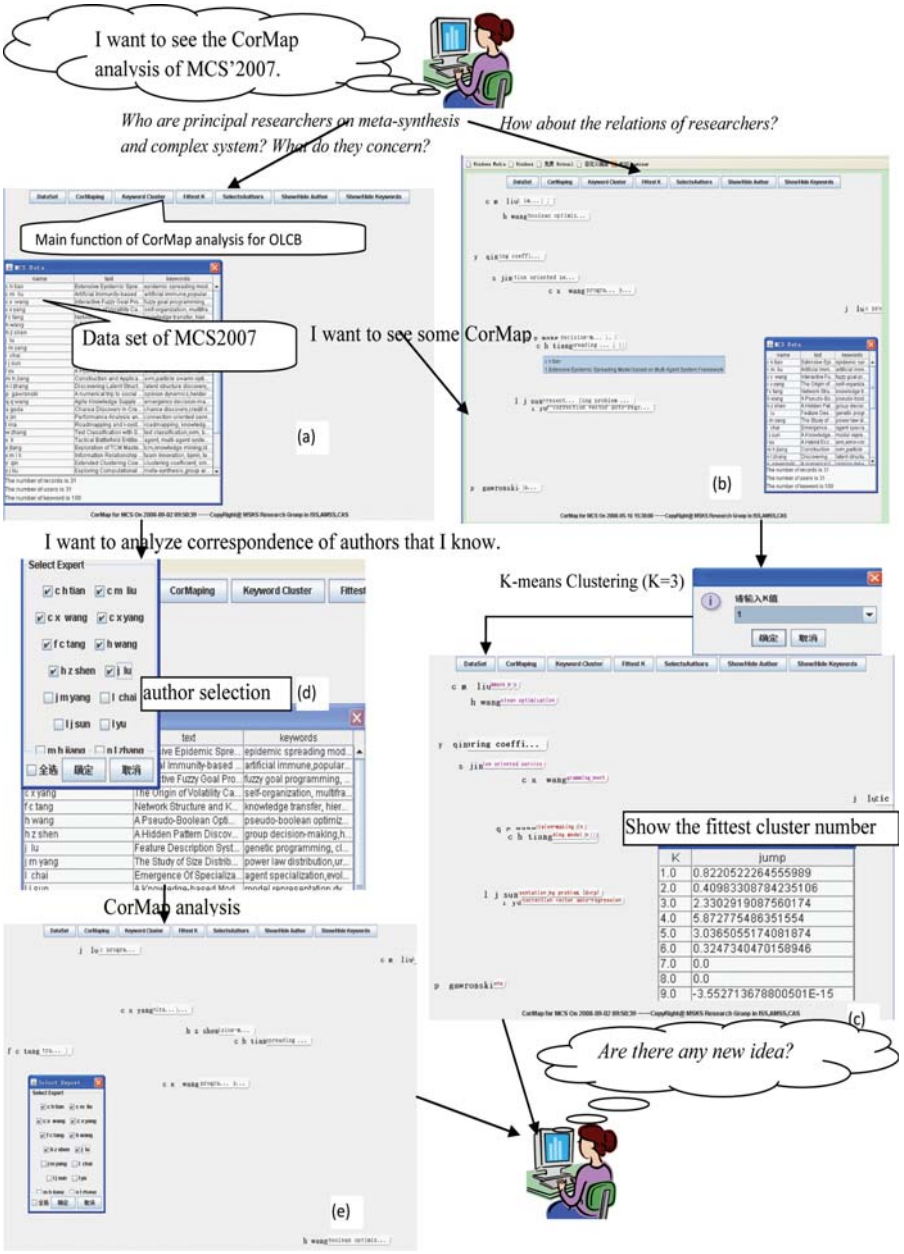
The visualization mining results of the interactive or directly manipulated CorMap analysis show authors (papers) with no background and keywords with white background at the 2D space based on their correspondence relations. As the mouse move and remains in the position of an author's label, the title of the paper written by that author will pop up. As the mouse moves to a keyword, the coordinates of that keyword will be displayed.

4.2 Applying Interactive CorMap Analysis of OLCB System to MCS'2007

Figure 4 shows the application of the Web-based interactive CorMap analysis of OLCB system to the 7th International Workshop on Meta-synthesis and Complex Systems (MCS'2007) affiliated with the 7th International Conference on Computational Sciences (ICCS'2007) held in Beijing during May 28-30, 2007. User clients can dynamically select to show full-scale conference data, and acquire steady conference mining results. Figure 4(a) shows the data set of MCS'2007 and the number of authors and keywords. Figure 4(b) displays the exploratory analysis result of the MCS'2007, all authors and keywords of the MCS'2007 and in particular show the paper's title of the author C.H. Tian. Some authors and keywords are unseen due to overlapping of keywords and authors. Figure 4(c) shows the result of K-means clustering analysis when k=3 and based on the exploratory analysis of MCS'2007. We can know from the dialog box that the fittest k is 4. Figure 4(d) shows the dialog of author selection. We selected 8 authors (Tian, Liu, Wang, Yang, Tang, Wang, Shen, and Lu) for exploratory analysis and Figure 4(e) shows the CorMap of the selected authors. For people who are interested in the meta-synthesis and complex system (MCS), it may be somewhat helpful to grasp the fundamental concepts of MCS by using the CorMap analysis of MCS'2007 OLCB system. Users may get a basic or possible association between authors and their academic thoughts represented by keywords from those visualization results.

With such an interactive tool, users can experience the conference mining process according to their own analysis, such as accessing the conference data and selecting experts and cluster numbers. Visualized results of conference mining allow users to access the perceptual knowledge and then go to further analysis. Enhancing the OLCB system with such kind of human-machine interaction may arouse users' interest to use the OLCB system and then drop messages at the on-line discussion area. Besides the enhanced OLCB system provides

Figure 4. Applying the interactive CorMap analysis of OLCB to MCS'2007 (a) Main interface (b) Correspondence analysis For MCS'2007 (c) K-mean cluster analysis (k=3) (d) author selection (e) correspondence analysis of the selected authors.



an effective exchange of information support for the physical meeting. Clustering analysis may help observers find some research groups from the visualization information, understand the perceptual knowledge of MCS, acquire some rational understanding, and thus trigger the exploration of tacit knowledge. The functions of showing/hiding authors or keywords help users to access more structured information.

The OLCB systems may not be evaluated in a quantitative way, but to a certain extent, users' comments and ideas at the on-line discussion area may show the effectiveness of the developed systems to some extent.

5. CONCLUSION

In this paper, we present the improvement of the early OLCB system by the implementation of the Web-based interactive CorMap analysis application. Such an endeavor may increase the users' experience of drill-down the conference data under their own interests and viewpoints for more scenarios of the research topics, and then promote the higher-level communication and information sharing among the participants and the other researchers. Through the process of dynamic human-machine interaction, the virtual conferencing ba may serve as a better supplement to the physical convening as a more humanized platform for knowledge creation to stimulate either deeper or wider thinking in addition to the improvement of information sharing and the users' enhanced experiences.

Improving the on-line conference ba system is still ongoing, and many functions will be further developed. Current interactive CorMap analysis application at the OLCB only analyzes the existing conference data. Some possible endeavors may include to achieve the human-machine interaction function of iView analysis and to conduct both analytical tools toward the on-line discussion data. Moreover, it is also worth explorations of expanding the application of OLCB to daily network exchanges such as BBS and blog.

Furthermore, if open environments are implemented to enable more applications dynamically integrated or manipulated, for example, to allow access to a simulation application reported at one paper at the conference, then the OLCB not only provides the basic ideas of the concerned topics relevant to the conference themes using the qualitative meta-synthesis technologies, such as CorMap and iView analysis, but also may enable interactive validating by interesting people for those hypotheses usually off-line validated by the authors themselves. Such a way may show the process from open qualitative hypothesis to quantitative validation under a consensus level, which just exhibits the practice of meta-synthesis approach (Tang, 2008b). Such a style is happening during the era of Science 2.0.

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