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Artificial Intelligence 157 (2004) 1–3
Artificial Intelligence
www.elsevier.com/locate/artint

Editorial

In many applications available pieces of information are uncertain, imprecise, having possible exceptions and generally issued from different conflicting multiple sources of information. The implementation of intelligent systems that can satisfactorily reason with such kind of imperfect pieces of information needs to go beyond the representation formalisms and reasoning engines of propositional and first order logic. In particular, such systems should be able to draw conclusions that are only plausible and that can be eventually withdrawn when new pieces of information are obtained. Thus, the set of conclusions does not grow monotonically with the given information. This kind of reasoning is called nonmonotonic reasoning.

Nonmonotonicity appears in many reasoning tasks: rule based reasoning with exceptions, reasoning about action, merging multiple source information, belief revision, handling preferences, handling causal rules, etc. Many approaches have thus been developed in order to formalize the nonmonotonicity underlying these reasoning tasks. Some approaches are "qualitative" in the sense that they provide reasoning mechanisms to change the underlying logical theory when given a new piece of information. Other approaches are "quantitative" being more numerically oriented and making use of probabilities, belief and plausibility functions, or possibilities.

This special issue gathers eight papers which present recent research on different aspects of nonmonotonic reasoning.

The first two papers deal with belief revision and data fusion. The revision of a database faces the problem of how to insert some input information while preserving certain desired properties, e.g., consistency. Data fusion is the process of merging pieces of information issued from different sources. Both fusion and revision may involve inconsistency handling. However, fusion differs from revision since it is basically a symmetric operation, namely it does not necessarily distinguish the new incoming information. The paper by Eduardo Fermé and Hans Rott provides a new extension of the Alchourrón, Gärdenfors and Makinson theory of belief change by considering how an agent should revise his epistemic state when confronted with information of the form "Accept A with a degree of plausibility at least equal to that of B" (rather than the usual, plain "Accept A"). Sebastien Konieczny, Jérôme Lang and Pierre Marquis present a general framework for expressing possible merging operators. This general framework introduces three parameters (a distance and two aggregation functions), allowing to recover many existing fusion operators, and to derive their computational complexity.

The next two papers deal with computational issues. The one of Adnan Darwiche and Pierre Marquis analyzes the problem of compiling a propositional weighted base into a form that allows for fast model checking and inference. A weighted base is a set of

0004-3702/$ – see front matter
doi:10.1016/j.artint.2004.04.011

sentences, each one being associated to a "weight" (a positive integer), representing the price to pay if the sentence is violated. The most preferred worlds are those with minimum associated weight, computed as the sum of the weights associated to the violated sentences in the base. The model checking problem consists in determining whether a world is among those that are most preferred, while the inference problem consists in determining whether a sentence is satisfied in all the most preferred worlds. The paper by Fangzhen Lin and Yuting Zhao describes an answer set solver based on a novel translation from answer set programs to (classical) propositional logic. The idea of the translation is to extend the completion of the program with so-called "loop formulas" which are shown to eliminate all models of the completion that are not answer sets. The solver uses propositional satisfiability (SAT) checkers to determine candidates answer sets, corresponding to models of a propositional formula φ initially set to the completion of he program. If the candidate is not an answer set, a violated loop formula is computed and added to φ. Then, a new model of φ is searched, and the entire process is iterated till an answer set is found, or φ becomes inconsistent. The solver is shown to have better performances than other state-of-the-art systems on a variety of benchmarks.

The paper of Gabriele Kern-Isberner and Thomas Lukasiewicz presents two approaches to probabilistic logic programming under maximum entropy. The first is based on the usual notion of entailment under maximum entropy, and is defined for the very general case of probabilistic logic programs over Boolean events. In the second one, the principle of maximum entropy is coupled with the closed world assumption, and is only defined for the more restricted case of probabilistic logic programs over conjunctive events. The authors' analysis of both approaches includes the proof of some properties, and the presentation of algorithms.

The last three papers concern representational issues of agent's preferences, causality and unreliable observations. The paper of Gerhard Brewka, Salem Benferhat and Daniel Le Berre introduces a nonmonotonic propositional logic, called "qualitative choice logic", which allows syntactical representation of preference ordering. This logic adds to classical propositional logic a new connective called ordered disjunction, denoted by $A \vec{\times} B$, and which intuitively means: if possible A, but if A is not possible then at least B. The semantics of qualitative choice logic is based on a preference relation among models. The paper also discusses potential applications of the logic. Laura Giordano and Camilla Schwind introduce a new approach to reasoning about action and causation, based on conditional logic. In their approach, conditional implication is interpreted as causal implication, making it possible to formalize in a uniform way causal dependencies between actions and their immediate and indirect effects. Further, the proposed approach also provides a natural formalization of concurrent actions and of the mutual dependencies that may exist between actions. The last paper of the special issue is by Frans Voorbraak, who presents a variant of default logic to define an "observation logic". Facts do not encode situational knowledge but background knowledge, and default rules do not represent generic information but pieces of information stemming from (uncertain) observations. An example of application to sensor fusion problem, where sensors have different levels of reliability, is presented.

Acknowledgements

The editors would like to thank the Editors in Chief Ray Perrault and Erik Sandewall for their support and suggestions. The editors are particularly indebted to all the colleagues who helped them at the various stages of the reviewing process:

G. Brewka, P. Besnard, A. Bochman, R. Booth, S. Chopra, G. Coletti, F. Cozman, A. Del Val, J. Delgrande, W. Faber, P. Ferraris, S. Ove Hansson, A. Herzig, A. Hunter, G. Kern-Isberner, S. Konieczny, H. Leitgeb, N. Leone, P. Liberatore, V. Lifschitz, F. Lin, T. Lukasiewicz, P. Marquis, T. Meyer, Y. Moinard, I. Niemela, O. Papini, G. Pfeifer, H. Prade, H. Prakken, A. Provetti, J. Rintanen, H. Rott, T. Schaub, C.M. Teng, H. Tompits, M. Truszczyński, H. Turner, L. Van Der Torre, E. Weydert, N. Wilson, D. Zhang.

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