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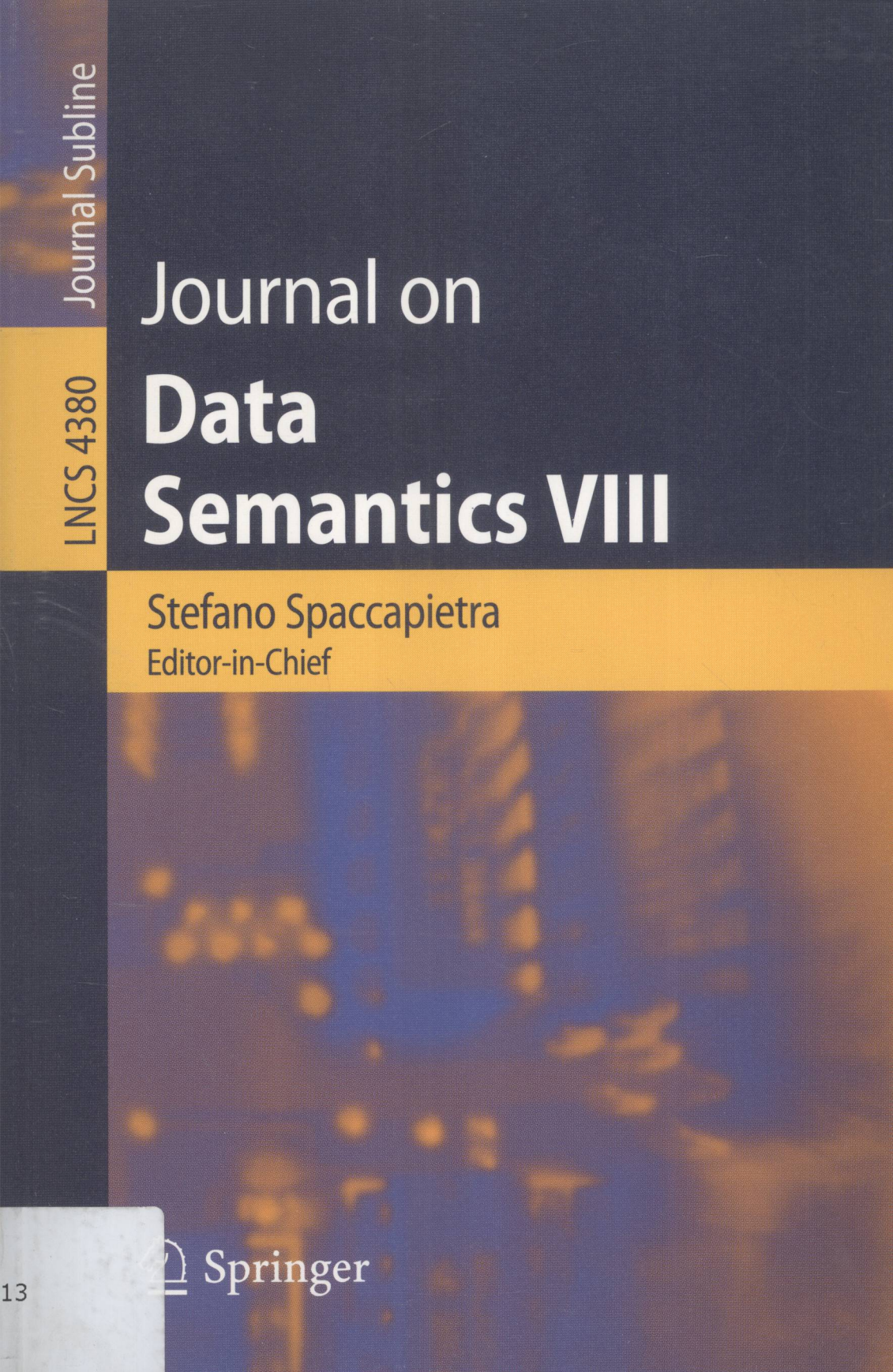

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Journal on Data Semantics VIII

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The LNCS Journal on Data Semantics

Computerized information handling has changed its focus from centralized data management systems to decentralized data exchange facilities. Modern distribution channels, such as high-speed Internet networks and wireless communication infrastructure, provide reliable technical support for data distribution and data access, materializing the new, popular idea that data may be available to anybody, anywhere, anytime. However, providing huge amounts of data on request often turns into a counterproductive service, making the data useless because of poor relevance or inappropriate level of detail. Semantic knowledge is the essential missing piece that allows the delivery of information that matches user requirements. Semantic agreement, in particular, is essential to meaningful data exchange.

Semantic issues have long been open issues in data and knowledge management. However, the boom in semantically poor technologies, such as the Web and XML, has boosted renewed interest in semantics. Conferences on the Semantic Web, for instance, attract big crowds of participants, while ontologies on their own have become a hot and popular topic in the database and artificial intelligence communities.

Springer's LNCS *Journal on Data Semantics* aims at providing a highly visible dissemination channel for most remarkable work that in one way or another addresses research and development on issues related to the semantics of data. The target domain ranges from theories supporting the formal definition of semantic content to innovative domain-specific application of semantic knowledge. This publication channel should be of the highest interest to researchers and advanced practitioners working on the Semantic Web, interoperability, mobile information services, data warehousing, knowledge representation and reasoning, conceptual database modeling, ontologies, and artificial intelligence.

Topics of relevance to this journal include:

- Semantic interoperability, semantic mediators
- Ontologies
- Ontology, schema and data integration, reconciliation and alignment
- Multiple representations, alternative representations
- Knowledge representation and reasoning
- Conceptualization and representation
- Multi-model and multi-paradigm approaches
- Mappings, transformations, reverse engineering
- Metadata
- Conceptual data modeling
- Integrity description and handling
- Evolution and change
- Web semantics and semi-structured data

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- Semantic caching
- Data warehousing and semantic data mining
- Spatial, temporal, multimedia and multimodal semantics
- Semantics in data visualization
- Semantic services for mobile users
- Supporting tools
- Applications of semantic-driven approaches

These topics are to be understood as specifically related to semantic issues. Contributions submitted to the journal and dealing with semantics of data will be considered even if they are not from the topics in the list.

While the physical appearance of the journal issues is like the books from the well-known Springer LNCS series, the mode of operation is that of a journal. Contributions can be freely submitted by authors and are reviewed by the Editorial Board. Contributions may also be invited, and nevertheless carefully reviewed, as in the case for issues that contain extended versions of best papers from major conferences addressing data semantics issues. Special issues, focusing on a specific topic, are coordinated by guest editors once the proposal for a special issue is accepted by the Editorial Board. Finally, it is also possible that a journal issue be devoted to a single text.

The journal published its first volume in 2003 (LNCS 2800). That initial volume, as well as volumes II (LNCS 3360), V (LNCS 3870), this volume, VIII, and the next volume, IX, represent the annual occurrence of a special issue devoted to publication of selected extended versions of best conference papers from the previous year's conferences. Volumes III and VI were special issues on a dedicated topic. Volume III (LNCS 3534), coordinated by guest editor Esteban Zimányi, addressed Semantic-Based Geographical Information Systems, while volume VI (LNCS 4090), coordinated by guest editors Karl Aberer and Philippe Cudre-Mauroux, addressed Emergent Semantics. Volumes IV and VI were "normal" volumes, built from spontaneous submissions on any of the topics of interest to the journal.

The Editorial Board comprises an Editor-in-Chief (with overall responsibility), a Co-editor-in-Chief, and several members. The Editor-in-Chief has a four-year mandate. Members of the board have a three-year mandate. Mandates are renewable, and new members may be elected anytime.

We are happy to welcome you to our readership and authorship, and hope we will share this privileged contact for a long time.

Stefano Spaccapietra
Editor-in-Chief
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JoDS Volume VIII

To foster the dissemination of the best ideas and results, the *Journal on Data Semantics* (JoDS) pursues a policy that includes annually publishing extended versions of the best papers from selected conferences whose scope encompasses or intersects with the scope of the journal.

This initiative is motivated by the difference in goals between conferences and journals. Conferences usually have a faster turnaround and a focused audience, but they have to enforce space limitation and a fixed time frame, with no chances for improving a paper by producing multiple versions. In contrast, journals offer more space, room for debate and refinement, and are usually considered the real archival venue.

Therefore, the publication of an extended version of a conference paper is a much appreciated opportunity for researchers to widely disseminate a significantly improved presentation of their work, where they can develop the appropriate motivations, reasoning, results and comparative analysis. Moreover, by gathering best papers from various conferences, JoDS special issues provide a unique opportunity for researchers to find in a single publication every year the best of ongoing research in the field of data semantics.

For this issue, papers from the following six 2005 international conferences were invited:

- The Seventh International Conference on Data Warehousing and Knowledge Discovery (DaWaK 2005),
- The 3rd International Workshop on Principles and Practice of Semantic Web Reasoning, (PPSWR 2005),
- The 1st International Workshop on Contexts and Ontologies, Theory, Practice and Applications (C&O 2005), joint event with the 25th National Conference on Artificial Intelligence (AAAI 2005),
- The 2nd International Workshop on Peer-to-Peer Knowledge Management (P2PKM 2005), joint event with the 2nd Annual International Conference on Mobile and Ubiquitous systems (Mobiquitous 2005)
- The 13th International Conference on Cooperative Information Systems, (CoopIS 2005) and the International Conference on Ontologies, Databases, and Applications of Semantics (ODBASE 2005), which both took place October 31 to November 4, 2005, Agia Napa, Cyprus.

In addition, this issue includes one paper from the 23rd International Conference on Conceptual Modeling (ER 2004), which was accepted but could not be included in JoDS V because of late delivery of the final version.

Papers from these conferences were invited based on their quality, relevance and significance, and the viability of extending their results. Extended versions prepared by authors were subject to the traditional two-round scholarly review process, and the authors were required to respond to all concerns expressed by the reviewers before papers were accepted.

The paper by Velcin and Ganascia, originating from ER 2004, considers a model dealing with sparse data sets and describes a theoretical framework for inducing knowledge out of them. The general framework relies on a lattice structure, and it is illustrated within two formalisms: the attribute-value formalism and Sowa's conceptual graphs. The induction engine is based on a non-supervised algorithm called default clustering, which uses the concept of stereotype and a new notion of default subsumption, inspired by the default logic theory.

The selection of CoopIS 2005 best papers eventually resulted in the acceptance of three papers. The paper "Semantic Matching: Algorithms and Implementation" by Giunchiglia, Yatskevich and Shvaiko provides a framework that views *match* as an operator that takes two graph-like structures and produces a mapping between the nodes of the graphs that correspond semantically to each other. The authors introduce model-based techniques at the structure level.

The paper "Semantic-Guided Clustering of Heterogeneous XML Schemas" by De Meo, Quattrone, Terracina and Ursino investigates a semantic-based approach for clustering heterogeneous XML schemas. The proposed approach makes use of the semantics of the underlying schemas by capturing the interschema properties among concepts of the schemas. The experimental analysis shows that the approach is scalable.

The paper "A Formal Framework for Adaptive Access Control Models" by Rinderle and Reichert proposes a framework that is suitable for handling evolution of organizational models and related access rules. The paper introduces a set of well-defined operators for defining and capturing changes in organizational models. In addition, the framework allows adaptation of access rules when the model changes.

DaWak 2005 contributed its best paper, "Processing Sequential Patterns in Relational Databases" by Shang and Sattler. The paper proposes an efficient SQL-based algorithm to mine sequential patterns in relational database systems. Authors start by saying that traditionally data mining techniques have been applied on flat files instead of on databases due to the low performance and high cost associated in implementing data mining with SQL on relational databases. Authors claim that it is possible to achieve a reasonable performance by implementing association rule mining and sequential pattern mining with carefully tuned SQL formulations. To this extent, authors depart from inefficient a-priori methods and propose an efficient SQL-based algorithm, called Prospad (PROjection Sequential PAttern Discovery), to mine sequential patterns in relational database systems. Prospad adopts the divide-and-conquer strategy and projects the sequence table into a set of frequent item-related projected tables. Experimental results show that the Prospad algorithm can get higher performance than k-way joins based on a-priori approaches, especially on large and dense datasets, although it has severe limitations in performance compared to in-memory PrefixSpan algorithms.

Two extended articles were selected from PPSWR 2005. The paper "A Tool for Evaluating Ontology Alignment Strategies," by Lambrix and Tan, addresses the important issue of aligning different ont logies, so that multiple sources of information can be exploited altogether. The paper describes a framework for the comparative evaluation of ontology alignment strategies and their combinations, and reports on the performance of an implementation of this framework. The test cases

used for the evaluation are composed of five biomedical ontologies. A detailed example shows the use of two matchers in combination.

The paper "SomeRDFS in the Semantic Web," by Adjiman, Goasdoué and Rousset, envisions the Semantic Web as a huge peer data management system, where data on the Web are annotated by ontologies networked together by mappings. The paper describes the SomeRDFS peer data management system architecture, its data model, query language, and query answering algorithm based on query rewriting techniques that are formally justified in the paper.

The selection from C&O 2005 resulted in three extended papers being accepted for JoDS.

The paper "Putting Things in Context: A Topological Approach to Mapping Contexts to Ontologies" by Segev and Gal, provides a framework that defines the relationship between contexts and ontologies by using topological structures. This work has been motivated by the needs of the eGovernment domain. In this approach ontologies are viewed as the result of a manual effort to model a domain, while contexts are automatically generated models. The uncertainty, which usually exists in automatic context extraction, is managed through the definition of distance among contexts and a ranking of ontology concepts with respect to a given context. The approach has been implemented and evaluated on two real-world data sets: Reuters news reports and RSS news headlines.

The paper "Context Dependency Management in Ontology Engineering: A Formal Approach," by De Leenheer, de Moor, and Meersman, introduces a framework that uses lexical knowledge to manage context dependences in ontology engineering tasks. The formalization of the context dependency management is built on top of the DOGMA ontology-engineering framework. The proposed approach is validated by a case study of inter-organizational competency ontology engineering.

The paper "Encoding Classifications into Lightweight Ontologies" by Giunchiglia, Marchese, and Zaihrayeu provides a theory of how to translate standard classifications, such as DMoz, into formal classifications, namely, graph structures where labels are written in a propositional concept language. Formal classifications turn out to be a form of lightweight ontologies. This allows reducing essential tasks on classifications, such as document classification and query answering, to reasoning about subsumption.

While the paper selected from P2PKM is still in the review process at this time, four extended versions of ODBASE 2005 papers were granted acceptance. The paper "Creating Ontologies for Content Representation - The OntoSeed Suite," by Paslaru Bontas Simperl and Schlangen, proposes a natural language-based technique to help ontology engineers decide which concepts to model in any particular domain. Unlike other NLP-based techniques, this approach does not require in-depth linguistic expertise. Instead it relies on the Web for collecting the documents against which to compare domain-specific texts.

"Metadata Management in a Multiversion Data Warehouse," a paper by Wrembel and Bebel, deals with the problem of evolving data warehouses in the presence of changes in the schema of the underlying data sources. The paper proposes a solution, called multiversion data warehouse, which maintains extensive metadata about the external data sources.

The paper by Kensche, Quix, Chatti, and Jarke, "GeRoMe: A Generic Role-Based Metamodel for Model Management," proposes a generic mechanism for describing data models. This approach assigns multiple roles to model elements and permits accurate description of these elements using only a small number of roles and metaclasses. This contrasts favorably with metamodel languages that are based exclusively on metaclasses, since such languages may require an exponentially large number of metaclasses.

The paper on "Security Ontology for Annotating Resources," by Kim, Luo, and Kang, proposes an ontology for describing security requirements of Web services. The goal of such an ontology is to enable Web service discovery that meets a client's security requirements, such as protocols, objectives, and credentials. The proposed ontology is more comprehensive and detailed than other similar ontologies.

Because of size limitations, only eight of the 14 above-described papers appear in this volume. The other six papers will appear in the next volume, JoDS IX, scheduled for Spring 2007.

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Default Clustering with Conceptual Structures

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Abstract. This paper describes a theoretical framework for inducing knowledge from incomplete data sets. The general framework can be used with any formalism based on a lattice structure. It is illustrated within two formalisms: the attribute-value formalism and Sowa's conceptual graphs. The induction engine is based on a non-supervised algorithm called default clustering which uses the concept of stereotype and the new notion of default subsumption, inspired by the default logic theory. A validation using artificial data sets and an application concerning the extraction of stereotypes from newspaper articles are given at the end of the paper.

1 Introduction

This paper presents a model dealing with sparse data sets. Our original goal was to simulate common-sense inductive reasoning. It appears from previous research [1,2,3] that common-sense reasoning is highly related to reasoning from partially described data. The general framework we propose treats such data by following a default reasoning. It can be applied to automatically process heterogeneous data which often fit this property of sparseness. The main considered application deals with newspaper articles translated into a logical formalism. Our goal is to extract characteristic representations called *stereotypes* from these newspapers. The extracted representations can be seen as a way of summarizing the data in a simplified and rough manner.

More precisely, we refer to representations that can be obtained through a task of clustering. Conceptual clustering, a fundamental machine learning task [4], takes a set of object descriptions, or *observations*, as input and creates a classification scheme. Our interest will be more focused on the concepts used to name the classes than on the classes themselves. However, information sparseness is a recurrent problem in clustering. This may be for several reasons: voluntary omissions, human error, broken equipment which causes a loss of data, etc. [5]. The phenomena increases drastically when you consider the information extracted from newspapers because the vocabulary used is often very heterogeneous. Usually, existing algorithms are not adapted when there are many missing values. One solution is to fill the holes, i.e. the unknown values, by analogy with the

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