

Database Systems Laboratory



Subhash Bhalla
Professor



Yutaka Watanobe
Associate Professor



Wanming Chu
Assistant Professor

Information systems in transportation, health-care and public utility services depend on large scale data management systems. Research activity in Database Systems is focused on broadening their range of applicability. It is also focused on improving the performance of domain specific applications.

Large applications for Services use database systems as a basic part for web data resources. This year the laboratory organized an International Symposium with many invited distinguished researchers during 7 to 9 December 2015. The selected papers from the proceedings have been published for the “Symposium on Big Data Analytics in Science and Engineering (BASE 2015)” in reputed journal published by InderScience. The delivered lecture and manuscripts are being utilized to develop the state-of-the-art lectures on current research problems. These created a focused view on new research problems. many current aspects of web related research activity were discussed at the Symposium. The delivered lecture created a focused view on new research problems.

Most of the advances in techniques concentrate on capturing more meaning within data. A number of researchers are actively developing improved data management strategies using Business Intelligence and data. This provides a challenging area for study. The domains of activity include :

- developing new user interfaces and query languages for skilled and semi-skilled users in health-care;
- developing infrastructures for computing facilities for cloud computing;
- supporting mobile computing applications, and

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- designing new data models and asynchronous computation models for transaction and services.

In addition to complexity in features such as multiple attributed data, many new types of raw data are emerging that need to be captured by DBMSs for information extraction. Many research efforts are being made to make suitable Object-Relational architectures for spatial databases.

The Database Systems Laboratory has research activity concentrating on data modeling as well as transaction processing activity.

Data Modeling for Spatial Objects

Information Processing Systems of future will be a combination of integrated components. There will be components for intelligent problem solving, or decision making, components for specialized data processing and components for shared information management. The applications will utilize a shared base of information. Some examples are - business automation, industrial automation, computer-aided design and manufacture, and cartography.

Work-flow and Web Services

Traditional approaches to transaction management introduce elements of unpredictable delays during transaction processing. Thus, making these not suitable for adoption in new application environments. The techniques for time-critical transactions are applicable to Mobile databases and multimedia databases.

Healthcare Studies

The goal of this research is to study the Standardized Electronic Health Records (EHRs) databases. It is a temporal computational system with the ability to process large volume of information. Such system will prove useful in various areas of information technology such as online healthcare agencies. The modeling considers the complementary points of view:

1. EHRs data mining approach to address the epidemic studies,
2. An approach that involves the user in the modeling process.
3. Query Language with reference to user skills

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Prototype systems to access dynamic contents through web based information systems are in progress. These emulate mobile e-commerce activity in banking and Geographic Information Systems, for test and studies. The test prototypes have been evolved based on research on new easy-to-use search and also new query language interfaces.

Refereed academic journal

[bhalla-307-008-01:2015] S. Kikuchi and S. Bhalla. Evolution of distributed monitoring for scalable business process management in cloud-based databases. *International Journal of Computational Science and Engineering*, 12(3):192–208, 2015.

Embodying business process as a service (BPaaS) in cloud computing has been actively investigated by many research studies. There are many proposals to establish the scalable workflows, for instance, by adopting the multiple instances of workflow execute engine (WEE). However, it is difficult to track exactly the states of individual instances of the workflow running across multiple engines globally, by only applying the multiple WEE. It is necessary to implement an independent monitoring function from outside. This study considers making this monitoring function scalable in accordance with increasing the number of WEE. When designing the monitoring function and the maintenance protocol, the following important factors have been considered. First, to deliver the meta-data such as definitions of business processes among WEE for sharing. The second, to deliver the event instances asynchronously, by compensating inconsistent status for recoverable events. This study proposes architecture and a set of maintenance protocols to realise the scalable workflow management. It shows the critical requirements and selects a reasonable approach through qualitative evaluations.

[w-chu-307-008-01:2015] Aastha Madaan and Wanming Chu. In-depth querying of web-based medical documents: beyond single page results. *IJCSE*, 11(3):284–296, 2015.

The World Wide Web has become a large source of health information. The paper-based medical resources are becoming available on the web. Hence, web-based information retrieval, automatic page-adaptation and in-depth querying are gaining importance especially in the healthcare domain. To address the problems of these ever-expanding information systems over the internet, traditional information retrieval techniques are applied. This study is an attempt to highlight the challenges faced by the users in the healthcare domain for in-depth querying of web-based healthcare information resources. It compares the existing approaches for in-depth querying for segment-level searches rather than page-level searches. It proposes a web document segmentation-based 'query-by-segment tag (QBT)' query-interface. It utilises the semantic and structural relationships among the various content groups of a web document. Such a query-interface enables the user to perform in-depth querying.

Unrefereed academic journal

- [yutaka-307-008-01:2015] Yutaka Watanobe. Development and Operation of an Online Judge System. *IPSJ Magazine*, 56(10):998 – 1005, 9 2015.

Refereed proceedings of an academic conference

- [yutaka-307-008-02:2015] Yutaka Watanobe Mark Sifer and Subhash Bhalla. Efficient Visualisation of the Relative Distribution of Keyword Search Results in a Corpus Data Cube. In *ACM Eighteenth International Workshop On Data Warehousing and OLAP (DOLAP)*, pages 85–88, 2015.

Most keyword searches target precision for finding the most relevant document. However some target recall, finding all relevant documents. Our system supports high recall searches that return hundreds or thousands of relevant results. In particular, it provides a visualization that shows the distribution of search results relative to the distribution of items for the entire corpus. Such relative distributional features include over and under representation, clusters and outliers. The contribution of this paper is efficient visualisation, that is, how to provide the best relative distribution view for a given data cube size. This requirement is translated to: for which limited size meta-data summary cube are search results disambiguated the most in our relative distribution view. We identify metrics and several algorithms for such a summary cube selection.

- [yutaka-307-008-03:2015] Alexander Vazhenin Mirai Watanabe, Yutaka Watanobe. Modeling Tools for Social Coding. In *Proceedings of the 14th International Conference on Intelligent Software Methodologies, Tools and Techniques*, pages 399–410, 2015.

In recent years, the social coding paradigm has become commonly used in software development, taking advantage of version control systems and tracking functions. However, most social coding platforms do not provide modeling tools which support the creation of documents for corresponding products. In the present paper, we propose modeling tools for social coding. The tools are based on hybrid editors, where different experts on a project team can use the correct input methods to modify some features of software components. These editors allow users to manipulate both a visual construct in a high-level representation and the corresponding texts in the low-level format. Some advantages of these approaches are also discussed through a case study and its evaluation.

Summary of Achievement

Writing a textbook or technical book

[bhalla-307-008-02:2015] (Same as Editors). *Databases in Networked Information Systems*, volume 8999 of *Lecture Notes in Computer Science*. Springer-Verlag, Germany, March 2015.

Writing a part of textbook or technical book

[yutaka-307-008-04:2015] Mirai Watanabe Yutaka Watanobe, Nikolay Mirenkov. *Educational Features of *AIDA Programs*, chapter Intelligent Software Methodologies, Tools and Techniques. Springer, 2015.

Programming in pictures is an approach whereby pictures and animation are used as super-characters for representing features of computational algorithms and data structures, as well as for explaining models and application methods involved. *AIDA is a language supporting programming in pictures. In this chapter, some features of *AIDA programs are discussed and how these features can be applied for educational goals oriented to users with little programming experience. Special attention is paid to new examples in which algorithmic dynamics is explained by animations and template programs supporting the implementation of this dynamics.

Research grants from scientific research funds and public organizations

[yutaka-307-008-05:2015] Yutaka Watanobe. Online judge system based on programming languages for the next generation, 2015.

Advisor for undergraduate research and graduate research

[w-chu-307-008-02:2015] Hiroto Ishii. Graduation Thesis: Book Recommendation System, University of Aizu, 2015.

Thesis Advisor: Wanming Chu

[w-chu-307-008-03:2015] Kazuki Furukawa. Graduation Thesis: Advance bus route search using Query by Object Interface, University of Aizu, 2015.

Thesis Advisor: Wanming Chu

Summary of Achievement

[w-chu-307-008-04:2015] Takanori Shinozaki. Graduation Thesis: Geographic Data Collection, Visualization and Search System using Google Maps API, University of Aizu, 2015.

Thesis Advisor: Wanming Chu

[w-chu-307-008-05:2015] Ken Ishihara. Graduation Thesis: Web-based Extraction and Search System for Medical Information Resources, University of Aizu, 2015.

Thesis Advisor: Wanming Chu

[w-chu-307-008-06:2015] Daisuke Kitazumi. Graduation Thesis: Implementation of Online Exercise Submission and Attendance System, University of Aizu, 2015.

Thesis Advisor: Wanming Chu

[yutaka-307-008-06:2015] Kazuki Yamamoto. Master, University of Aizu, 2016.

[yutaka-307-008-07:2015] Yuto Marisaki. Bachelor, University of Aizu, 2016.

[yutaka-307-008-08:2015] Ryuya Takahashi. Bachelor, University of Aizu, 2016.

[yutaka-307-008-09:2015] Kazuya Watanabe. Bachelor, University of Aizu, 2016.

[yutaka-307-008-10:2015] Hirotomo Tanji. Bachelor, University of Aizu, 2016.

Advisor of a student club or circle

[yutaka-307-008-11:2015] University of Aizu Competitive Programming Club ACM-ICPC Asia Regional, Singapore, 8 th place ACM-ICPC Asia Regional, Tsukuba, 5 th place (Advanced to World Finals) ACM-ICPC Asia Regional, Taipei, 20 th place

Contribution related to educational planning management

[yutaka-307-008-12:2015] PC Koshien, Committee for Problem Set and Judge

**Did you participate in Public Lectures, and/or Open Campus?
(Yes or No) If yes, please describe what you did.**

Summary of Achievement

[yutaka-307-008-13:2015] Programming Challenge! Introduction to C/C++ Programming

[yutaka-307-008-14:2015] Programming Challenge! Introduction to Algorithms and Data Structures