EDITORIAL

Intelligent Decision Analysis and Applications

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Big data, Internet, Internet of things, and cloud computing have profoundly affected decision paradigms and methods in various disciplines and application areas, ranging from business and management to finance and economics, decision sciences, system evaluation, forecasting, psychology, sociology, tourism, health, safety, engineering, smart city management, and environmental management. Intelligent computing technology and intelligent decision models are developed to meet the needs of academia and practitioners. This special issue of *International Journal of Computational Intelligence Systems* (IJCIS) entitled "Intelligent Decision Analysis and Applications" aims to provide a forum for some state-of-the-art research in this emerging field and outline new and important developments in fundamentals, approaches, models, and intelligent decision support systems with applications to different areas. Twelve papers have been selected for publication in this special issue. Below is a brief summary of these twelve papers.

The paper "A Bargaining Solution with Level Structure" (https://doi.org/10.2991/ijcis.d.191016.002), by Yan Xiao and Deng-Feng Li, develops a solution to n-person bargaining problems in which external cooperation among coalitions is permitted. This type of problem is referred to as bargaining games with level structure, which allow more cooperative types than those with coalition structure. The proposed solution builds upon the concept of the bargaining solution with coalition structure by defining level structure and each player at each level. This research greatly extends the traditional bargaining models.

In the paper "EDAS Method for Multiple Attribute Group Decision Making with Probabilistic Uncertain Linguistic Information and Its Application to Green Supplier Selection" (https://doi.org/10.2991/ijcis.d.191028.001), Yan He, Fan Lei, Guiwu Wei, Rui Wang, Jiang Wu, and Cun Wei adopt uncertain linguistic terms to express alternatives' assessment information on attributes furnished by decision makers (DMs). Linguistic assessments can accommodate DMs' lack of sufficient knowledge and fuzziness of human thinking process. This paper first transforms uncertain linguistic terms into probabilistic uncertain linguistic term sets (PULTSs) and, then, formulates multiple attribute group decision-making (MAGDM) problems under the PULTS setting. By combining the information entropy with the Evaluation based on Distance from Average Solution (EDAS), an integrated model is established to rank alternatives or select the best alternative(s) for MAGDM problems under the PULTS setting.

By accounting for maximizing gross domestic product (GDP) and minimizing energy consumption and greenhouse gas (GHG) emission, the paper "Regional Input–Output Multiple Choice Goal Programming Model and Method for Industry Structure Optimization on Energy Conservation and GHG Emission Reduction in China" (https://doi.org/10.2991/ijcis.d.191104.002), by Pingping Lin, Deng-Feng Li, Binqian Jiang, Anpeng Wei, and Gaofeng Yu, proposes an input–output multi-choice goal programming model to optimize China's industry structure on energy conservation and GHG emission reduction. Subject to such factors as the input–output balance, economic growth, energy supply, GHG emission, and industrial diversity, the constructed model allows DMs to set multiple aspiration values for each goal to avoid underestimating its potential, thereby providing appropriate designs of industrial restructuring by expanding the potential feasible region.

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In the paper "Econometric Analysis of Disequilibrium Relations between Internet Finance and Real Economy in China" (https://doi.org/10.2991/ijcis.d.191128.001), Yixiao Li, Xin Jin, and Wenwen Tian employ three major virtual economies, the Internet "Baby" fund, Internet financial credit, and Shanghai Composite Index, to assess the development level of Internet finance. Then, using the vector autoregression model, the authors analyze the disequilibrium relations between the development of the Internet finance and real economy in China. The deviation between them is subsequently gauged by the Financial Interrelations Ratio. This study sheds insights on the current status of the development between the Internet finance and real economy in China.

Although dual hesitant fuzzy sets (DHFSs) reflect disagreement and hesitancy of DMs, they cannot describe DMs' hesitant probabilistic preference on different criteria. The aim of the paper "Interval-Valued Probabilistic Dual Hesitant Fuzzy Sets for Multi-Criteria Group Decision-Making" (https://doi.org/10.2991/ijcis.d.191119.001), by Peide Liu and Shufeng Cheng, is to furnish a three-phase multi-criteria group decision-making (MCGDM) framework for decision problems with evaluation information represented by interval-valued probabilistic dual hesitant fuzzy sets (IVPDHFSs). First, the authors define IVPDHFSs and their score functions, ordered distances, and similarity measures. Then, they define an interval-valued probabilistic dual hesitant fuzzy ordered weighted averaging operator. Finally, unified criteria weights are derived by a mathematical program based on the water-filling theory, which can eliminate the impact of criteria dimension and magnitude. The proposed method generalizes MCGDM models with evaluation information expressed by hesitant fuzzy sets and/or dual hesitant fuzzy sets.

The paper "GRA Method for Probabilistic Linguistic Multiple Attribute Group Decision Making with Incomplete Weight Information and Its Application to Waste Incineration Plants Location Problem" (https://doi.org/10.2991/ijcis.d.191203.002), by Fan Lei, Guiwu Wei, Jianping Lu, Jiang Wu, and Cun Wei, develops a probabilistic linguistic MAGDM model based on the concept of grey relational analysis (GRA). First, the linguistic term sets are employed to express attribute ratings of alternatives, which are transformed into probabilistic linguistic term sets to formulate probabilistic linguistic MAGDM problems. Then, attribute weights are derived from a GRA-based multiple objective optimization model by computing grey relational coefficients of the alternatives based on the probabilistic linguistic positive ideal solution (PLPIS) and negative ideal solution. Finally, the ranking of the alternatives is generated by obtaining their probabilistic linguistic relative relational degrees from the PLPIS. The proposed method offers a new tool to deal with decision problems under uncertainty.

To provide semantic tagging words for social images using image metadata information and meet users' personalized requirements, the paper "Personalized Tag Recommendation Based on Convolution Feature and Weighted Random Walk" (https://doi.org/10.2991/ijcis.d.200114.001), by Zheng Liu, Tianlong Zhao, Huijian Han, and Caiming Zhang, proposes a model and an algorithm for personalized tag recommendations. First, an image visual feature representation is characterized by a multi-layer convolutional neural network. Then, weighted image neighbors are determined by mining image visual features and the influence of user group metadata in Flickr on image correlation. Finally, a weighted random walk algorithm is designed based on a bipartite graph model with nearest neighbors for personalized tag recommendation. The proposed algorithm is able to automatically annotate social image semantics.

In the paper "Bi-GRU Sentiment Classification for Chinese Based on Grammar Rules and BERT" (https://doi.org/10.2991/ijcis.d.200423.001), Qiang Lu, Zhenfang Zhu, Fuyong Xu, Dianyuan Zhang, Wenqing Wu, and Qiangqiang Guo develop a novel sentiment classification approach to address the ambiguity of Chinese vocabulary and the complexity of Chinese grammar rules. First, a bidirectional encoder representation from transformers (BERT) model is used to preprocess data or word vectors. Then, the Chinese grammar rules, such as nonsentiment, sentiment, negative, and degree words, are integrated into the Bi-gated recurrent neural network (GRU) model to solve sentiment transfer of Chinese words at the sentence level. The proposed method offers a useful reference for sentiment classification in various fields such as e-commerce and public opinion.

The paper "An Integrated Decision Framework for Group Decision-Making with Double Hierarchy Hesitant Fuzzy Linguistic Information and Unknown Weights" (https://doi.org/10.2991/ijcis.d.200527.002), by Raghunathan Krishankumar, Kattur Soundarapandian Ravichandran, Huchang Liao, and Samarjit Kar, constructs an integrated decision framework for MAGDM problems in which DMs furnish their preferences of alternatives on attributes as double hierarchy hesitant fuzzy linguistic term sets (DHHFLTSs). A generalized Maclaurin symmetric mean operator is defined to capture the interrelationship among attributes under the DHHFLTS setting. The attribute weights and DM weights in MAGDM problems with DHHFLTS information are, respectively, determined by the statistical variance method and evidence theory-based Bayesian approximation method. By extending the Borda function, the double hierarchy hesitant fuzzy narrow and broad Borda counts are computed to rank the alternatives. The proposed decision framework is suitable for dealing with hesitation in complex preference information and interrelated attributes.

In the paper "Discovering Potential Partners via Projection-Based Link Prediction in the Supply Chain Network"

(https://doi.org/10.2991/ijcis.d.200813.001), Zhi-Gang Lu and Qian Chen establish a projection-based link prediction method to identify potential partners in a supply chain network to reduce existing partners' collaborative interruption risk. First, candidate partnership links are predicted by using the projection one-model graph that is transformed from the supply chain network structure. Then, potential partners are identified by comparing the connectivity of candidate partnership links with the maximal connectivity of existing partnerships. Finally, a resilience evaluation framework is developed to assess how resilient the resulting supply chain network is in terms of connectivity and flexibility. The proposed method offers a new way to locate potential partners in a supply chain network, thereby enhancing the resilience, visibility, and collaboration among the partners.

The paper "Novel Cross-Entropy Based on Multi-attribute Group Decision-Making with Unknown Experts' Weights Under Interval-Valued Intuitionistic Fuzzy Environment" (https://doi.org/10.2991/ijcis.d.200817.001), by Yonghong Li, Yali Cheng, Qiong Mou, and Sidong Xian, proposes a cross-entropy measure to analyze the relations between interval-valued intuitionistic fuzzy sets (IVIFSs). This measure is built upon the concepts of entropy and J-divergence in information theory. Expert weights are determined by a weighted average of two weight vectors derived from two cross-entropy-based optimization models that, respectively, account for the experts' experience and professional knowledge. Finally, an integrated algorithm is developed to solve MAGDM problems with IVIFS information and unknown expert weights. The proposed method provides a more flexible way to deal with DMs with different experience and expertise in an MAGDM setting.

The aim of the paper "An Intuitionistic Fuzzy Time Series Model Based on New Data Transformation Method" (https://doi.org/10.2991/ijcis.d.210106.002), by Long-Sheng Chen, Mu-Yen Chen, Jing-Rong Chang, and Pei-Yu Yu, is to put forward an intuitionistic fuzzy time series forecasting method. By using the Nth quantile discretization approach and the concept of average fuzzified values, the authors construct a weighted intuitionistic relation fuzzy time series model to determine the number, interval length, the membership, and non-membership degrees of linguistic values based on a training data set. The proposed model offers a new forecasting approach for time-related uncertain data.

We would like to thank all the authors for their contribution to this special issue and all the reviewers for volunteering their time and expertise to review the submitted papers. We sincerely thank Professor Luis Martinez and Professor Jie Lu, Editors-in-Chief of *IJCIS*, for their invaluable contribution and great support in the publication of this special issue.

Declarations

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