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Advances in Preference Handling: foreword

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This special issue of the *Annals of Mathematics and Artificial Intelligence* is devoted to recent advances in the handling and learning of preferences. The idea of this special issue emerged from the organisation of two connected events: the *13th Multidisciplinary Workshop on Advances in Preference Handling (M-PREF)* organized at IJCAI 2022, and the workshop *From Multiple Criteria Decision Aid to Preference Learning (DA2PL)*, held in Compiègne in 2022. We want to thank Ulrich Junker for proposing us to organize M-PREF 2022, and for helping us in this endeavour, as well as the DA2PL steering committee (Eyke Hüllermeier, Vincent Mousseau, Marc Pirlot, Roman Slowinsky) for trusting us with the DA2PL organisation.

We felt that AMAI was an ideal venue for such a special issue, as modelling, manipulating, aggregating and learning preferences are at the crossroads of many disciplines, including mathematics and computer science, but not only. Indeed, preferences also play a key role in operations research and optimisation, as well as economics, cognitive psychology, risk analysis, et cetera.

This ubiquity of preferences in different fields is also reflected in this special issue. The accepted papers concern very diverse topics such as computational social choice, learning customer preference from data or multi-criteria preference models. The themes of the articles only partially reflect the richness of the field, and show that there is still a great need for venues where various views of preferences can meet. Each

accepted paper has undergone a thorough peer review, with reviewers' comments on each paper improved it, bringing it to fruition.

A total of 6 papers were accepted in the special issue. The two first papers deal with problems that are foremost related to the fields of multi-criteria decision aid:

- *"An improvement of Random Node Generator for the uniform generation of capacities"* by Peiqi Sun, Michel Grabisch and Christophe Labreuche, deals with the problem of uniformly generating capacities, that plays an important role in many preference and decision aiding problems. This task is particularly hard, given that the capacities live in a high-dimensional space and have to satisfy monotony constraints. The paper proposes an exact method for the case where the number of criteria is limited, and improve upon the existing Random Node Generator (RNG) method for higher-dimensional cases.
- *"Weighted and Choquet L_p Distance Representation of Comparative Dissimilarity Relations on Fuzzy Description Profiles"* by Giulianella Coletti, Davide Petturiti and Bernadette Bouchon-Meunier, proposes new dissimilarity measures between fuzzy profiles through the use of Choquet integrals, verifying that the proposed measures do satisfy a number of axioms associated to dissimilarity notions. This gives rise to general families of dissimilarity measures, that can in turn be used to perform recommendations based on profiles similarities, e.g., in case-based recommendation scenarios.

The next paper is mainly connected to the field of computational social choice, another field where agent preferences play a central role:

- *"Collective Combinatorial Optimisation as Judgment Aggregation"* by Linus Boes, Rachael Colley, Umberto Grandi, Jérôme Lang and Arianna Novaro, considers collective combinatorial optimisation problems, that aim at finding optimal solutions of combinatorial space when multiple agents provide their preferences, such as in participatory budgets or collective scheduling. It unifies them by expressing them as judgment aggregation problems, thus identifying their common properties that were so far studied independently, and suggesting new ways to consider those problems. It also compares, from a complexity point of view, the differences between general purpose algorithms issued from judgment aggregation and algorithms dedicated to different Collective Combinatorial Optimisation problems.

The three final papers are, on their side, very much related to the problem of learning preference models in different contexts:

- *"A metaheuristic for inferring a ranking model based on multiple reference profiles"* by Arwa Khannoussi, Alexandru-Liviu Olteanu, Patrick Meyer, and Bastien Pasdeloup, shows how genetic algorithms can be used for eliciting the parameters of a model that ranks alternatives, evaluated according to multiple criteria, by comparing them to some reference profiles, that are hypothetical assignments of values to all criteria.
- *"Personalized Choice Prediction with Less User Information"* by Francine Chen, Yanxia Zhang, Minh Nguyen, Matt Klenk and Charlene Wu, presents a deep learning approach to learn personalized choices, in the sense that recommendation accounts

for user information as well as the recommendation context. It also develops strategies to minimize the quantity of information a user has to deliver in order to be provided with personalized recommendations

- *"Learning Preference Representations based on Choquet Integrals for Multicriteria Decision Making"* by Margot Hérin, Patrice Perny and Nataliya Sokolovska, discusses new methods to learn preference modelled by Choquet (bi-)capacities. Such models are very generic, but their many parameters make them potentially hard to learn. This paper proposes elicitation to learn marginal utilities as spline representation, as well as methods to learn sparse Choquet capacities through the use of L_1 penalisation techniques, allowing one to have more interpretable models.

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