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Special issue: Decision, risk analytics and data intelligence

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The intelligent decision-making domain is a fast-growing area of research that integrates various aspects of computer science and information systems, which includes risk analytics, intelligent systems, intelligent technology, intelligent agents, artificial intelligence, fuzzy logic, neural networks, machine learning, knowledge discovery, computational intelligence, data science, big data analytics, inference engines, recommender systems or engines, and a variety of related disciplines.

Innovative applications that emerge using intelligent decision-making often have a significant impact on decision-making processes in government, industry, business, and academia in general. This is particularly applied in finance, accounting, healthcare, computer networks, real-time safety monitoring, and crisis response systems. Moreover, intelligent decision-making is commonly used in military decision-making systems, security, marketing, stock market prediction, and robotics (Tweedale et al., 2016).

Intelligent decision-making has incorporated new capabilities that mimic and extend human cognitive abilities in some manner. In today's environment, information needed for decision-making tends to be distributed (Phillips-Wren and Forgionne, 2002). Networks exist within and outside of enterprises, home, the military, government, and national boundaries. Information is segmented for logistical and security reasons onto different machines, databases, and systems. Informed decisions may need integration of information from various internal or external sources. As enterprises become multinational, information tends to be distributed geographically across national boundaries. The speed of communication in the 21st century requires fast response to be competitive, so the integration of information for decision making needs to be fast and accurate. Technology can help decisions that are complex and semi-structured by integrating information flow with analysis using both conventional and artificial intelligence techniques (Tweedale et al., 2016).

Intelligent decision-making systems have possibilities to convert human decision-making by integrating information technology, artificial intelligence and system engineering research areas. The field of intelligent decision-making and risk analytics is developing rapidly. The purpose of this special issue is to provide exquisite research methodologies in intelligent decision-making and risk analytics.

This special issue contains 10 research papers. These papers focus on recent advances topics of intelligent decision-making and risk analytics including non-probabilistic scenarios and decision analysis coupling, credit and financial risk assessment, quality function deployment (QFD) with Pythagorean fuzzy sets (PFSs), real-time decision making, system dynamic simulation, intelligent knowledge management, network data envelopment analysis, and application of big data in sustainable urban energy planning.

Collier and Lambert present an approach using non-probabilistic scenarios coupled with decision analysis to investigate how particular scenarios influence priority setting for products and systems. Scenarios are generated

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from a list of emergent and future conditions related to obsolescence. Moreover, an example is presented related to the selection of technologies for energy islanding, which demonstrates the methodology using six obsolescence scenarios. The key result is the identification of the most and least disruptive scenarios to the decision-maker's priorities.

Jemmali and Salhi investigate the relationship between several factors of governance and the level of risk in 10 Tunisian banks during an analysis period of eight years. This estimation is based on a model with a single equation that examines variables relative to governance and credit risk to determine their impact on banking financials. Results indicate that the internal mechanisms of governance present diverging effects on the financial risk of the Tunisian banks in the case study.

Liao et al. extend the approach to quality function deployment based on Pythagorean fuzzy sets and makes application to assembly robot design evaluation. A combined weight determining method is used to integrate former weights to objective weights derived from the evaluation matrix. To determine the exact score of each PFS in the evaluation matrix, an improved score function is developed. Also, a case study about assembly robot design evaluation is investigated.

Tien presents convergence of real-time decision-making. Real-time decision-making can be described in terms of three converging dimensions: Internet of Things, decision-making, and real-time. The Internet of Things includes tangible goods, intangible services, ServGoods, and connected ServGoods. Decision-making includes model-based analytics (since before 1990), information-based big data (since 1990), and training-based artificial intelligence (since 2000), and it is bolstered by the evolving real-time technologies of sensing (i.e., capturing streaming data), processing (i.e., applying real-time analytics), reacting (i.e., making decisions in real-time), and learning (i.e., employing deep neural networks). Real-time includes mobile networks, autonomous vehicles, and artificial general intelligence.

Al-Shihabi and AlDurgam present an MILP model to solve the multi-objective multi-mode FBSP. The model shows the best project execution schedule with the bidding parameters. Through tests of existing problems in the literature, the authors demonstrate that CPLEX 12.9 can be used to solve multi-objective optimization problems. Furthermore, the proposed model guarantees the optimality of solution. In addition, the linear programming-relaxation of the model shows good performance on providing of an excellent lower bound within seconds.

Zhang and Huang introduce a new technology foresight method based on intelligent knowledge management. This method constructs a technological online platform to increase the number of participating experts. A secondary mining is performed on the results of patent analysis and bibliometrics. Thus, forward-looking, innovative, and disruptive areas and relevant experts must be discovered through the following comprehensive process: Topic acquisition → topic delivery → topic monitoring → topic guidance → topic reclamation → topic sorting → topic evolution → topic conforming → expert recommendation.

Bian et al. create a model to solve two-level uncapacitated lot-sizing problem considering the financing cost of working capital requirement (WCR). Working capital requirement has been recognized as a key factor for releasing tied-up cash in companies and reducing the default risk in time of financial crisis. A two-level (supplier–customer) model is established on the basis of the classic multi-level lot-sizing model integrated with WCR financing cost. Moreover, sequential and centralized approaches are applied to solve the two-level case with a serial chain structure. The ZIO (zero inventory ordering) property is further confirmed valid in both cases. This property allows us to establish a dynamic programming-based algorithm, which solves the problem in $O(T^4)$. Finally, numerical tests show differences in optimal plans obtained by both approaches and the influence of varying delays in payment on the WCR of both actors.

An et al. propose a data-driven, mixed two-stage network data envelopment analysis model. This method aims to reasonably define the allocation portion of shared extra intermediate resources among several nonhomogeneous subsystems and measure the overall system performance. A data set of 58 international hotels is used to test the features of the proposed model.

Denk et al. investigate two different model approaches for the equity long/short strategy, where weighted segmented linear regression models are employed and combined with two-state Markov switching models in the distribution of hedge fund returns. The main finding proves a short put option structure, i.e., short equity market volatility, with the put structure present in all market states. Results indicate that the hedge fund managers decrease their short-volatility profile during turbulent markets.

Chalal et al. apply big data to support sustainable urban energy planning. This study examines the validity and

reliability of EvoEnergy under the new UK household longitudinal study (UKHLS) launched in 2009. To obtain this aim, the household transition and energy prediction modules of EvoEnergy have been tested under both data sets using various statistical techniques such as Chow test. Results show that EvoEnergy remains a reliable prediction system and has a good prediction accuracy (MAPE; 5%) when compared to actual energy performance certificate data. In addition, two scenarios of EvoEnergy development in relation to energy policy and decision-making are discussed.

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Guest Editors-in-Chief

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