

# Research on Intelligent Scientific Research Collaboration Platform and Taking Journal Intelligence System as example

Hao Lu<sup>1,2</sup>, Xiaolong Zheng<sup>1,3</sup>, Xingkai Sun<sup>1,3</sup>, Nan Zhang<sup>4</sup>

1. State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences, Beijing, China
  2. Dongguan Research Institute of CASIA, Cloud Computing Center, Chinese Academy of Sciences, Songshan Lake, Dongguan, China
  3. Beijing Engineering Research Center of Intelligent Systems and Technology, Institute of Automation, Chinese Academy of Sciences, Beijing, China
  4. Chinese Association of Automation, Beijing, China
- {hao.lu, xiaolong.zheng, xingkai.sun}@ia.ac.cn, zhangnanbest@gmail.com

*Abstract*—Currently, the research issues are becoming increasingly global and complex. In order to master more and more professional and comprehensive ability to solve problems, it is proposed in this paper that academic intelligence, journal intelligence, conference intelligence, paper intelligence and so on are integrated together to establish intelligent scientific research collaboration platform. And taking the system application of Science and Technology Review as example, the process of scientific research collaboration is carried out to verify the effectiveness of the system. In conclusion, the scientific research collaboration platform could satisfy the comprehensive needs for effectively acquiring a mass of information and launching scientific research collaboration as well as facilitating academic communication.

*Keywords*—Research Collaboration; SciTS; Journal Intelligence; Collaboration Innovation;

## I. INTRODUCTION (HEADING 1)

As we are gradually stepping into the society of knowledge-based economy, the important role and production potential of the knowledge have been exposed. Researchers are facing great challenges [4] [5]. On one hand, the objects of scientific research become more complex, the research issues become more complicated, which not only involve multi-disciplinary knowledge but also exceed boundaries of traditional subjects. On the other hand, the methods and environment are inevitably changing. In this era of globalization, information contents is explosively increasing; the communication between scientific research activities and the acquisition scientific research information are all making new changes.

SciTS stands for Science of Team Science, which means the science of “research group” [1] [7]. The core task is to understand and facilitate all kinds of situations and phrases of science and technology cooperation, in order to achieve effective management and usage of knowledge. SciTS

undoubtedly provides a much better clear thought and methods for solving the problems above [2] [3].

The development of internet technology alleviates the limitation of time and space. Highly effective collaboration feature of internet applications are applied for users all over the world. The scientific research collaboration platform, which is based on the concept of SciTS and integrated with academic intelligence, journal intelligence, conference intelligence, paper intelligence and such kind of intelligent systems, also possesses feasibility [6]. The establishment of scientific research collaboration platform is particularly important.

## II. CURRENT SITUATION, PURPOSE AND SIGNIFICANCE OF THE RESEARCH

### A. Current situation, purpose and significance of the research

Recently, it has been paid more and more attention on science and technology project researches related with SciTS, such as: VIVO、iPlant、LiquidPub etc [12]. For these projects, natural language processing, ontology modeling method, semantic web technology and so on developed solid and fruitful work for researchers, things and publishing process during the science and technology knowledge production among multi-disciplinary groups.

LiquidPub project is one of the typical projects among those projects. Currently, some prototype systems, including LiquidPub Platform、LiquidJournal and so on, show the development concept of SciTS, but there are still certain limitations and defects. Firstly, it contains few open source information, which could not effectively monitor and acquire the web media related with science and technology information in time, lack of processing and analysis functions after information acquisition, and deficient in the interaction between users. Nevertheless, its development concept and idea provide certain reference for the establishment of scientific research collaboration platform.

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Nowadays, some research institutions in China also begin their positive exploration on establishing scientific research collaboration platform. Such as ScienceNet, it is a platform for communicating and transmitting scientific information between scientific researchers in domestic exploration. It mainly provides scientific news report, scientific information services and network platform services for communication and interaction.

Generally speaking, most work preferred to be deemed as an information provision platform, and deficient in science and technology collaboration innovation and academic communication.

*B. The purpose and significance of the research*

The main purpose of establishing scientific research collaboration platform is to intelligently acquire, process, analyze and mine open source science and technology information resource by applying web monitoring, information analysis and processing, data mining, machine learning, information retrieval, natural language processing and such kind of key technologies and algorithms [8] [9]. And based on it, it can provide users a scientific research collaboration innovation platform with new application, which is integrated with academic intelligence, journal intelligence, conference intelligence and such kind of intelligent systems. With this platform, users can cooperate to develop publication and management activities of journals, conferences, papers, which can better and effectively organize and exert the efficiency of research groups, and realize development of breakthrough. The main users and services, which the system faces and provides, are shown in the Fig. 1.

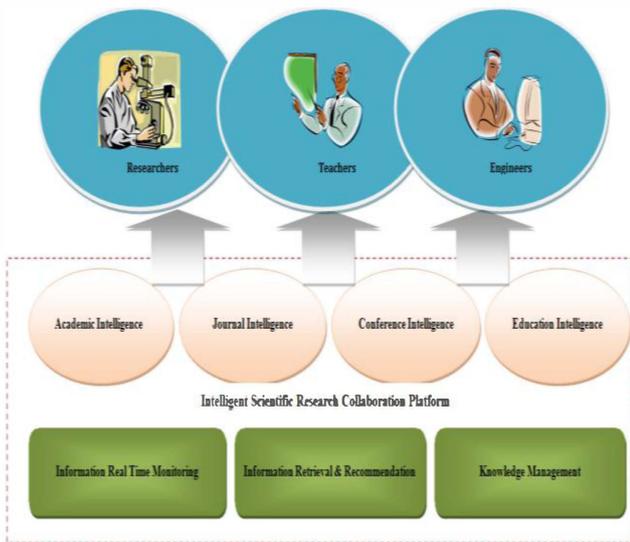


Figure 1. Main users and services provide by Intelligent Scientific Research Collaboration Platform

III. THE CONSTRUCTION OF THE PLATFORM

After serious researches on all kinds of key processes which affect scientific research innovation [10] [11], based on user collaboration behaviors to produce knowledge, and on the purpose of effective scientific research collaboration with cross of time and space omnidirectionally, new intelligent scientific research collaboration platform is proposed, which including integrating information acquisition module, information retrieval and recommendation module, information analysis and data mining module, science and technology collaboration module and so on, as in Fig 2.

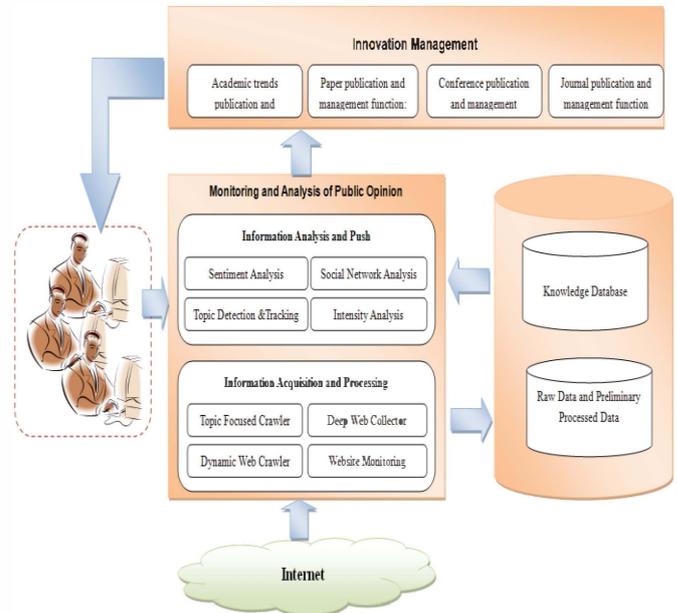


Figure 2. The construction of the Intelligent Scientific Research Collaboration Platform

1) *Information acquisition module*

The resource data of information acquisition module is acquired by crawler program, including the open source science and technology social media data on internet, non-open source metadata of literatures and the research progress data uploaded by users. Open resource science and technology social media data on internet can be effectively acquired by designing and realizing focused crawler and deep-web crawler. The main acquired data includes: science and technology events and news, research papers, research conference, science and technology comments, research reports, patents and academic development etc. These data come from technical reports of journals, conferences, research groups, the news reports from science and technology websites, websites library of academic papers, scientific research SNS, scientific research blogs and such kind of social media platform.

Meanwhile, users can upload and submit their own research contents via the submission platform. The content includes users' own research progress in the certain field, published papers or collected papers, comments, perspectives, experiment results, conference, and patent information. The function of content editing provided by the platform can be used to input

these information into database and make unified management, in order to provide support for later exploring and collaboration.

### 2) Information push module

Information push module is mainly consisted of information retrievals function and information recommendation function. It effectively pushes data for innovation management system and data monitoring and analysis system. Information retrieval module mainly provides full-text retrieval, query expansion and advanced retrieval functions. Information recommendation mainly makes use of users' profile and users' behavior record, applied collaboration filtering and system recommendation algorithm of complex network, to effectively recommend useful information, including news, papers, relative researchers etc, therefore providing effective support for launching scientific research collaboration.

### 3) Science and technology collaboration innovation module

The science and technology collaboration innovation module is mainly consisted of the following sub-functions: journal publication and management, academic trends publication and management, conference publication and management, paper publication and management.

Journal publication and management function: it provides support of cooperative editing and publishing journals, acquiring contents related with scientific research journal column from all direction, including related journals in this field, key research institutions, key research groups, academic development files, scientific technology comments and so on, which can converge and integrate the newest scientific research thoughts. Meanwhile, it can provide shared editing environment and thorough function of concurrent version control to acquire material of the journal and continuous feedback about journal's content from the users' collaborative contents.

Academic trends publication and management function: it can systematically edit and publish briefing about scientific research development, scientific research trend in this field, important scientific technology news, policies and rules in scientific and technology area, scientific research funds and projects, patents and so on for researchers to understand the newest scientific research trends in one certain field.

Conference publication and management function: users can publish conferences, acquire newest conference notification in one certain field, apply to join in the conference on line, collect conference, interactively discuss about the conference content between users and so on.

Paper publication and management function: For the submitted paper, users can comprehensively acquire the value analysis about the paper: whether the topic is innovative, whether there is similar experiment before; the papers with the same or similar research content, related authorities and experts from the same field can be also known.

## IV. APPLICATION CASE FOR SCIENTIFIC RESEARCH COLLABORATION PLATFORM –JOURNAL INTELLIGENCE SYSTEM

### A. The requirement of journal intelligence system

Journal is deemed as the most important platform for scientists' paper publication, research achievement transmission, and idea communication. Therefore, it is greatly significant to typically apply journals as a scientific research collaboration platform. SciTS fully demonstrated its essence to completely make use of rich knowledge resource from internet, improve the enthusiasm of researchers and facilitate the cooperation between experts from different disciplines.

### B. The application description of journal intelligence system

The flowchart of users' publication and management of journals on the journal intelligence system is shown as Figure 3.

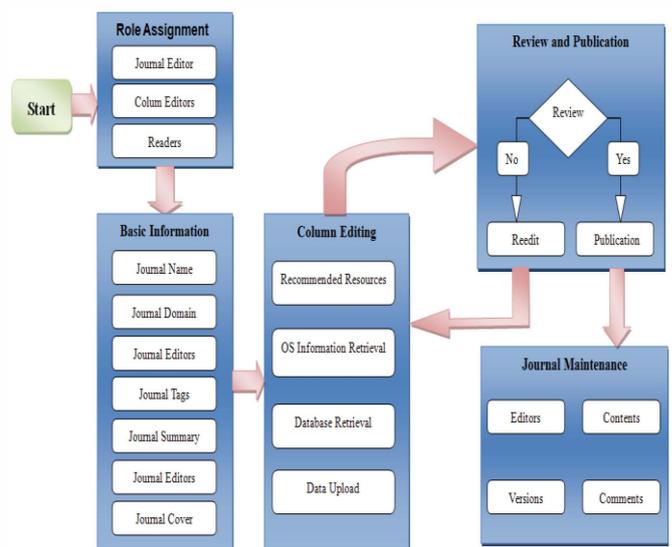


Figure 3. The application description of journal intelligence system

- Firstly, the title of the journal, belonged field and journal editors must be confirmed. The journal creator can assign journal editors by the way of inviting site friends, searching related people. Besides, recommendation module can be constructed according to the journal creator's research field, interested field and journal column topic etc; then, related researchers from database can be pushed for journal creator and then journal creator will send invitation.
- Second, After the initial journal information is confirmed, journal column will be confirmed for the next step. According to the feature of this journal's theme, journal creator will set all kinds of columns, and set editors for each column; and users who participate later can apply to be editors for one or some columns, in charge of managing and maintaining related contents.

- Third, After the confirmation of column information, we will begin the most important part: content edition. According to the feature of the column and their own research accumulation, the editor who is responsible for each column, on one hand, will retrieval scientific research data and documents gathered by focused crawler and information push module omnidirectionally; on the other hand, the column information resource will be further supplemented by the data which users uploaded. Then journal columns will be confirmed by the editors who charge the column, and the final version of the journal will be submitted by the creator at last
- At last, After publication of the journal, the recommendation system can recommend published journals to journal share platform and related users, according to users' interest and research field. It will effectively facilitate journal transmission for scholars in the same field and maximize the impact of the journal. And it also provides an effective platform for communicating research ideas, showing research achievements, making comments and discussing academic issues for users, which provide effective feedback channel for further optimizing column of the journal.

#### V. APPLICATION EXPERIMENT OF JOURNAL INTELLIGENCE SYSTEM

Taking creating a volume of Science and Technology Review journal as example, the application experiment of journal intelligence system, which is a subsystem of Scientific Research Collaboration Platform, is implemented. Due to the word limitation, the three parts mentioned below are mainly taken in this experiment to introduce the application of the system: 1. The top Science and technology news Science and technology news with breakthrough in research field will be published, namely science and technology hot news; 2. Science and technology talent recruiting: It provides services for showing information of recruiting senior engineer, professors, researchers and other Ph.D related position; 3. Paper value-added service: It provides submitted paper with related research paper, scholars and institutions, and explores the most valuable parts of related information for the author.

##### 1) The top science and technology news in certain domain

According to the requirement from the journal editors, when editing the top science and technology news, corresponding science and technology domain news can be recommended according to the editor's defined conditions. The crawler program will implement real-time monitoring and circulating acquisition from all famous science and technology news websites. The amount of effective science and technology news items from Jun. 1 to Jun. 31, which is acquired and downloaded into database via information acquisition module, is shown as Tab I:

TABLE I. STATISTIC TABLE FOR SCIENCE AND TECHNOLOGY NEWS ACQUISITION DATA FROM JUN. 1 TO JUN. 31 2011

来源	科学	EurekAlert!	人民	凤凰	腾讯	新浪	中国科	新华	中国科
	网	中文版	网	网	网	网	学院	网	技网
条目	1045	86	296	938	1887	1372	99	263	1855
数量									

Information acquisition module has acquired 7841 items of science and technology news in sum. Recommendation module need to rank several hottest news from lots of science and technology news and recommend to journal editors. Currently, the applied recommendation algorithm is integrated with the comprehensive weighted index for news publication resource, transferred coverly from internet and the amount of news of reading and comments. More indexes will be added to improved recommendation algorithms in the future, in order to strengthen the credibility and reliability of the results. From ranking the acquired science and technology news in ten days (from Jul. 17 to Jul. 27 2011), the top science and technology news is shown as Figure 4:

科技新闻媒体关注排行							
序号	标题	时间	来源	关注度	评论	收藏	分析
1.	长征二号F 运抵酒泉	2011.7.24	新浪网	★★★★★	发表评论	收藏	分析
2.	蛟龙号载人潜水器 22日创下潜冲击5000米深度	2011.7.22	新浪网	★★★★★	发表评论	收藏	分析
3.	天宫一号运载火箭运抵发射场	2011.2.24	新浪网	★★★★★	发表评论	收藏	分析
4.	阿特兰蒂斯号永别空间站	2011.7.20	网易科技	★★★★★	发表评论	收藏	分析
5.	美国航天局传数据▲运载火箭	2011.7.20	科学网	★★★★★	发表评论	收藏	分析
6.	美黎明探测器进入火星轨道	2011.7.18	科学网	★★★★★	发表评论	收藏	分析
7.	2号小行星 望神星 22日冲日	2011.7.21	新华网	★★★★★	发表评论	收藏	分析
8.	韩自主研制的民用飞机试飞成功	2011.7.21	中国科技网	★★★★★	发表评论	收藏	分析
9.	美科学家解释意大利死因之谜	2011.7.18	科学网	★★★★★	发表评论	收藏	分析
10.	NASA 称将于 15 年内将宇航员送上近地小行星	2011.7.22	腾讯网	★★★★★	发表评论	收藏	分析

Figure 4. Screenshot of top science and technology news in journal intelligence system

The amount of news ranking list can be set, and news lists recommended by the system can be reedited, corresponding science and technology domain news can also be chosen and added via searching function by the journal editor. Meanwhile, editor can also change the rank according to internal journal followers focused news. Later, system will provide entropy analysis index for all science and technology events.

##### 2) Science and technology talents recruiting

According to the requirement of recruiting information for high level talents, information acquisition module mainly acquire the recruiting information of Ph.D or above from enterprises and institutions in 11 famous recruiting websites.

The recruiting information will be automatically categorized as professor, associate professor, assistant professor, senior teachers, researchers, associate researchers, assistant researchers and senior engineer by the information extraction function in information acquisition module. In this experiment, 11 famous recruiting websites are acquired, the time period of recruiting information publication is from Jun. 1 to Jun. 31 2011. The acquired recruiting information is summarized as Tab II

TABLE II. STATISTIC TABLE FOR RECRUITING INFORMATION STATISTIC TABLE ACQUISITION DATA FROM JUN. 1 TO JUN. 31 2011

来源	智联	数字	前程	科学	应届	应届	高校	万行硕	中国研	职友	电力
	招聘	英才	无忧	网	生	毕业	人才	博人才	究生人	集	英才
					生		网	网	才网		网
条目数量	148	177	80	83	47	31	27	15	5	6	4

Meanwhile, journal editor can set recruiting category when editing recruiting column. For example, when classifying the recruiting information from universities, research institutions, research and development center of the enterprises; journal editor can also classify the recruiting information shown by positions, working locations and such kind of conditions, which is convenient for journal searchers to seek for special recruiting information. The screenshot is shown as Fig 5:

高校					
序号	职位	招聘单位	来自	发布日期	
1.	科研项目经理	华中科技大学制造工程研究院	应届毕业生	2011-6-3	
2.	科研助理	复旦大学生物医学研究院	高校人才网	2011-6-9	
3.	有机化学博士后	德国杜塞尔多夫大学	科学网	2011-6-13	
4.	海洋学博士后	塞浦路斯大学	科学网	2011-6-14	
5.	研究人员	上海交通大学医学院附属新华医院	科学网	2011-6-29	
研究所					
序号	职位	招聘单位	来自	发布日期	
1.	科研人员	中科院水生所藻类遗传学学科组	应届毕业生	2011-6-3	
2.	研究员	中科院大连化学物理研究所	数字英才	2011-6-7	
3.	研究员	中国科学院微电子研究所	前程无忧	2011-6-21	
4.	博士后	中国中医科学院针灸研究所	前程无忧	2011-6-23	
5.	国家重点实验室主任	中科院植物研究所	科学网	2011-6-27	
企业					
序号	职位	招聘单位	来自	发布日期	
1.	高级研究员	巨化集团公司	数字英才	2011-6-1	
2.	分子生物学研究员	上海朗康生物科技有限公司	数字英才	2011-6-1	
3.	科研人员	北京美莱博医学科技有限公司	应届毕业生	2011-6-3	
4.	科研带头人	长沙威保持环保科技有限公司	数字英才	2011-6-13	
5.	药物合成研究员	南京生命能科技开发有限公司	应届毕业生	2011-6-17	

Figure 5. Screenshot of talent recruiting column in journal intelligence system

### 3) Value-added services of the submission paper

Data related with submitted paper from all domains will be acquired by information acquisition module; from voluminous database of the paper, lots of value-added data for the paper can be explored. To illustrate paper value-added service, Taking Science and Technology Review journal is chosen as the paper resource and analyzed as paper samples. Information acquisition module is used to acquire the metadata of 5052papers published in IEEE T-ITS from the year 1999 to 2010 as data set. The APS (Adjusted productivity score) index algorithm is applied to implement data mining and statistics for the most productive researchers in this journal. For one paper written by n authors, the score for each author is 1/n with the algorithm of APS. The total score of one's total papers is one's APS. The final result is shown as Fig 6:

排名	作者姓名	作者单位	论文数	ASP
1	周建军	清华大学	15	10.17
2	刘静	中国科学院	19	7.6
3	哈木拉提·吾甫尔	新疆医科大学	25	7.33
4	邓甲昊	北京理工大学	11	6.5
5	王飞跃	中国科学院	11	5.33
6	吴超	中南大学	14	5.45
7	黄丽华	复旦大学	14	5.0
8	柴立和	天津大学	10	4.83
9	霍有光	西安交通大学	9	4.75
10	唐勤天	清华大学	19	4.33

Figure 6. System screenshot of Top productive researcher in Science and Technology Review

Taking the amount of papers as statistic index, the most productive research institution is shown as Fig 7:

排名	作者姓名	论文数	ASP
1	中国科学院	427	414.94
2	清华大学	215	188.60
3	复旦大学	108	106.76
4	北京理工大学	107	101.57
5	中南大学	94	90.56
6	北京大学	86	84.38
7	中国矿业大学	87	82.46
8	北京航空航天大学	70	70.66
9	西北农林科技大学	61	63.60
10	中国农业科学院	64	57.20

Figure 7. The most productive research institution in Science and Technology Review

The purpose of our experiment is to verify the effectiveness of the system; In the aspect of paper value-added services, more metadata information analysis results can be provided for users from the journal intelligence system, such as exploring whether the experimental parts of the paper have been tried by other authors, and obtaining the cooperation social network of researchers and research institutions in this field, as well as research development dynamic chart in this field and so on.

## VI. CONCLUSION

In this paper, taking intelligent journal prototype system which is a subsystem of Scientific Research Collaboration Platform as example, the establishment of scientific research collaboration platform is discussed. Intelligent information acquisition and analysis module, information push module, journal collaboration innovation module such kind of key modules can facilitate researchers to acquire the newest research data, understand the newest science research trends in one certain field. Widely communication and cooperation in one certain field can be launched by the means of creating and managing journals.

In order to adapt and facilitate the development of scientific research collaboration platform, the following work will be carried out based on journal intelligence prototype system:

- Prototype system can be changed to reliable, available, and effective scientific research collaboration platform by further developing and testing;
  - Based on prototype system, science and technology collaboration system will be further developed to improve conference, papers and so on;
  - Functions of prototype system will be further strengthened and improved by developing the plug-ins of the system.
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