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Introduction to the special issue on the International Web Rule Symposia 2012–2014

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The annual International Web Rule Symposium (RuleML) is an international conference on research, applications, languages, and standards for rule technologies. It has evolved from an annual series of international workshops since 2002, international conferences in 2005 and 2006, and international symposia since 2007. It is the flagship event of 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. RuleML 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, and business rules engines/business rules 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.

This special issue of Theory and Practice of Logic Programming consists of extended versions of five selected papers from:

- The 6th International Web Rule Symposium (RuleML 2012), which was held in conjunction with ECAI 2012, the 20th European Conference on Artificial Intelligence, in Montpellier, France, in August 27–29, 2012.

- The 7th International Web Rule Symposium (RuleML 2013), which took place in Seattle, USA in July 11–13, 2013, collocated with the 27th AAAI Conference on Artificial Intelligence.
- The 8th International Web Rule Symposium (RuleML 2014), which was held in conjunction with ECAI 2014, the 21st European Conference on Artificial Intelligence, in Prague, Czech Republic, in August 18–22, 2014.

These three RuleML editions received a total of 120 submissions, of which 52 were accepted as full papers. From those, we selected six papers – one from 2012, two from 2013 and three from 2014 – 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 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 community.

"An Event Calculus Production Rule System for Reasoning in Dynamic and Uncertain Domains" by Theodore Patkos, Dimitris Plexousakis, Abdelghani Chibani, and Yacine Amirat is an extended version of Patkos *et al.* (2012), which received the best paper award at RuleML 2012. The paper presents *Cerbere*, a forward-chaining rule-based reasoner for the Event Calculus that can perform causal, temporal, and epistemic reasoning with sensing at run-time. To demonstrate its applicability in dynamic, environments, the authors integrated *Cerbere* with a probabilistic component in a hybrid framework, which enables reasoning under uncertainty in smart spaces, and conducted a series of experiments to evaluate its performance.

"Solving Stable Matching Problems using Answer Set Programming" by Sofie De Clercq, Steven Schockaert, Martine De Cock, and Ann Nowé is an extension of (Clercq *et al.* 2013), which was presented at RuleML 2013. The paper proposes an Answer Set Programming encoding of the Stable Marriage Problem, a well-known matching problem with many practical applications. It focuses on two well-known variants of Stable Marriage Problem: a variant where every person can specify a set of unacceptable partners, and a second variant allowing indifference in preferences. The authors present their encoding as a disjunctive Answer Set Programming program, and prove the soundness of their approach.

"Rationale behind the Concept of Goal" by Guido Governatori, Francesco Olivieri, Simone Scannapieco, Antonino Rotolo, and Matteo Cristani, which extends their RuleML 2013 paper (Governatori *et al.* 2013), presents the concept of goal from a new perspective: it models desires as acceptable outcomes, goals as preferred outcomes and the preferences of an agent as sequences of "alternative acceptable outcomes". It formalizes them in a novel modal defeasible logic and proves that it is computationally feasible by presenting a manageable algorithm that computes the extension of a finite defeasible theory.

"Using Linear Constraints for Logic Program Termination Analysis" by Marco Calautti, Sergio Greco, Cristian Molinaro, and Irina Trubitsyna extends (Calautti *et al.* 2014), which received the best paper award at RuleML 2014. The paper focuses on techniques that check the termination of answer set programs with functional symbols under the stable model semantics. The authors propose two alternative

techniques that allow to identify classes of logic programs that terminate, namely rule-bounded and cycle-bounded programs. The first class looks at the possible propagation of variables from the body to the head of a rule within individual rules, while the second tries to do the same considering a group of rules together. The termination techniques are based on solving a set of linear equations that measure and relate the size of head and body atoms.

"Programming in Logic Without Logic Programming" by Robert Kowalski and Fariba Sadri, an extended version of Kowalski and Sadri (2014) presented at RuleML 2014, introduces the operational semantics of KELPS (a logical framework for reactive systems) and shows that it can generate all reactive models, in which the consequent of reactive rules is made true after their antecedents become true. This operational semantics is incomplete, because it can generate only reactive models. While this semantics is similar to that of imperative reactive rule languages, its incompleteness shows that the operational semantics of imperative rule system languages, which maintain only a single current state using destructive state transitions, are also incomplete if their reactive rules are read as logical implications.

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Program Chairs of RuleML 2012-2014 and Guest Editors

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