JAIR Special Track on Description Logics

The International Workshop on Description Logics is the main annual event of the description logics research community. To commemorate its 25th edition, the Description Logics Steering Committee has organized this Special Track on Description Logics (DLs) for the Journal of Artificial Intelligence Research (JAIR).

Over the past two decades, DLs have grown tremendously in popularity both within the AI community and beyond, due to the balanced trade-off between expressivity and complexity of reasoning. The current success of DLs is the result of many years of rigorous research carried out by the DL community, which has yielded not only beautiful theoretical results but also powerful systems and important practical applications. Notably, DLs provide the logical underpinning of ontology languages (including the W3C standard OWL), making them relevant to a variety of application domains, such as semantic web, medical informatics, life sciences, e-commerce, etc.

The objective of this special track is to showcase the best of current DL research. We received 17 submissions of high quality and selected the following 7 papers for publication in the special track:

1. Andrea Calì, Georg Gottlob and Michael Kifer. *Taming the Infinite Chase: Query Answering under Expressive Relational Constraints*

2. Diego Calvanese, Magdalena Ortiz, Mantas Šimkus and Giorgio Stefanoni. *Reasoning about Explanations for Negative Query Answers in DL-Lite*

3. Giovanni Casini and Umberto Straccia. *Defeasible Inheritance-based Description Logics*

4. Balder ten Cate, Enrico Franconi and İnanç Seylan. *Beth Definability in Expressive Description Logics*

5. Enrico Franconi, Volha Kerhet and Nhung Ngo. *Exact Query Reformulation over Databases with First-order and Description Logics Ontologies*

6. Ilianna Kollia and Birte Glimm. *Optimizing SPARQL Query Answering over OWL Ontologies*

7. Milenko Mosurovic, Nenad Krdzavac, Henson Graves and Michael Zakharyaschev. *A Decidable Extension of $\mathcal{SROIQ}$ with Complex Role Chains and Unions*

Several of these papers (specifically, papers 1, 2, 5, and 6) focus on various aspects of query answering, currently one of the most active research areas in DLs. Paper 1 deals with query answering under tuple-generating and equality-generating dependencies. The authors obtain decidability results in some non-trivial cases where the conventional database chase procedures do not terminate. Paper 2 looks into the query abduction problem, which studies how

to add new facts in order to obtain a given tuple as an answer to a given query. Paper 5 studies how to decide the existence, and obtain rewritings, of first-order queries when the interpretation of database predicates are fixed as given in the database. That is, the database predicates are interpreted under the closed-world semantics, whereas all other predicates are interpreted under the open-world semantics. Paper 6 generalizes the well-known strategies for evaluation of conjunctive queries in databases, such as cost-based query execution order, to the problem of answering SPARQL queries over OWL ontologies.

Apart from query answering, other key areas of current DL research are covered by the selected papers. Paper 3 contributes to non-monotonic extensions of DLs, by proposing a new hybrid approach for non-monotonic reasoning that combines the ideas of rational closures and inheritance networks. Paper 4 studies the classical notion of Beth Definability in the context of DLs, providing a classification of expressive DLs based on whether these logics admit Beth Definability or not. Finally, Paper 7 pushes the frontiers of decidability in DLs by establishing new results for very expressive logics with role compositions and unions of roles in the right-hand sides of role inclusion axioms.

The papers included in this special issue provide some deep insights into the current state of the art of DL research and the kind of technical tools, problems and applications the scientific community is focussing on. In particular, it is evident that the mathematical techniques have advanced tremendously in these 25 editions of the DL workshop. Currently, the insights and results from the DL community do not only contribute to Knowledge Representation, but also to a large range of other research areas, including Logic, Databases, and Automated Reasoning. Interestingly, in spite of a profound technical evolution, research in DLs has maintained a special focus on the computational aspects of reasoning, which has shaped the field since its beginning more than 30 years ago.

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