Book Reviews

Database and Expert Systems Applications

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1. Introduction

The Annual DEXA Conference addresses some of the most important aspects of databases, knowledge bases and related technologies, as well as their applications. The Program Committee unifies specialists in many and diverse fields of database world, artificial intelligence, information systems, etc. On the occasion of DEXA Conference, important workshops have been organized, many of them pointing to new fields and topics in databases and information systems.

DEXA'99, in Florence, was the tenth Conference in the series, following the events held in Vienna, Berlin, Valencia, Prague, Athens, London, Zurich, Toulouse and Vienna.

This book gathers the papers and tutorials selected for DEXA'99. It is dedicated to researchers and specialists in databases and related fields that search for theoretical answers and possible solutions to their questions and problems, mainly in artificial intelligence. The readers who are novice in database theory might get an idea on the main aspects that will substantially impact on their work with computer, some of them in the near future.

Almost all Sections at DEXA'99 resume aspects which have extensively and thoroughly been tackled so far by the dedicated conferences in the database world (on OO/ distributed/ spatial/ temporal / advanced databases, on transaction management, on WWW etc). However, reading this book, one has the advantage of getting knowledge of or finding answers to several fields and problems, all at once. It might be considered a guide in the world of the database research, using conceptual tools from artificial intelligence.

As Invited Talks at DEXA'99, the following have been proposed:

1. **"On Tractable Queries and Constraints"**, by **Gottlob G., Scarcello F.** (Technical University of Vienna). It is about the database problem of evaluating a conjunctive query (CQ) and, at the same time, about solving a constraint satisfaction problem (CSP). The paper surveys some recent results of the authors with respect to acyclic and nearly acyclic CQs and CSPs, and introduces a new algorithm for computing a decomposition of a hypergraph associated with a CQ or CSP.

2. **"Data Warehouse Design and Maintenance through View Normalization"**, by **Monania M.** (University of South Australia), **Karlapalem K.** (University of Hong Kong), **Kambayashi Y.** (Kyoto University). The paper starts from the finding that data warehouse design driven by queries is difficult to realise because of the materialized view selection and maintenance problems. Since user queries change over time, data warehouse design becomes a dynamic problem, that has to contain frequent changes. The paper advocates for the applicability of the view normalization technique to facilitate robust

data warehouse design and efficient maintenance of materialized views.

3. "**Experiments in Adaptable and Secure Multimedia Database Systems**", by **Bhargava B., Li S.** (Purdue University, USA). The paper presents several adaptive quality of service (QoS) control techniques for video conferencing under run-time resource constraints. It shows that adaptability is an approach to dealing with run-time resource constraints and various anomalies by showing how a video conferencing system maintains its QoS in a user-satisfactory manner when the network bandwidth decreases. Due to the importance of multimedia security to QoS, the paper also presents a fast MPEG video encryption algorithm that bounds computation time for any video frame size and is robust to both plain text and cipher text.

About one hundred papers have been selected for DEXA'99. They have been distributed into the following *Sections*:

- Object-Orientation
- Query Aspects
- Fundamentals of Applications
- Advanced Databases
- Heterogeneous, Distributed and Federated Database Systems
- Transactions
- Data-Warehousing and Data-Mining
- Spatial Aspects
- World Wide Web Applications
- Temporal aspects
- Applications

The next Sections will enumerate the main topics that one can find in the eleven domains approached at DEXA'99.

2. Object-Orientation

The papers concerned with object -orientation tackle various aspects such as: schema dynamic evolution; dynamic relationships in OO databases; intelligent OO database architecture; integration of OO DBMSs and the information retrieval systems; ordered delivery of messages in object-based systems; storage and retrieval of XML documents using object-relational databases; query processing of nested objects; object-based caching with consistency; from OO conceptual modeling to component-based development; retrieval of structured documents from object-relational databases; active database rules behaviour using rewriting logic; architecture and performance of a parallel object- server; a hologram approach instead of inheritance mechanism; viewpoints in an object model with criterion-based classes.

Improving OO solutions, mainly regarding object evolution, their flexibility and intelligence and their dynamic relationships and behaviour have been presented as basic trends in this domain at DEXA'99.

3. Query Aspects

Main query aspects revealed at DEXA'99 are with respect to: controlled hypertextual navigation; the implementation of a generic query processor; hybrid simultaneous scheduling and mapping in SQL multi-query parallelization; cluster-based database selection techniques for routing bibliographic queries; a time series extension of SQL based on limited patience patterns; a knowledge-based approach for modeling and querying multidimensional databases; an incremental hypercube approach for finding best matches for vague queries; query processing in Relationlog (a persistent deductive database system); rewriting queries using views; a query subsumption technique; contextual fuzzy views to query imprecise data; combining pat-trees and signature files for query evaluation in document databases; answering queries by semantic caches; a method for query containment checking; the specification of representation-based conditions in a context of incomplete databases.

One may notice that, composing and processing complex, distributed, multi-dimensional queries as well as intelligent and precise answers still need new solutions, partly proposed at DEXA'99.

4. Fundamentals of Applications

This Section unifies papers where various theories meet their practical application. Main topics and their applications selected for DEXA'99 are about: developing patterns as a mechanism for assisting the management of knowledge in the context of conducting organizational change; knowledge acquisition for mobile robot environment mapping; text understanding for knowledge base generation; knowledge discovery with the association memory model Neunet (Neural Network); formalizing ontology and its relations; a theory for argumentation; efficiency issues during the process of integrity maintenance; a conference

key multicasting scheme using knapsack and secret sharing; verify updating trigger correctness; a weighting scheme for multimedia documents; simulating the interaction of database agents; automatic and semantic techniques for scheme integration and scheme abstraction; dialogue management in a virtual college; methods and interpretation of database summarisation; a scalable parallel view maintenance algorithm for shared multi-processor machines; using back propagation algorithm and genetic algorithm to train and refine neural networks for object detection.

5. Advanced Databases

This Section unifies papers with diverse topics and applications, in databases, e-commerce, workflows, enterprises, virtual organizations, metadata definition, etc. They tackle the following themes: tracking mobile users utilizing their frequently visited locations; parallel signature file techniques using vertical partitioning and extendable hashing; a case for Deltas in business-to-business electronic commerce; workflow management systems: an approach based on generic process models; quality and recommendation of multi-source data for assisting technological intelligence applications; benchmarking attribute cardinality maps for database systems using TPC-D specifications; self-organizing maps to organize document archives and to characterize subject -matters; a fast method for ensuring the consistency of the integrity constraints; a mechanism for deriving specifications of security functions in the common criteria framework; metadata based EDI for small enterprises; database challenges for Genome Information in the Post sequencing -phase; supporting teams in virtual organizations; an adaptive, maintainable, extensible process agent; metadata added to Web documents.

Besides their theoretical purpose, the topics of the papers in this Section reveal the applications that require and motivate the advanced databases today.

6. Heterogeneous, Distributed and Federated Database Systems

Although many researchers consider unpractical the idea of database federation, mainly because of the unsolved problems with respect to schema semantic integration, new solutions are still searched for, more or less related to the basic theory on database federation. Directly or indirectly, the papers gathered in this Section approach this problem pointing to: a framework for heterogeneous database systems integration; a solution to the ontological heterogeneity; the generation of conceptual wrappers for legacy databases; optimal horizontal fragmentation; object clustering methods and a query decomposition strategy for distributed object-based information systems; dynamic adjustment of localized constraints; a platform for distributed open hypermedia applications; local and federated database schemas evolution; adaptive caching management for multimedia support; an approach towards virtual global information systems.

The conclusion that can be drawn from these papers is that database (and, implicitly, information system) federation must be seen in its complex context today, dominated by the heterogeneity of the models, application domains, media, languages, etc., by the system autonomy, by the rapid evolution of computer technology.

7. Transactions

Most papers in this Section introduce theoretical ideas regarding the transaction management or the transactional computation, mainly with respect to: the design and implementation of a linear hash algorithm in a nested transaction environment; partial isolation in flat transactions; concurrency control for global transaction management in multidatabase systems; specification of procedural and transactional computation; database versions to represent bitemporal databases; transaction shipping approach for mobile distributed real-time databases; distributed global transaction support for workflow management applications.

Pure research on multidatabase (global) transactions, aiming at managing and controlling general distributed databases, has lately been extended to its application to workflows, spatial or temporal databases, real - time processes, etc. This trend appears obviously from the papers in this section.

8. Data-Warehousing and Data-Mining

Usually using conceptual tools from artificial intelligence and having databases as main study object, the papers in this Section try to solve the following aspects: designing and maintaining data warehouse through view normalization; cleansing data; handling sparse but clustered

multidimensional data; enhancing data warehousing with fuzzy technology; mining databases with an ensemble of classifiers; discovering patterns to customize the server hypertext organization dynamically.

9. Spatial Aspects

Relatively new as research domain, spatial databases are approached in this Section from more directions and with diverse applications such as: update propagation of replicated data in distributed spatial databases; split algorithms for sets of high-dimensional objects; spatio-temporal multimedia presentations as database objects; spatial indexing; spatial storage based on main-memory database architecture.

10. World Wide Web Applications

Although the research on improving WWW has been poorly represented at DEXA'99, four papers have been selected on the following topics: a fuzzy based approach on WWW bookmark modeling and visualization; a personal translation assistant for accessing WWW; Website refresh queries; building cyberbroker in Digital marketplaces using Java and CORBA.

11. Temporal Aspects

Among the numerous unsolved aspects of the temporal databases, the DEXA '99 selected papers were mainly concerned with: reasoning about events with imprecise location and multiple granularities; effective temporal aggregation using point-based trees; temporal indexing with multidimensional file structures; communicating time-oriented, skeletal plans to domain experts lucidly.

12. Applications

Because of their application in fields from real life, such as health, music, aeronautics, retail markets, etc., the papers separated in this Section introduce us in: a similarity measurement to partition a vocabulary of medical concepts; a study on musical features for melody databases; using multimedia in aeronautical technical documentation; a case study in information delivery to mass retail markets; a scalable system architecture in Digital libraries; a multi-feature access method for large image databases.

13. Conclusions

The main purpose of DEXA'99 Conference was that of offering a place where the researchers in two domains, databases and artificial intelligence, could meet and find a way to combine their most valuable ideas. The last editions of the Conference, including DEXA'99, as noticeable from the topics above, were dominated by the many unsolved problems in the database field. However, the two domains have met, more or less, in all Sections. Basic ideas from knowledge representation and acquisition, fuzzy technology, neural networks, formal ontology, intelligent agents, etc. are used as conceptual tools for many solutions in databases, as exposed at DEXA'99.

Math. Alexandra Galatescu
Database Systems Laboratory
National Institute for Research and Development in Informatics Bucharest