

GUEST EDITORIAL PREFACE

Special Issue on Fuzzy and Rough Hybrid Intelligent Techniques in Medical Diagnosis

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In recent years, computational intelligence has been used to solve many complex problems by developing intelligent systems. Fuzzy logic has proved to be a powerful tool for decision-making systems, such as expert systems and pattern classification systems. Fuzzy logic has made its way into general medicine, biomedical engineering, bioinformatics as well as diagnosis and treatment. The complexity of medical practice makes traditional quantitative approaches of analysis inappropriate. In medicine, the lack of information, and its imprecision, and, many times, contradictory natures are common facts. The combination or integration of more distinct intelligent methodologies can be done in any form, either by a modular integration of two or more intelligent methodologies, which maintains the identity of each methodology, or by integrating one methodology into another, or by transforming the knowledge representation in one methodology into another form of representation, characteristic to another methodology.

The objective of this special issue is to showcase the most recent developments and research in the field of medical diagnosis using rough sets and fuzzy set hybridization approaches with other intelligent as well as to enhance its state-of-the-art. This special issue solicits original, full length original articles on new findings and developments from researchers, academicians and practitioners from industries, in the area of rough set theory for medical diagnosis.

This issue for 2013 of the International Journal of Fuzzy System Applications (IJFSA) covers many topics in *Fuzzy and Rough Hybrid Intelligent Techniques in Medical Diagnosis*. It contains *five contributions that are distributed as follows*.

The first paper by Sampath and Ramya presents a clustering algorithm capable of producing rough clusters automatically without requiring the user to give as input the number of clusters to be produced. The efficiency of the

algorithm in detecting the number of clusters present in the data set has been studied with the help of some real life data sets. Further, a nonparametric statistical analysis on the results of the experimental study has been carried out in order to analyze the efficiency of the proposed algorithm in automatic detection of the number of clusters in the data set with the help of rough version of Davies-Bouldin index.

The second paper by Jothi et al. proposes an approach based on the tolerance rough set model, which has the flair to deal with real-valued data whilst simultaneously retaining dataset semantics. In this paper, a novel supervised feature selection in mammogram images, using Tolerance Rough Set - PSO based Quick Reduct (STRSPSO-QR) and Tolerance Rough Set - PSO based Relative Reduct (STRSPSO-RR), is proposed. The results obtained using the proposed methods show an increase in the diagnostic accuracy.

In the third paper by Elshazly et al., a hybrid system that integrates Rough Set (RS) and Genetic Algorithm (GA) is presented for the efficient classification of medical data sets of different sizes and dimensionalities. Genetic Algorithm is applied with the aim of reducing the dimension of medical datasets and RS decision rules were used for efficient classification. Furthermore, the proposed system applies the Entropy Gain Information (EI) for discretization process. Four biomedical data sets are tested by the proposed system (EI-GA-RS), and the highest score was obtained through three different datasets. Other different hybrid techniques shared the proposed technique the highest accuracy but the proposed system preserves its place as one of the highest results systems four three different sets.

In the sequel, the paper by Xiao et al. deals with a novel FCM variation method that is suitable for medical image segmentation. The proposed method, typically by incorporating multi-resolution bilateral filter, which is combined with wavelet thresholding, provides the following advantages: (1) it is less sensitive to both high- and low-frequency noise and

removes spurious blobs and noisy spots, (2) it yields more homogeneous clustering regions, and (3) it preserves detail, thus significantly improving clustering performance. By the use of synthetic and multiple-feature magnetic resonance (MR) image data, the experimental results and quantitative analyses suggest that, compared to other fuzzy clustering algorithms, the proposed method further enhances the robustness to noisy images and capacity of detail preservation.

Finally, Schaefer G in the last paper of this special issue performs gene expression analysis and applies two hybrid GA-fuzzy approaches to classify gene expression data. Both are based on fuzzy if-then rule bases but they differ in the way these rule bases are optimized. The author employs both a Michigan style approach, where single rules are handled as individuals in the population of the genetic algorithm, and a Pittsburgh type algorithm, which treats whole rule sets as individuals. Experimental results show that both approaches achieve good classification accuracy but that the Michigan style algorithm clearly outperforms the Pittsburgh classifier.

As guest editors, we hope that the papers in this issue will stimulate further research in Fuzzy and Rough sets in Medical Diagnosis. We hope that this issue, covering so many different aspects, will be of value for all readers.

We are pleased with the fact that the journal has been attracting good quality papers covering very interesting and novel aspects of fuzzy and rough sets. This issue is a clear indication of the positive trend and we thank the authors for their contributions in this issue. We would like to thank also the reviewers for their diligence in reviewing the papers and the Editors who managed the review of the papers. Special thanks to the editor-in-chief of International Journal of Fuzzy System Applications (IJFSA), Toly Chen, Feng Chia University, Taiwan.

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Ahmad Azar has received the M.Sc. degree (2006) in System Dynamics and Ph.D degree (2009) in Adaptive Neuro-Fuzzy Systems from Faculty of Engineering, Cairo University (Egypt). He is currently assistant professor, Faculty of computers and information, Benha University, Egypt. Dr. Azar is the Editor in Chief of two journals published by IGI Global, USA entitled International Journal of System Dynamics Applications (IJSDA) and International Journal of Rough Sets and Data Analysis (IJRSDA). He is associate editor of IEEE Trans. Neural Networks and Learning Systems. Dr Azar is a reserach member of Scientific Research Group in Egypt (SRGE). He has worked in the areas of System Dynamics, Intelligent Control, soft computing and Modelling in Biomedicine and has authored/coauthored over 80 research publications in peer-reviewed reputed journals, book chapters and conference proceedings. He is an editor of four Books in the field of Fuzzy logic systems and biomedical Engineering. Dr. Ahmad Azar is closely associated with several international journals as a reviewer. He serves as international programme committee member in many international and peer-reviewed conferences. He is currently serves as the Editor of a lot of international journals. His biography was selected to appear in the 27th and 29th Editions of Who's Who in the World, Marquis Who's Who, USA, 2010 and 2012, respectively. Recently, his biography was selected to appear in the 67th Edition Who's Who in America, Marquis Who's Who, USA, 2013. Dr Ahmad Azar is currently the Vice chair of IEEE Computational Intelligence Society (CIS) Egypt Chapter and Vice President Of Egypt System Dynamics Chapter. He is an Academic Member of IEEE Systems, Man, and Cybernetics Society Technical Committee on Computational Collective Intelligence and also a member in KES Focus Group on Agent and Multi-agent Systems. His reserach interests include: Soft computing, Data mining, Machine learning, Rough set, Mathematical Modeling and Computer Simulation, Modeling of Biomedical Systems, Bioinformatics, Automatic Control Systems, Systems Engineering, System Dynamics, Process Control, Robotics and Systems, Intelligent control systems, Computational intelligence like artificial neural network, fuzzy logic and Genetic algorithms, Hybrid Intelligent Systems like Neuro-Fuzzy systems, and Genetic-Fuzzy systems, Signals and Systems, Digital Signal Processing, System thinking, Probability and Statistical Analysis, Decision Support systems, Computer Aided Diagnosis, Urea Kinetic Modeling, Biofeedback systems.

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