Introduction to the Special Issue on the International Joint Conference on Rules and Reasoning, RuleML+RR 2019

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Abstract

This special issue of Theory and Practice of Logic Programming consists of extended versions of five selected papers from the 3rd International Joint Conference on Rules and Reasoning (RuleML+RR 2019). RuleML+RR 2019 was held in conjunction with the 5th Global Conference on Artificial Intelligence, GCAI 2019, as part of the Bolzano Rules and Artificial INtelligence Summit in Bolzano, Italy, from 17 to 19 of September 2019.

KEYWORDS: RuleML, RR, rules and reasoning

1 Introduction

The International Joint Conference on Rules and Reasoning (RuleML+RR) is the leading international joint conference in the field of rule-based reasoning, applications, languages, and standards for rule technologies. Stemming from the synergy between the well-known RuleML and RR events, one of the main goals of this conference is to build bridges between academia and industry. The conference has evolved from an annual series of international workshops since 2002, international conferences in 2005 and 2006, the international RuleML symposia since 2007, and the International Conference on Web Reasoning and Rule Systems (RR) since 2007. It is the flagship event of both the Rule Markup and Modeling Initiative (RuleML, `http://ruleml.org`), a nonprofit umbrella organization of several technical groups from academia, industry, and government working on rule technology and its applications, and the Web Reasoning and Rule Systems Association (RR, `http://www.rr-conference.org`), which led standardization efforts such as the Rules Interchange Format activity at W3C. In 2017, RuleML and RR joined their conferences into the International Joint Conference on Rules and Reasoning (RuleML+RR). RuleML+RR is the leading conference to build bridges between academia and industry in the field of rules and its applications, especially as part of the semantic technology

stack. It is devoted to rule-based programming and rule-based systems including production rules systems, logic programming rule engines, as well as business rules engines and management systems; Semantic Web rule languages and rule standards (e.g., RuleML, SWRL, RIF, PRR, SBVR, DMN, CL, Prolog); rule-based event processing languages and technologies; and research on inference rules, transformation rules, decision rules, production rules, and ECA rules. Since 2011, the annual Reasoning Web summer school has been co-located with RR.

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This RuleML+RR edition received a total of 87 submissions, of which 21 were accepted for presentation. From those, we selected six papers and invited their authors to submit revised and extended versions of their papers. After a two-round review process, during which each submission and revised submission was reviewed by at least three referees, we selected five of the submissions for inclusion in the special issue. The five selected papers illustrate the range of research areas tackled by the RuleML+RR community.

"Efficient TBox Reasoning with Value Restrictions using the FL0wer Reasoner" by Franz Baader, Patrick Koopmann, Friedrich Michel, Anni-Yasmin Turhan, and Benjamin Zarriess is an extended version of the paper by Michel et al. (2019). The paper presents a novel algorithm for solving the ExpTime-hard subsumption problem in FL0 w.r.t. general TBoxes that is based on the computation of so-called least functional models. To build such a model, the algorithm treats TBox axioms as rules that are applied to objects of the interpretation domain. This algorithm is implemented in the FL0wer reasoner, which uses a variant of the Rete pattern matching algorithm to find applicable rules. An evaluation of FL0wer on a large set of TBoxes generated from real world ontologies indicates that the implementation of the specialized technique for FL0 leads in most cases to a huge performance gain in comparison to the highly optimized tableau reasoners.

Temporal Minimal-World Semantics over Sparse ABoxes by Stefan Borgwardt, Walter Forkel, and Alisa Kovtunova is an extended version of the paper by Borgwardt et al. (2019). The paper presents a temporal extension of the tractable language ELH, which features a new class of convex diamond operators that can be used to bridge temporal gaps. The completion algorithm for the logic keeps entailment tractable. The authors also developed a minimal-world semantics for answering metric temporal conjunctive queries with negation, where query answering is combined first-order rewritable, and hence in polynomial time in data complexity.

Operating Room (Re)Scheduling with Bed Management via ASP by Carmine Dodaro, Giuseppe Galatà, Muhammad Kamran Khan, Marco Maratea, and Ivan Porro is an extended version of the paper by Dodaro et al. (2019). The paper tackles the Operating Room Scheduling (ORS) problem of assigning patients to operating rooms, taking into account different specialties, lengths, and priority scores of each planned surgery, operating room session durations, and the availability of beds for the entire length of stay both in the Intensive Care Unit and in the wards. A proper solution to the ORS problem is of utmost importance for the quality of the healthcare and the satisfaction of patients

in hospital environments. The paper presents a solution to the ORS problem based on Answer Set Programming (ASP). Results of an experimental analysis, conducted on benchmarks with realistic sizes and parameters, show that ASP is a suitable approach for solving the ORS problem.

Reasoning on DL-LiteR with Defeasibility in ASP by Loris Bozzato, Thomas Eiter, and Luciano Serafini is an extended version of the paper by Bozzato et al. (2019). The paper presents a framework for representing (contextualized) OWL RL knowledge bases with a notion of justified exceptions on defeasible axioms: reasoning in such a framework is realized by a translation into ASP programs. The paper includes the justified exception approach to knowledge bases in DL-LiteR (the language underlying OWL QL). The authors define DL-LiteR knowledge bases with defeasible axioms and study their semantic and computational properties. The limited form of DL-LiteR axioms allows to formulate a simpler encoding into ASP programs, where reasoning on negative information is managed by direct rules. The resulting materialization method gives rise to a complete reasoning procedure for instance checking in DL-LiteR with defeasible axioms.

"Alternating Fixpoint Operator for Hybrid MKNF Knowledge Bases as an Approximator of AFT" by Fangfang Liu and Jia-Huai You is an extended version of the paper by Liu and You (2019). The approximation fixpoint theory (AFT) provides an algebraic framework for the study of fixpoints of operators on bilattices, with applications in characterizing semantics of various types of logic programs and nonmonotonic languages. In this paper, the authors show one more application of this kind: the alternating fixpoint operator for the study of well-founded semantics for hybrid MKNF knowledge bases is in fact an approximator of AFT in disguise, which, thanks to the power of abstraction of AFT, characterizes not only the well-founded semantics but also two-valued as well as three-valued semantics for hybrid MKNF knowledge bases. Furthermore, the paper shows an improved approximator for these knowledge bases, of which the least stable fixpoint is information-rich. This leads to an improved computation for the well-founded semantics.

Acknowledgements

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