This is the Pre-Published Version.

The following publication Yuen, K. K. F., Leu, J.-S., Ishizaka, A., Tawfik, H., & Coenen, F. (2024). Editorial for Special Issue on “Expert decision making for data analytics with applications”. Applied Soft Computing, 155, 111480 is available at https://doi.org/10.1016/j.asoc.2024.111480.

Editorial for Special Issue on “Expert Decision Making for Data Analytics with Applications”

Decisions can be made using human judgements, data analytics, or a combination of the two. With the rapid growth of data, various data analytics techniques have been adopted to explore data to find meaningful patterns to support decision-making. On the other hand, a lot of decision problems are without past data, or the related data exists but is very difficult and/or expensive to obtain; in which case formulation of a suitable decision model based on ‘expert’ judgements is the main solution for decision making. Whilst many decision problems are supported with partial data or are not merely based on historical data to find patterns, hybrid techniques integrating Expert Decision Models (EDMs) into Data Analytics Algorithms (DAAs) present a promising solution for complex decision and data analytics problems.

Data analytics techniques use modern statistical and machine learning mechanisms to analyze diverse kinds of data, on either a small or big scale, to discover information or knowledge for better decision making. Data analytics techniques may refer to clustering, regression, classification, association learning, reinforcement learning, evolutionary learning, deep learning, or statistical learning. EDMs are concerned with decision-making techniques based on expert judgements, preferences, or opinions as inputs. EDM may refer to the research areas of multi-criteria decision making, recommender systems, user preference engineering, knowledge engineering and expert systems.

This special issue aims to bring together academia and practitioners of both applied decision science and applied data science to report on the recent developments to integrate decision models based on expert judgements into data analytics algorithms to form sophisticated approaches for solving complex decision problems for various application domains. 139 submissions were received for this special issue. A screened submission was rigorously and blindly reviewed by at least three anonymous referees. After a comprehensive review process, seven papers have been selected for this special issue. The authors of the selected papers are from Australia, Canada, China, Hong Kong, Poland, Spain, Taiwan, United Arab Emirates, United Kingdom, and United States of America.

Chan et. al.[1] co-authored the paper entitled “Ball bonding inspections using a conjoint framework with machine learning and human judgement”. A detection framework integrated with machine learning and human judgement is proposed for ball bonding inspections based on visual images, which are essential in the manufacturing processes of semiconductors devices and integrated circuits (ICs). The machine learning methods employ the Convolution Neural Network (CNN), Support Vector Machine (SVM) and Circle Hough Transform algorithm (CHT), whilst human judgement is only used when the detection uncertainty is below the threshold. hence significant numbers of human judgements can be saved, compared to the traditional manufacturing inspection which is fully relied on human judgements.

Chen et. al.[2] co-authored the paper entitled “Sustainable building material selection: An integrated multi-criteria large group decision making framework”. An integrated multi-criteria large-group decision-making framework is developed to address the problem of sustainable building material selection. The assessment information is characterised by Improved Basic Uncertain Linguistic Information (IBULI), which incorporates reliable degrees of decision experts that can accurately quantify subjective assessment information

© 2024. This manuscript version is made available under the CC-BY-NC-ND 4.0 license http://creativecommons.org/licenses/by-nc-nd/4.0/

provided under uncertainty. The weights of assessment criteria for SBMS are determined by the Quality Function Deployment-based method that is capable of accommodating the influences of multiple stakeholders. Subsequently, an IBULI-based correlation- and consensus-driven clustering method is used to aggregate the assessment information given by a large group of decision experts to achieve the classification of large-scale decision experts and the satisfied consensus level simultaneously. Finally, IBULI-based TOPSIS method is used to select the best sustainable building materials. An illustrative example accompanied by sensitivity and comparative analyses is performed.

Kadzinski and Szczepański[3] co-authored the paper entitled "Learning the parameters of an outranking-based sorting model with characteristic class profiles from large sets of assignment examples". The authors applied the optimization method for the parameters learning problem of Electre TRI-rC, one of the outranking-based multiple criteria sorting models, from large sets of assignment examples. Four optimization algorithms are used to aim at the problem: evolutionary algorithm, linear programming combined with a genetic approach, simulated annealing, and a dedicated heuristic. Two ensemble methods, bagging and boosting, are incorporated to improve the search results. The experiments on both artificial and real-world data sets are carried out to reveal the impact of the comparison and veto thresholds, various sorting rules, and ensembles on the classification accuracy of the proposed algorithms.

Jia et. al.[4] co-authored the paper entitled "An incentive mechanism in expert-decision-based crowdsensing networks". To address the data quality problem of crowdsensing, the authors proposed the multidimensional rating for incentive mechanism based on user cost and data quality (MRAI-UCDQ) comprising user cost evaluation model, data quality evaluation model, contribution quantification and reward distribution by analysing user sensing cost data and collected sensing data. The MRAI-UCDQ is a multi-attribute reverse auction incentive mechanism based on expert-decision Real experiments from 159 volunteers generating 7000 pieces running in nearly 30 days are performed. The simulation results show the MRAI-UCDQ performs better than some existing methods such as MAA and RADP-VPC.

Li et. al.[5] co-authored the paper entitled "A data-driven decision-making framework for personnel selection based on LGBWM and IFNs". A three-stage decision-making framework combining data analytics algorithms (DAAs) and multi-criteria decision-making (MCDM) method is proposed to solve the personnel selection problem. Evaluation criteria are selected from the historical HR database for the role, and statistical testing is performed to validate the significance of the criteria. Next, an improved ranking aggregation algorithm based on the graph is proposed for the preliminary screening of candidates. Finally, an integrated MCDM method formed by linear group best–worst method (LGBWM) and intuitionistic fuzzy numbers (IFNs) is designed to help decision-makers express their preferences in group decision-making. A case of the personnel evaluation and selection (PLEAS) decision support system is demonstrated for the implementation of the proposed framework.

Liou et. al.[6] co-authored the paper entitled "Application of an MCDM model with data mining techniques for green supplier evaluation and selection". This study proposes an MCDM model combined with data mining techniques. The SVM technique is the data mining technique used to screen out green supplier evaluation criteria. Fuzzy best worst method (FBWM) and Fuzzy TOPSIS are the MCDM techniques used to obtain fuzzy weights and select green suppliers respectively.

Porro et. al.[7] co-authored the paper entitled “A multi-attribute group decision model based on unbalanced and multi-granular linguistic information: An application to assess entrepreneurial competencies in secondary schools”. For their models, a perceptual-based distance based on the lattice structure of hesitant fuzzy linguistic term sets is developed to capture differences among unbalanced linguistic assessments. Next, a projected algebraic structure is defined to deal with multi-perceptual group decision-making contexts. Finally, a methodology is developed to deal with different multi-granularity linguistic environments to aggregate unbalanced linguistic information based on different perceptual maps. A pilot test is demonstrated how the proposed framework is applied to classify and rank a set of secondary students according to their degree of entrepreneurial competency, where real data is provided by the Andorra Government.

The guest editors of this special issue would like to thank the authors for submitting their valuable research outcomes to this special issue, as well as the reviewers who devoted their time to providing critical comments on the papers. We sincerely hope that readers will enjoy the papers in this special issue and will find them useful.

Kevin Kam Fung Yuen, Hong Kong Polytechnic University, Hong Kong SAR, China,
Email: kevinkf.yuen@gmail.com ; kevin.yuen@polyu.edu.hk.

Jenq-Shiou Leu, National Taiwan University of Science and Technology, Taiwan,
Email: jsleu@mail.ntust.edu.tw.

Alessio Ishizaka, NEOMA Business School, France,
Email: Alessio.ISHIZAKA@neoma-bs.fr.

Hissam Tawfik, College of Engineering, University of Sharjah, UAE,
Email: htawfik@sharjah.ac.ae.

Frans Coenen, University of Liverpool, Liverpool, United Kingdom,
Email: coenen@liverpool.ac.uk.

Reference

1. K.Y. Chan, K. F.C. Yiu, H.-K. Lam, B. W. Wong, Ball bonding inspections using a conjoint framework with machine learning and human judgement, Applied Soft Computing, Volume 102, 2021, 107115, https://doi.org/10.1016/j.asoc.2021.107115 .
2. Z.-S. Chen, L.-L. Yang, K.-S. Chin, Y. Yang, W. Pedrycz, J.-P. Chang, L. Martínez, M.J. Skibniewski, Sustainable building material selection: An integrated multi-criteria large group decision making framework, Applied Soft Computing, 113 (2021), 107903, https://doi.org/10.1016/j.asoc.2021.107903 .
3. M. Kadziński, A. Szczepański, Learning the parameters of an outranking-based sorting model with characteristic class profiles from large sets of assignment examples, Applied Soft Computing, Volume 116, 2022, 108312, https://doi.org/10.1016/j.asoc.2021.108312 .

4. B. Jia, H. Gong, Z. Zong, T. Zhou, T. Baker, Ahmed Al-Shamma'a, Yan Jia, An incentive mechanism in expert-decision-based crowdsensing networks, Applied Soft Computing,Volume 122, 2022,108834, https://doi.org/10.1016/j.asoc.2022.108834 .
5. J. Li, R. He, T. Wang, A data-driven decision-making framework for personnel selection based on LGBWM and IFNs, Applied Soft Computing, 126 (2022),109227, https://doi.org/10.1016/j.asoc.2022.109227.
6. J.J.H. Liou, M.-Hsin Chang, H.-W. Lo, M.-H. Hsu, Application of an MCDM model with data mining techniques for green supplier evaluation and selection, Applied Soft Computing, 109 (2021),107534, https://doi.org/10.1016/j.asoc.2021.107534.
7. O. Porro, N. Agell, M. Sanchez, F. J. Ruiz, A multi-attribute group decision model based on unbalanced and multi-granular linguistic information: An application to assess entrepreneurial competencies in secondary schools, Applied Soft Computing,111,2021,107662, https://doi.org/10.1016/j.asoc.2021.107662 .