Database Systems Laboratory

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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 workshop with many invited distinguished researchers during 24-24 March 2013. The proceedings have been published for the 9th workshop on "Databases in Networked Information System (DNIS)" by Springer-Verllag in the Lecture Notes in Computer Science series (LNCS) in Volume 8381. 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 workshop. In addition to DNIS 2014 workshop, the laboratory organized an International conference with many invited distinguished researchers during 16 - 18 December 2013. The proceedings have been published for the conference (2nd BDA 2013) by Springer-Verllag in the Lecture Notes in Computer Science series (LNCS). 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

- 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

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 protypes have been evolved based on research on new easy-to-use search and also new query language interfaces.

Refereed Journal Papers

[bhalla-01:2013] A. Madaan and S. Bhalla. Usability Measures for Large Scale Adoption of the Standardized Electronic Health Record Databases. *Journal of Information Processin*, 22(3):508–526, 2014.

With the adoption of Standardized Electronic Health Records (EHRs) databases, recent research studies consider - standardization and interoperability. At the same time the need for querying (the archival data) is becoming important. The complex and dynamic nature of these databases give rise to several usability challenges. This study aims to reduce the gap between the designed application flow and user work-flows (anticipated by them) within the system. Moreover, in the case of standardized EHRs databases, there is a need to reduce the dependency on post- release user-feedbacks and surveys. This will facilitate the task of system redesign (and re-engineering). We assume that socio-technical features of the users and their usage-patterns over the standardized EHRs databases are correlated. Therefore, we propose the application of user-centric design and automated usability support for the standardized EHRs databases. It provides an insight for improving the system on a continuous basis.

[yutaka-01:2013] Nikolay Mirenkov Yutaka Watanobe. Hybrid intelligence aspects of programming in *AIDA algorithmic pictures. *Future Generation Computer Systems*, page 417428, 2014.

Programming in algorithmic pictures (View the MathML source-pictures) is an approach where pictures and moving pictures are used as supercharacters for representing features of computational algorithms and data structures. Within this approach some "data space structures" are traversed by "fronts of computation" and/or some "units of activity" are traversed by flows of data. There are compound View the MathML source-pictures to define algorithmic steps (called Algorithmic CyberFrames) and generic View the MathML source-pictures to define the contents of compound pictures. Compound View the MathML source-pictures are assembled into special series to represent some algorithmic features. The series are assembled into an Algorithmic CyberFilm. The generic/compound View the MathML source-pictures and their series are developed and acquired in special galleries of an open type where supportive pictures of embedded clarity annotations are also included. In this paper, *AIDA (Star-AIDA) modeling/programming language (AIDA stands for Animation and Images to Develop Algorithms) and its Filmification modeling (F-

modeling) environment are briefly considered and examples of programs in View the MathML source-pictures are provided. A special attention is paid to *AIDA programs as special information resources which perception, comprehension and cognition depend on interaction with, at least, a few different but mutually supplementing features of View the MathML source-pictures. A scheme of data/knowledge acquisition based on clusters of different views and how this acquisition is oriented to enhancing user ' s ability within works on developing application models, corresponding algorithms and programs, are presented.

Refereed Proceeding Papers

[bhalla-02:2013] J. Terazono H. Nakamura, S. Bhalla and W. Chu. Kaguya Moon Mission Data Repository: New Query Language Interface for Locating GIS Objects. In A. Madaan, S. Kikuchi, and S. Bhalla, editors, *9th International Workshop on Databases in Networked Information Systems*, pages 232–255, Germany, March 2014. Lecture Notes in Computer Science Series, Springer Verlag.

The observation data gathered by a luanr probe Kaguya, is now being officially published by Japan Aerospace Exploration Agency (JAXA) through the web site. However, this web site does not have the lunar location and name based search function, thus we can not retrieve the data by location name or by feature type. Therefore, we developed the lunar feature/name based Kaguya data search system. In addition, this system can be used by the simple keyword input, making use of Kaguya data. However, at present, only a geometric image product Ortho_MAP is available among the 88 Kaguya products. We plan to store, adopt all remaining products in a similar way, but the importing operation is not completely automated yet. Also it is hard to say that this system is highly optimized for dealing with Kaguya data. Because the base of this system is another support system called the Moon Seeker, it is for a lunar feature searching. Since finish of the Kaguya mission, some processed data, such as 3D map, are still generated by Kaguya's observation data. Hence we hope to continue the enrichment of this system for further promotion of these demands for Kaguya data.

[w-chu-01:2013] Wanming Chu. Search System for City Information using Multiple Public Transportation Information Resources. In Sub-

hash Bhalla Editor Aastha madaan, Shinji Kikuchi, editor, *9th International Workshop on Databases in Networked Information Systems*, pages 256–265, Germany, March 2014. Lecture Notes in Computer Science Series, Springer verlag.

In this paper, we propose a novel search system for city public transportation. This system collects the bus timetable information from Aizu bus home page, the city information from Internet, and the public facilities map of Aizu-Wakamatsu city, to generate geographic data by using Google Maps API. Multiple search methods are developed to obtain the information that users are interested in. One of the search results can be set as the origin or destination of a bus route. The shortest bus route with the minimum number of bus stops between the origin and destination can be found by using the bus routing function. The search results and the shortest bus route are visualized on the embed Google map(interactively). The search detailed information are shown in the side-bar. Since this system finds city information with bus route, residents and visitors can utilize the city public transportation more efficiently for their daily life, business, and travel planners.

[w-chu-02:2013] Wanming Chu Aastha. Handling Domain Specific Document Repositories for Application of Query Languages. In Subhash Bhalla Editor Aastha madaan, Shinji Kikuchi, editor, *9th International Workshop on Databases in Networked Information Systems*, pages 152–167, Germany, March 2014. Lecture Notes in Computer Science Series, Springer verlag.

Domain specific information is increasingly available on the Web in form of document repositories. In specialized domains such as agriculture, biomedical sciences and health-care, this information is required by various domain experts. Health-care experts such as researchers and practitioners require it during health-care delivery and for educational purposes. These users differ from the Web users and database users. Most of the existing document repositories on the Web have alphabetical and keyword based searches. These are not sufficient for the expert users with precise and complex queries, who require in-depth results within time constraints. Their information needs can be supported by providing user-level schema. Such a schema can support database-style high-level query languages over these repositories. Seeking specialized domain-specific information through queries is gaining importance. In this paper, a model for on-line document repositories is proposed. Queries can be performed with

in-depth results. The model can be replicated to similarly structured document repositories in any given domain.

[yutaka-02:2013] Nikolay Mirenkov Yutaka Watanob. *AIDA declarations supporting program compactness. In *In: Proceedings of the 2013 International Joint Conference on Awareness Science and Technlogy and Ubi-Media Computing*, page 552, 2013.

Abstract—*AIDA (Star-AIDA) is a programming (modeling) language for programming in pictures. The pictures play a role of algorithmic super-characters and their compositions can be considered as compound pictures and as "super-texts." A veryhigh level of the super-characters allows not only to essentially decrease the algorithm representation sizes, but also to increase understandability of algorithms. In addition to the level of the super-characters, important contributions to the compactness and understandability of *AIDA programs are related to forms of the picture compositions and displaying (visualizing) such compositions. These forms are based on folding/unfolding techniques, clarifying annotations, patterns for representing formulas, etc. In this paper, *AIDA declarations are considered and a special approach for manipulating with large-scale formulas and large number of variables is presented.

[yutaka-03:2013] Nikolay N. Mirenkov Yutaka Watanobe. Diagram scenes in *AIDA. In *Proceedings of the 12th IEEE International Conference on Intelligent Software Methodologies, Tools and Techniques*, pages 209–215, 2013.

Abstract—*AIDA modeling/programming language is based on algorithmic pictures and animations as super-characters for representing and explaining features of computational (or other type) algorithms. Generic pictures are used to define compound pictures and compound pictures are assembled into special series (Cyber-scenes) prepared for automatic code generation. There are super-characters related to space structures for imitating some physical regions (shapes) in 3-D space and (computational) activities in time on structure nodes, and to diagram structures for representing connections between a set of activity units and specifying a partial order of the activity execution. The sets of the super-characters are open and adding new ones is implemented as a special knowledge/experience acquisition to support various modeling techniques and applications. In this paper we focus on the diagram structures and present how new Cyber-scenes for statechart and clients-server alliances are incorporated into *AIDA language.

[yutaka-04:2013] Maria Ganzha Marcin Paprzycki Alexander Vazhenin Yutaka Watanobe Michal Drozdowicz, Kensaku Hayashi. Implementing Agent-Based Resource Management in Tsunami Modeling - Preliminary Considerations. In *DNIS 2014*, pages 95–111, 2014.

Recently, work has started to apply the agent-semantic infrastructure, developed within the scope of the Agents in Grid project, to the resource management needed in tsunami modeling. The original proposal was based on the perceived simplicity, versatility and flexibility of the agent-based approach that makes it easier to deploy than the standard grid middlewares. The aim of this paper is to report on the progress in implementing and deploying the proposed system at the University of Aizu.

Books

[bhalla-03:2013] A. Madaan, S. Kikuchi, and S. Bhalla, editors. *Databases in Networked Information Systems*, volume 8381 of *Lecture Notes in Computer Science*. Springer-Verlag, Germany, March 2014.

Grants

[yutaka-05:2013] Yutaka Watanobe. 次世代プログラミング言語によるオンラインジャッジシステム, 2013.
科研費

Academic Activities

[yutaka-06:2013] Yutaka Watanobe, 2013.
Reviewer

[yutaka-07:2013] Yutaka Watanobe, 2013.
Organizing Committee Co-Chairs

[yutaka-08:2013] Yutaka Watanobe, 2013.
Program Committee Reviewer

[yutaka-09:2013] Yutaka Watanobe, 2013.
可視化情報学会 2013 実行委員会

[yutaka-10:2013] Yutaka Watanobe, 2013.
        Program Committee Reviewer

[yutaka-11:2013] Yutaka Watanobe, 2013.
        Reviewer

[yutaka-12:2013] Yutaka Watanobe, 2013.
        Program Committee Reviewer

[yutaka-13:2013] Yutaka Watanobe, 2013.
        Reviewer

Ph.D and Others Theses

[w-chu-03:2013] Chiaki Kawasaki. Graduation Thesis: Web Query Interface for Drug and Health Topic in MedlinePlus, University of Aizu, 2013.
    Thesis Advisor: Wanming Chu

[w-chu-04:2013] Naohiro Nakamura. Graduation Thesis: Web-based Geographic Data Collection System, University of Aizu, 2013.
    Thesis Advisor: Wanming Chu

[w-chu-05:2013] Risa Fukuda. Graduation Thesis: Book Management and Recommendation System(BMRS), University of Aizu, 2013.
    Thesis Advisor: Wanming Chu

[w-chu-06:2013] Eri Suzuki. Graduation Thesis: Public Transportation Navigation System on Google Map, University of Aizu, 2013.
    Thesis Advisor: Wanming Chu