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GUEST EDITORIAL

Special issue on "Fuzzy systems and intelligent decision making"

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Decision making is the study of identifying and choosing alternatives based on the values and preferences of a decision maker. Making a decision implies that there are alternative choices to be considered, and in such a case we want not only to identify as many of these alternatives as possible but to choose the one that best fits with our goals, objectives, desires, values, and so on.

The history of fuzzy sets began with the introduction of ordinary fuzzy sets by Zadeh [10] and evolved by the extensions of ordinary fuzzy sets: interval-valued fuzzy sets [3–5,11], type-2 fuzzy sets [11], intuitionistic fuzzy sets [1], fuzzy multisets [8], neutrosophic sets [6], nonstationary fuzzy sets [2], Hesitant fuzzy sets [7], and Pythagorean fuzzy sets [9].

Each of these extensions has been used in the solutions of single criterion and multiple criteria decision making problems. Intuitionistic fuzzy sets and hesitant fuzzy sets are the most used extensions in the fuzzy sets history. Neutrosophic sets and Pythagorean fuzzy sets are the generalization of intuitionistic fuzzy sets and they are expected to be competitive with the other extensions in the future.

This special issue includes five papers on decision-making theory and applications using fuzzy sets. Most of these papers have been presented at FLINS 2016 (Conference on Uncertainty Modelling in Knowledge Engineering and Decision Making) in Roubaix, France between the dates August 24–26, 2016. They have been selected after a peer review process with at least three reviewers per paper.

The first paper *Modeling renewable energy usage with hesitant fuzzy cognitive map* whose authors are Coban and Cevik Onar defines dynamic environmental factors affecting the production of solar and wind energy and the relations among them are linguistically expressed by the experts. These linguistic relationships among factors and their initial states are assessed by the proposed hesitant linguistic cognitive map method. Relational development between factors is observed by simulating the model according to the initial condition of the factors.

The second paper *A hesitant fuzzy linguistic term sets-based AHP approach for analyzing the performance evaluation factors: an application to cargo sector* whose authors are Tüysüz and Şimşek presents a fuzzy multi-criteria decision-making approach for evaluating the factors used for performance evaluation. A new hesitant fuzzy analytic hierarchy process method is proposed for analyzing the factors affecting the performance of the branches of a cargo company.

The third paper *A hesitant group emergency decision making method based on prospect theory* whose authors are Zhang et al. proposes a new group emergency decision-making method that considers the decision-maker's psychological behaviors in the decision process using prospect theory and replaces the aggregation process by a fusion method with hesitant fuzzy sets, which keeps the experts' information as much as possible.

The fourth paper *Analysis of variance in uncertain environments* whose authors are Parchami et al. extends one-way ANOVA to a case where observed data are composed of imprecise numbers rather than crisp numbers. Similar to the classical testing ANOVA, the total observed variation in the response variable is explained as the sum of observed variation due to the effects of the classification variable and the observed variation due to random error.

The fifth paper *Dynamic intuitionistic fuzzy multi-attribute aftersales performance evaluation* whose authors are Cevik

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Onar et al. presents a dynamic intuitionistic fuzzy multi-attribute aftersales performance evaluation method to measure the performance of an electronics company. A sensitivity analysis is conducted to examine the robustness of the given decisions.

I hope this issue will provide a useful resource of ideas, techniques, and methods for the research on the theory and applications of fuzzy decision-making. I thank all the authors whose contributions and efforts made the publication of this issue possible. I am also grateful to the referees for their valuable and highly appreciated works contributed to select the high quality of papers published in this issue. Finally, my sincere thanks go to Prof. Yaochu Jin, Editor-in-Chief, for his supports throughout the process of editing this issue.

Prof. Cengiz Kahraman

Guest-editor

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