

Knowledge Technology

Preface

This special issue is dedicated to the Fourth International Conference on Rough Sets and Knowledge Technology (RSKT 2009) held in Gold Coast, Australia, July 14-16, 2009. The RSKT 2009 proceedings (Springer, LNAI 5589) contained 86 papers selected from 229 submissions. After the additional peer reviewing process, we accepted seven revised and extended articles for publication in this issue. We believe that they reflect a variety of current aspects of knowledge technology research and applications, with rough sets treated as one of useful methodologies.

The first paper, by Taichi Haruna and Yukio-Pegio Gunji, is titled "Double Approximation and Complete Lattices". The authors discuss rough set based double approximation spaces from a lattice theoretic point of view. They introduce a generalization of complete atomic Boolean algebras called a complete prime lattice. They also prove an adjunction between the category of semiprime double approximation systems and the dual of the category of complete prime lattices. The results enrich rough set theory, especially, for the categorical formulation of pointless topology.

The second paper, by Tong-Jun Li and Wei-Zhi Wu, is titled "Attribute Reduction in Formal Contexts: A Covering Rough Set Approach". The authors introduce notions of reducible attributes and irreducible attributes in a formal context and give some judgment theorems which can determine all attribute reducts in the formal context. They partition all attributes of a formal context into three types: absolutely necessary attributes, relatively necessary attributes, and unnecessary attributes. They further employ properties of irreducible classes of the formal context to characterize each type of attributes. The proposed method provides a new hybrid knowledge representation model that combines rough sets and concept lattices.

The third paper, by Yan-Qing Yao, Ju-Sheng Mi, Zhoujun Li, and Bin Xie, is titled "The Construction of Fuzzy Concept Lattices Based on (θ, σ) -Fuzzy Rough Approximation Operators". The authors develop approaches to construct fuzzy concept lattices based on generalized fuzzy rough approximation operators. They introduce and examine some pairs of fuzzy rough upper and lower approximation operators over fuzzy formal contexts, via a residual implicator θ satisfying condition $\theta(a, b) = \theta(1 - b, 1 - a)$. Using such approximation operators, they obtain three theoretical approaches to constructing fuzzy concept lattices. This work leads to a potential application to data analysis, based on rough set theory and formal concept analysis.

The fourth paper, by Zhengjiang Wu, Tianrui Li, Keyun Qin, and Da Ruan, is titled "Approximation Operators, Binary Relation and Basis Algebra in L-Fuzzy Rough Sets". The authors present constructive and axiomatic approaches for the study of generalized fuzzy rough sets based on residuated lattices

and IMTL algebras. They examine properties of basis algebras corresponding to the properties of dual approximation operators. Their work provides background for further investigations in fuzzy logics, with reasoning methods based on the framework of rough set theory.

The fifth paper, by Yong Du, Qinghua Hu, Degang Chen, and Peijun Ma, is titled "Kernelized Fuzzy Rough Sets Based Yawn Detection for Driver Fatigue Monitoring". The authors discuss an application of rough set based approach to image recognition. They develop a kernelized fuzzy rough set based technique to evaluate the quality of candidate features and construct some classification algorithms to extract useful features from the driver images. Their experiments show effectiveness of the proposed technique.

The sixth paper, by Jian Yu, Miin-Shen Yang, and Pengwei Hao, is titled "A Novel Multimodal Probability Model for Cluster Analysis". The authors investigate partitional clustering algorithms from a statistical point of view. They propose a novel multimodal probability distribution model and examine its properties. It is shown that some properties of the existing clustering algorithms, such as C-means or fuzzy C-means, can be interpreted within the proposed model. The presented framework can play an important role in algorithm design and performance evaluation for cluster analysis.

The seventh paper, by Deepti Mishra and Alok Mishra, is titled "Object-Oriented Inheritance Metrics in the Context of Cognitive Complexity". The authors explore two inheritance metrics based on cognitive complexity, one at the class level CCI (Class Complexity due to Inheritance) and the other at the program level ACI (Average Complexity of a program due to Inheritance), for object-oriented software systems. In practice, the proposed metrics turn out to be better in representing cognitive complexity due to inheritance than other well known class level and program level inheritance metrics.

We wish to express our deep appreciation to the authors for their contribution and to the reviewers for their careful, insightful and constructive reviews. We are especially thankful to Professor Damian Niwiński, Editor-in-Chief of the Journal, for accepting this special issue and for his help throughout the publication process.

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