



Editorial: New trends on machine learning applied to information processing under uncertainty

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The digitalization era has brought an increasing presence of data-driven systems in all fields, activities and processes related to human-beings machine learning in which uncertainty plays a significant role. Generally, the uncertainty in machine learning may be due to two reasons: data uncertainty (noise) and model uncertainty (or imperfect model of the problems). Disregarding the reason, uncertainty in information processing applications will make decision-making process much harder. Many effective machine learning methods have been developed to model uncertainty and revealed beneficial for a better decision-making process such as Bayesian Deep Learning, combination of fuzzy logic with neural networks, Rough set theory, Imprecise probability, etc. Therefore, the research in this direction is becoming very popular among researchers due to its high performance and successful results.

Therefore, this special issue aims at offering a comprehensive view of new trends on the application of machine

learning techniques to information processing under uncertainty, which will raise novel approaches, models, and systems in the area. Consequently, it provides a debate forum for spreading recent results of theoretical research, technological development and practical applications, including the use of machine learning with successful techniques for information processing under uncertainty such as, Measures of Information and Uncertainty, Fuzzy Sets and Fuzzy Reasoning, Data Clustering and Classification Methods, Rough Sets, Aggregation Methods, Group Decision Making Methods, Deep Learning Methods including CNN, LSTM, GNN, and their extended methods, etc.

This Special Issue encompasses 16 high quality papers, from 36 submissions, in different related topics of the scope. The accepted papers fall into 5 groups according to their proposals, methodologies, tools and applications, that is, Data Clustering and Classification, Decision Making Methods, Fuzzy Sets and Fuzzy Reasoning, Deep Learning and related Methods, Measures of Information and Uncertainty. The summary of these papers is as follows.

In “Knowledge granularity reduction for decision tables”, Guilong Liu and Yanbin Feng show that knowledge granularity reduction is equivalent to both positive region reduction and X-absolute reduction, and derive its corresponding algorithm based on a discernibility matrix to fill the gap. They provide a simple knowledge granularity reduction algorithm for finding a reduct with the help of binary integer programming.

In “Group decision making for internet public opinion emergency based upon linguistic intuitionistic fuzzy information”, Yi Liu et al., present the emergency group decision-making model for multiple network public opinion emergencies under the linguistic intuitionistic environment, and introduce extended Copula and extended Co-Copula, respectively, which can be used to capture the relation of attributes in the group decision making problems of network public opinion emergencies.

In “q-ROF-SIR methods and their applications to multiple attribute decision making”, Hua Zhu et al., present several q-ROF-SIR methods to extend the superiority and

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inferiority ranking methods to solve multiple attribute decision making problems within the q-ROF environment which can determine the attribute weights assume the weights of attribute are unknown.

In “Novel fusion strategies for continuous interval-valued q-rung orthopair fuzzy information: A case study in quality assessment of SmartWatch appearance design”, Yi Yang et al., present several continuous IVQROF aggregation operators, and a parameter optimization model and its algorithm-solving strategy driven by consensus measures are built for group decision-making.

In “A novel multiple attribute decision-making approach for evaluation of emergency management schemes under picture fuzzy environment”, Zheng Pei et al., develop an innovative decision algorithm which takes the prioritized relations and correlation of the ascertained attributes into account based upon the generalized picture fuzzy archimedean copula prioritized operators and a novel score function.

In “Multi-view document clustering based on geometrical similarity measurement” Bassoma Diallo et al., present five models of similarity metric and multi-view document clustering plan which depends on the proposed similarity metric.

In “Multi-view data clustering via non-negative matrix factorization with manifold regularization” Ghufraan Ahmad Khan et al. present a new non-negative matrix factorization clustering method with manifold regularization for multi-view data. An iterative optimization strategy depended on multiplicative update rule is also applied on the objective function to achieve optimization.

In “Steadiness analysis of means-end conceptual paths and problem-chains based on concept lattices and similarity measuring”, Lankun Guo et al., develop a scheme for designing problem-chains based on concept lattices and provide evaluation methods towards steadiness of the corresponding learning processes. A method of evaluating the steadiness of problem-chains is proposed by taking advantage of linear regression analysis on problem-chains.

In “Biomedical event trigger extraction based on multi-layer residual BiLSTM and contextualized word representations”, Hao Wei et al., propose the language model to dynamically compute contextualized word representations and propose a multi-layer residual bidirectional long short-term memory architecture, the proposed model achieves the competitive performance on the biomedical multilevel event extraction corpus without any manual participation and feature engineering.

In “Imbalanced data classification based on diverse sample generation and classifier fusion”, Junhai Zhai et al., present a generative adversarial network based framework which includes an over-sampling method and a two-class imbalanced data classification approach.

In “Sustainable competitiveness evaluation of container liners based on granular computing and social network group decision making”, Xueqin Liu et al., present a modification

method by constructing information granules and using particle swarm optimization. Moreover, based on the combination of individual preference relations and experts’ weights obtained from the social network, the aggregated overall opinion of alternatives is achieved.

In “Data reduction based on NN-kNN measure for NN classification and regression”, Shuang An et al., propose a sample quality evaluation measure denoted by NN-kNN, and present corresponding sample reduction algorithms for the classification and regression data. the robustness of the sample reduction algorithms is also validated.

In “MGPOOL: multi-granular pooling graph convolutional networks representation learning”, Zhenghua Xin et al., present graph node embedding framework that is, MGPOOL. This method can generate a new coarsest graph based on node embeddings which makes up the uniqueness of the coarsening result at a time and expands the receptive field for each node to avoid high proximity information lost.

In “Stochastic configuration broad learning system and its approximation capability analysis”, Wei Zhou et al., propose a kind of stochastic configuration broad learning system for data modeling, which is established in the form of a flat network and its architecture is determined by a constructive learning approach. The proposed method also possesses universal approximation properties.

In “Enhancing extended belief rule-based systems for classification problems using decomposition strategy and overlap function”, Longhao Yang et al. present the research and comparative evaluation of the commonly used one-versus-one decomposition strategy and five common overlap functions to improve the performance of EBRBSs on multi-class and multi-attribute problems.

In “Emotion-enhanced classification based on fuzzy reasoning”, Ruiteng Yan et al., propose the low-dimensional hybrid feature model and the emotion-enhanced inference model based on word embedding, emotion-dictionary and fuzzy reasoning by considering the characteristics of short texts including sparseness, non-standardization and ambiguities in a subject.

All the contributions accepted in this Special Issue cover problems related to machine learning-based decision-making and represent considerable progress in state-of-the-art application in the field.

We expect that this Special Issue will contribute to support and stimulate the field to address new research challenges for Machine Learning applied to Information Processing under Uncertainty.

The guest editors thank all the contributors for their effort in submitting high quality papers, all the reviewers for their careful and constructive comments to further enhance the quality of the papers, and Prof. Xizhao Wang, Editor-in-chief of the International Journal of Machine Learning and Cybernetics, for his valuable advice, support and assistance in the organization of this Special Issue.