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## ***Preface of Special Issue on Rules Systems \****

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# Preface

Rule systems are generally considered to be a major area in the further development of the Semantic Web. On one hand, rules can specify declarative knowledge in ontology languages, expressing constraints or transformations, either in conjunction with, or as an alternative to, description logics. On the other hand, rules can specify behavioral knowledge, enforcing policies or reacting to events/changes.

This Special Issue attracted twelve submissions, of which four were accepted after a careful, two-level reviewing process.

The papers collected here all study the combination of rules with ontologies for the Semantic Web. While the first paper evaluates practical aspects of such a combination with production rules, the other papers study theoretical aspects of combining versions of Datalog and description logics.

In *“Rules and Ontologies in Support of Real-time Ubiquitous Application”*, Marek Hatala et al. evaluate the practical challenges and capabilities of combining ontologies and rules in the context of a realtime ubiquitous application. A rule-based user model was specifically designed to work in environments where rich semantic descriptions are available. Retrieval criteria are represented as inference rules that combine knowledge from psychoacoustics and cognitive domains with compositional aspects of interaction. The evaluation concerns the laboratory and museum deployment testing together with the end user usability evaluations.

In *“OWL Rules: A Proposal and Prototype Implementation”*, Ian Horrocks et al. present SWRL (the Semantic Web Rules Language), which extends OWL in a syntactically and semantically coherent manner. SWRL rules are given formal meaning via an extension of the OWL DL model-theoretic semantics. The authors discuss the expressive power of SWRL, showing that the ontology consistency problem is undecidable, provide several examples of SWRL usage, and discuss a prototype implementation of reasoning support for SWRL.

In *“Query Answering for OWL-DL with Rules”*, Boris Motik et al. argue that a combination of OWL-DL and rules is desirable for the Semantic Web. While this may easily lead to the undecidability of interesting reasoning problems, they present a decidable combination with DL-safe rules: each variable in a rule is required to occur in a non-DL-atom in the rule body. The authors discuss the expressive power of such a combination and present an algorithm for query answering in the related logic SHIQ extended with DL-safe rules, based on a reduction to disjunctive programs.

Finally, “*On the decidability and complexity of integrating ontologies and rules*” by Riccardo Rosati defines a formal framework of r-hybrid knowledge bases (KBs) integrating ontologies and rules. These KBs are parameterized by the logic used to specify the ontology, and for the rules use Datalog<sup>¬</sup> (with negation as failure and disjunction), where the rules interact with the ontology according to a general safeness condition. The paper shows that r-hybrid KBs capture many systems proposed for combining rules and description logics. A general algorithm is proved to preserve decidability of reasoning when adding safe Datalog<sup>¬</sup> rules to a KB, and an analogous property holds for complexity. It is proved that reasoning with OWL-DL as the ontology parameter is decidable.

We are grateful to all submitters and reviewers for their hard work leading to this Special Issue and to various results found on the way.

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