



New Reasoning Models: Improving Optimisation and Decision Support with the Management of Uncertainty and Constraints

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Formal models for reasoning are of outmost importance in the field of Intelligent Systems. This special issue is focused on reasoning methods that involve the management of uncertainty or constraints, and its application in optimisation and decision-support problems. The papers included in this issue present recent advances in logic-based models and systems in two main thematic areas:

- **Management of Uncertainty**

In this area, we have four papers that cover the following topics: The paper by Ojeda-Hernández et al. extends the standard Formal Concept Analysis model (based on lattices) by incorporating mixed attributes that model positive and negative information in the same framework. It has been applied to a Mathematical course to define learning paths and study the knowledge space of the students. Alsinet et al. propose the use of graph isomorphism networks to approximately compute the polarization degree of arguments in conversational systems. Experiments are done in the Reddit debate tool. Pascual-Fontanilles et al. present a method for using incoming sets of new examples to adapt a classification model, which is based on fuzzy logic. It is tested in the problem of diagnosis of diabetic retinopathy. The paper of Zhu et al. proposes a linguistic multiple criteria decision aiding model for large groups of decision makers, to be used in evaluation of opinions in complex livelihood projects. They use uncertain linguistic values based on

intervals and define different aggregation and consensus operations for this kind of information.

- **Constraints Satisfaction**

In this category, we have six papers. The one by Akbay et al. provides an adaptative version of the hybrid combinatorial optimization generic algorithm Construct, merge, solve and adapt. This version is able to self-adapt, avoiding an intensive parameter tuning process while still being state-of-the-art in the minimum positive influence dominating set problem. The one by Zhou et al. addresses the Budgeted Maximum Coverage Problem with a variable depth local search 1 algorithm that is further improved with neighbour structures. Their proposed method outperforms the best existing heuristics and the exact solver CPLEX. The other four papers deal with SAT and its optimization version, MaxSAT. The paper by Almagro-Blanco and Giráldez-Cru analyzes the accuracy of several machine learning techniques to estimate the hardness of realistic pseudo-industrial SAT instances, generated with the Popularity-Similarity SAT model. Their experimental results show that ensemble methods (e.g., Random Forest) achieve the best performance, remaining robust to perturbations in the training phase. The paper by Bofill et al. explores the impact of using implied constraints in a MaxSAT model for the problem of scheduling business-to-business meetings. The experimental results clearly show that variable selection by the SAT solver is significantly affected depending on the implied constraints used in the encoding. Nurcahyadi et al. describe an ant colony optimization solver with negative learning for solving MaxSAT. The experimental results indicate that the proposed approach can be used to improve the results of existing solvers by internally using them to solve smaller sub-instances. Finally, Li et al. tackle the problem of reducing non-clausal MaxSAT and MinSAT to clausal MaxSAT and MinSAT. They define three cost-preserving transformations and report on an empirical comparison that provides evidence that non-clausal MaxSAT and MinSAT can be effectively solved

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with the state-of-the-art clausal MaxSAT and MinSAT solvers.

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We are also grateful to the referees, whose valuable and much-appreciated work has contributed to the high quality of the papers published in this issue.

We believe that this issue provides a broad view of the advances in logic-based models and optimisation systems, together with its use in practical applications in different fields.

Declaration

Conflict of interest Authors declare that they have no conflict of interest.

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