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Preface

Decision Making Using Intelligent and Fuzzy Techniques

Intelligent systems are computer-based systems used to solve complex problems, which can learn and think like humans. Fuzzy set-based approaches are usually very appropriate when modeling of human knowledge is needed under vagueness and impreciseness. Decision-making is the cognitive process of selecting a course of action from multiple alternatives. This special issue covers several theoretical and practical representations of decision-making on intelligent and fuzzy techniques. The issue covers eleven original research and application-oriented papers covering different areas of decision-making on intelligent and fuzzy techniques. These papers are the substantially extended versions of the papers selected from 200 contributions presented at the first INFUS Conference on Intelligent and Fuzzy Systems (INFUS 2019), organized by Istanbul Technical University held at Istanbul, Turkey in July 23-25, 2019.

In the first paper of this issue, Oztaysi et al. (2020) model the location based advertisement selection problem as a multi-criteria decision making problem and use spherical fuzzy AHP integrated with spherical fuzzy VIKOR method to provide an autonomous decision mechanism.

The second paper handles the gaps in techniques that had not been explored earlier by previous researchers and proposes the blended technologies of neural fuzzy inference hybrid system along with support vector machines to reduce complexities in stock market prediction.

The next paper proposes an intelligent farming system and evaluates it by using fuzzy sets theory and simulation technique. Fuzzy logic is used to control the heating and lighting of the intelligent farming system, and simulation is used for evaluating the system.

The fourth paper presents a state of the art survey of fuzzy extensions of AHP when it is integrated with another fuzzy MCDM method such as fuzzy VIKOR, fuzzy TOPSIS, fuzzy ELECTRE, fuzzy PROMETHEE, fuzzy, EDAS,

fuzzy CODAS, fuzzy COPRAS, fuzzy TODIM, fuzzy MULTIMOORA, fuzzy MABAC, and fuzzy WASPAS. Graphical and tabular illustrations are given to summarize the results of the literature survey.

The fifth paper develops a novel attribute reduction strategy based on rough set (RS) and tug of war optimization (TWO) algorithm. Since the original TWO is appropriate for a problem with a continuous search space, the authors propose a binary version of TWO combined with RS theory called BTWORSR to find the best attribute reduct sets.

In the next paper, the authors aim to propose a convenient methodology for the evaluation of customer satisfaction levels to show and improve the service level for each bus operator in Istanbul. An interval type-2 fuzzy EDAS method is proposed with the use of customer satisfaction surveys.

The seventh paper evaluates the performance of seven factoring and financial leasing firms traded in the stock exchange of Istanbul (BIST) in terms of a balanced scorecard viewpoint by considering four main criteria. Pythagorean fuzzy sets are used in order to better explain decision-makers' views under a vague environment. Then TODIM approach and Pythagorean Fuzzy AHP are used for decision-makers' risky psychological behaviors.

The eight paper seeks to uncover the visit purposes of customers from their paths. Due to customers' unpredictable moods and plenty of stores in the shopping mall, the discovered paths are usually too complicated to analyze. The visited stores are seen as an activity in a business process. PALIA, a discovery algorithm in process mining, is applied to find and cluster customer paths. This study contributes to the literature by examining customer needs from their indoor paths, which were created by the PALIA algorithm.

The ninth paper examines the problem of forecasting the amount of money to be withdrawn from automated teller machines (ATM). The authors compare the performances of eleven different algorithms from four different research areas on two different datasets. The exploited algorithms are fuzzy time series, multiple linear regression, artificial neural network, autoregressive integrated moving average, Gaussian process regression, support vector regression, long short term memory, simultaneous perturbation stochastic approximation, migrating birds optimization, differential evolution, and particle swarm optimization.

The tenth paper presents a Fuzzy Inference System (FIS) to predict the relationship between the causes and effects of climate change. Here, CO2 (Carbon Dioxide), Global Temperature Changes, Snow Cover, Percentage of Forestlands, Natural Forces, and Net Radiation are considered as important factors and FIS inputs while the considered FIS outputs are: Ozone Layer Changes, Arctic Ice Sheet Level, Permafrost Level, and Sea Level. The proposed FIS is tested on realistic scenarios and the results are in agreement with results from other authors' approaches. However, the use of a FIS allows to include elements of uncertainty and vagueness in the input variables considered.

The last paper develops a novel probabilistic linguistic term set based energy maturity evaluation model. The developed model is explained through a numerical analysis.

I hope that this special issue will serve as a useful source of ideas, techniques, and methods for further research in the theory and applications of intelligent and fuzzy systems. I am grateful to the referees whose valuable and highly appreciated works contributed to the selection of the high quality papers published in this special issue. My sincere thanks go to Prof. Dan Simovici, the editor-in-chief, who was highly instrumental in bringing this project to its fruitful completion.

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