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# Semantic Technology

6th Joint International Conference, JIST 2016  
Singapore, Singapore, November 2–4, 2016  
Revised Selected Papers

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# Preface

This volume contains the papers presented at JIST 2016: the 6th Joint International Semantic Technology Conference held during November 2–4, 2016, in Singapore. JIST 2016 was co-hosted by National University of Singapore, Nanyang Technological University (Singapore), and Monash University (Australia). JIST is a regional federation of semantic technology-related conferences. It attracts many participants from mainly the Asia Pacific region and often Europe and the USA. The mission of JIST is to bring together researchers in semantic technology research and other areas of semantic-related technologies to present their innovative research results and novel applications.

The main topics of JIST 2016 include ontology and reasoning, linked data, and knowledge graph, among others. JIST 2016 consisted of two keynotes, a main technical track, including (full and short) papers from the research and the in-use tracks, a poster and demo session, a workshop, and two tutorials. There were a total of 34 submissions for the main technical tracks from 17 countries. All papers were reviewed by at least three reviewers and the results were rigorously discussed by the program co-chairs. In all, 16 full papers (47%) and eight short papers were accepted in the technical tracks.

The paper topics are divided into six categories: Ontology and Data Management, Linked Data, Information Retrieval and Knowledge Discovery, RDF and Query, Knowledge Graph, and Applications of Semantic Technologies.

We would like to thank the JIST Steering Committee, Organizing Committee, and Program Committee for their significant contributions. We would also like to especially thank the co-hosts for their support in making JIST 2016 a successful and memorable event. Finally, we would like to express our appreciation to all speakers and participants of JIST 2016. This book is an outcome of their contributions.

November 2016

Yuan-Fang Li  
Wei Hu  
Jin Song Dong  
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# Keynotes

# Managing Dynamic Ontologies: Belief Revision and Forgetting

Kewen Wang

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Ontologies have recently been used in a wide range of practical domains such as e-Science, e-Commerce, medical informatics, bio-informatics, and the Semantic Web. An *ontology* is a formal model of some domain knowledge of the world. It specifies the *formalization* of the domain knowledge as well as the *meaning* (semantics) of the formalization. The Web Ontology Language (OWL), with its latest version, OWL 2, is based on description logics (DLs). Thus, an ontology is often expressed as a knowledge base (KB) in DLs, which consists of both terminological knowledge (or schema information) in the TBox and assertional knowledge (or data information) in the ABox. As with all formal knowledge structures, ontologies are not static, but may evolve over time. Indeed, ontology engineering is described as a life-cycle, which is based on evolving prototypes and specific techniques peculiar to each ontology engineering activity. An important and challenging problem is thus how to effectively and efficiently modify ontologies.

In this talk, we discuss some recent developments and challenges for two paradigms of ontology changes. We focus on model-based approaches.

*Knowledge Update:* Outdated and incorrect axioms in an ontology have to be eliminated from the ontology and newly formed axioms have to be incorporated into the ontology. In the field of belief change, extensive work has been done on formalising various kinds of changes over logical knowledge bases. In particular, elimination of old knowledge is called contraction and incorporation of new knowledge is called revision. The dominant approach in belief change is the so called AGM framework. Regardless of its wide acceptance, the AGM framework is incompatible with DLs due to its assumption on an underlying logic that includes propositional logic. The incompatibility is the major difficulty in defining DL contraction and revision. Additionally, DL revision is more involved than AGM revision. AGM revision aims to resolve any inconsistency caused while incorporating a new formula. Since a meaningful DL ontology has to be both consistent and coherent (i.e., absence of unsatisfiable concepts), DL revision has to resolve not only inconsistency but also incoherence. Finally, DL contraction and revision should lead to tractable instantiations and at the same time respecting the mathematical properties of AGM contraction and revision.

*Forgetting:* To support the reuse and combination of ontologies in Semantic Web applications, it is often necessary to obtain smaller ontologies from existing larger ontologies. In particular, applications may require the omission of many terms, e.g., concept names and role names, from an ontology. However, the task of omitting terms

from an ontology is challenging because the omission of some terms may affect the relationships between the remaining terms in complex ways. The technique of forgetting provides an effective way for extracting modules from a large ontology.

# The Rise of Approximate Ontology Reasoning: Is It Mainstream Yet?

Jeff Z. Pan

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The last five years have seen a growing volume and complexity of ontologies and large-scale linked data available,<sup>1</sup> which present a pressing need for efficient and scalable ontology reasoning services. Major technology vendors are starting to embrace semantic technologies by supporting new standards and integrating with state of the art semantic tools. For example, in their new release 12.1, Oracle Spatial and Graph supports both RDF and OWL2-EL natively,<sup>2</sup> and integrates with an OWL2-DL reasoner (TrOWL) via OWL-DBC.<sup>3</sup>

The second version of the ontology standard OWL (Web Ontology Language) offers a family of ontology languages, including OWL2-DL, the most expressive decidable language in the family, and three tractable sub-languages of OWL2-DL, i.e. OWL2-EL, OWL2-QL and OWL2-RL. Such a two-layered language architecture allows approximate reasoning for OWL2-DL, by approximating OWL2-DL ontologies to those in its tractable sub-languages, so as to exploit efficient and scalable reasoners of the sublanguages. This is motivated by the fact that real-world knowledge and data are hardly perfect or completely digitalised. State of the art approximate reasoners, such as the TrOWL reasoner, can out-perform sound and complete reasoners in time constrained sound-and-complete reasoner competitions, such as the ORE competitions.

In this talk, we will look into how and why approximate reasoners work. Indeed, approximation approaches bring a new dimension – quality, in terms of completeness and soundness of reasoning, into the trade-off between expressiveness and performance, attempting to strike a balance among the three. Once we start to consider such a third dimension, many interesting questions follow: What are the typical approximate reasoning approaches? Should we approximate the input ontology or the input query? Are approximations always finite and unique? Given an ontology and some target queries, are there any best approximations? Why do some approximate reasoning algorithms lose many reasoning results, while others can enjoy high recall? Are approximate reasoning algorithms relevant to optimisations for sound and complete reasoners? Can we extend approximate reasoning algorithm with some post-processing to ensure soundness and completeness? I will discuss many of these questions, in the context of the TrOWL reasoner and related work, and share some thoughts on what approximate reasoning might bring in the near future.

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<sup>1</sup> <http://lod-cloud.net/state/>.

<sup>2</sup> [http://download.oracle.com/otndocs/tech/semantic\\_web/pdf/semtech\\_datamining\\_v8.pdf](http://download.oracle.com/otndocs/tech/semantic_web/pdf/semtech_datamining_v8.pdf).

<sup>3</sup> [http://download.oracle.com/otndocs/tech/semantic\\_web/pdf/trowl\\_integration\\_with\\_orasag.pdf](http://download.oracle.com/otndocs/tech/semantic_web/pdf/trowl_integration_with_orasag.pdf).

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