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Preface

A Special Issue of Journal of Multiple-Valued Logic and Soft Computing on Applications of Recent Fuzzy Sets Extensions

In the recent years, new extensions of ordinary fuzzy sets have appeared in the literature more than ever. Most well-known extensions with their historical order Interval-valued fuzzy sets and Type-2 fuzzy sets (Zadeh, 1975); intuitionistic fuzzy sets (Atanassov, 1986); hesitant fuzzy sets (Torra, 2010); intuitionistic type-2 fuzzy sets (Atanassov, 1999); Pythagorean fuzzy sets (Yager (2013); q-rung orthopair fuzzy sets (Yager, 2017); neutrosophic sets (Smarandache, 1998); picture fuzzy sets (Cuong, 2017); spherical fuzzy sets (Kahraman and Kutlu Gündoğdu, 2018); circular intuitionistic fuzzy sets (Atanassov, 2020); decomposed fuzzy sets (Cebi et al., 2022); continuous intuitionistic fuzzy sets (Alkan and Kahraman, 2023); proportional intuitionistic fuzzy sets (Kahraman, 2924a), proportional picture fuzzy sets (Kahraman, 2024b); and proportional neutrosophic sets (Kahraman, 2024c).

This issue includes eleven original papers on the theory and applications of these extensions in various research areas, each written by their well-known experts. The first paper uses the most popular forms of the IFL-operations implication and negation, and the conjunction and disjunction generated by them. Subsequently, it provides illustrations with use of other IFL-operations for quantum logic axioms interpretation.The second paper navigates the intricate landscape of automation degree selection within the automotive industry evolution, employing a structured approach merging fuzzy AHP and fuzzy CODAS methods by utilizing Continuous Intuitionistic Fuzzy Sets. This approach not only brings a new perspective to autonomous vehicles but also highlights the importance of choosing the right automation degree.

The third paper outlines the basic operations of probabilistic hesitant bifuzzy sets and develops a basic aggregation operator for probabilistic hesi-

tant bifuzzy sets to enable their implementation. The paper also provides a basic overview of information fusion processes and suggests a visualization method based on probabilistic hesitant bifuzzy entropy to analyze the aggregated information and improve assessment results.The fourth paper utilizes a novel extension of ordinary fuzzy sets, which are called Decomposed Fuzzy Sets. In the proposed approach, the DFS based Analytic Hierarchy Process (AHP) is used to determine the weights of the criteria, and then DFS based TOPSIS is used to determine the priorities of the projects. To demonstrate the performance of the proposed approach, it is applied for prioritizing EU project calls. The fifth paper integrates flow approaches in transportation networks and hesitant fuzzy decision-making to transport the maximum number of potential aggrieved to the safe destination in shortest time. Multi-attribute decision making is applied to find the order in which aggrieved must be transported to the sink. Hesitant fuzzy ELECTRE method is applied find the ranks of intermediate nodes for transportation the potential victims

The sixth paper develops a hesitant fuzzy linguistic term sets-based AHP & TOPSIS methodology to select the best coal type alternative for industrial facilities. As the HFLTS-AHP is used to weight the evaluation criteria, TOPSIS is utilized to rank the fuel coal type alternatives. The proposed methodology offers an innovative and novel approach to help industrial facilities select the appropriate coal product while balancing the outputs, such as carbon, sulphur, ash content, and so on. The seventh paper presents an extended comparison between the variants obtained from diverse chaotic maps. This comparison is done by evaluating the resulting variants from a set of three chaotic maps and comparing also with two different fuzzy inference systems (Mamdani and Sugeno types). The main objective is to present the obtained variants and compare which are the best chaotic maps in the fuzzy-chaotic multiverse optimizer algorithm to improve further in other study cases.

The eighth paper proposes a decision model involving six criteria, namely compatibility, scalability, reliability, security, cost-effectiveness, and human-machine collaboration. A hybrid decision-making model that integrates proportional pythagorean fuzzy AHP & TOPSIS is proposed to solve the Industry 5.0 selection problem. The sensitivity analysis, comparative analysis, and discussions with decision-makers reveal that the proposed approach provides a robust, and easy-to-use methodology. The ninth paper tries to compute the coefficients of the simple linear regression model between the study variables in an intuitionistic fuzzy environment by using an index matrix approach. In order to store and analyze a sizable IF dataset, the authors suggest extending the linear classical least squares approach with the use of intuitionistic fuzzy sets and index matrices. Furthermore, an approach is proposed to assess the applicability of the model in an IF environment.

The tenth paper dynamically establishes stop-loss and take-profit levels by conducting an in-depth analysis of historical data, utilizing both standard deviation and Sharpe Ratios. This analysis incorporates the Fuzzy Soft Set

approach. The study bifurcates the TP/SL levels into two distinct categories, each tailored to specific strategies for selling (short) or buying (long) positions. The overarching goal of this study is to develop and refine trading strategies adept at navigating the stock market's unpredictable and often turbulent landscape. The last paper presents a novel technique of propositional picture fuzzy 2-tuple linguistic (PPF2-TL) set, where the grades in PPF2-TL sets are linked with each other with the help of parameters. Some algebraic operational laws and Aczel-Alsina operational laws for PPF2-TL values are also given. It describes the technique of PPF2-TL Aczel-Alsina power averaging (PPF2-TLAAPA) operator, PPF2-TL Aczel-Alsina power weighted averaging (PPF2-TLAAPWA) operator, PPF2-TL Aczel-Alsina power geometric (PPF2-TLAAPG) operator, PPF2-TL Aczel-Alsina power weighted geometric (PPF2-TLAAPWG) operator, and their basic properties. Additionally, it evaluates the TOPSIS method and WASPAS method by using the initiated operators and measures.

I thank the anonymous reviewers for their hard works in selecting high-quality papers of this issue. This issue would be impossible without their invaluable efforts. I would like to thank the world-renowned researchers who chose the MVLSC journal to publish their valuable works in this issue. I would also like to express my sincere thanks to Editor-in-Chief of the journal, Prof. Dan Simovici for his continuous supports and helps.

Prof. Cengiz Kahraman

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