Applied Soft Computing (2013) 1–2

Contents lists available at SciVerse ScienceDirect

Applied Soft Computing

journal homepage: www.elsevier.com/locate/asoc

Editorial

Special issue on granular soft computing for pattern recognition and mining

This issue introduces the state-of-art in granular soft computing for pattern recognition and mining and presents some novel contributions. Granulation is a computing paradigm, among others such as self-reproduction, self-organization, functioning of brain, Darwinian evolution, group behavior, cell membranes, and morphogenesis that are abstracted from natural phenomena. Granulation is inherent in human thinking and reasoning processes. Granular computing (GrC) provides an information processing framework, where computation and operations are performed on information granules (clumps of similar objects or points), and it is based on the realization that precision is sometimes expensive and not very meaningful in modeling and controlling complex systems. The structure of granulation can often be defined using methods based on rough sets, fuzzy sets or their combination. In this consortium, rough sets and fuzzy sets work synergistically, often with other soft computing approaches, and use the principle of granular computing. Depending on the nature of computing and granules, crisp or fuzzy, one may have granular fuzzy computing or fuzzy granular computing. The objective of the special issue on "Granular Soft Computing for Pattern Recognition and Mining" is to provide a much needed overview of this interdisciplinary research area as it enters maturity, hosting novel research contributions which (i) augment the current tools, models and languages by means of granular soft computing techniques (ii) provide facilities for representing uncertain knowledge and for reasoning in the presence of uncertainty, and (iii) are potentially applied to pattern recognition and data mining tasks. The special issue would provide a repository to help academics, practitioners, post-graduates and policy makers, working in the area of granular soft computing to disseminate information and to learn from each other's work.

Twenty-four submissions from all over the world were received. After a rigorous review process, only five articles spanning a segment of the research in granular soft computing and its applications were selected for publication in this issue. Apart from these five articles, a title paper authored by the guest editors introduces the granular information processing aspects of natural computing. The article provides an overview of the significance of natural computing with respect to the granulation-based information processing models, such as neural networks, fuzzy sets and rough sets, and their hybridization. The article emphasizes the biological motivation, design principles, application areas, open research problems and challenging issues of these models.

A brief description of the five contributions are stated below in the order they appear in the issue. The article "Granular Computing Neural-Fuzzy Modelling: A Neutrosophic Approach" by A.R. Solis and G. Panoutsos models a neuro-fuzzy system based on a neutrosophic approach. Neutrosophy is a unifying field in logics that extends the concept of fuzzy sets into a three-valued logics that uses an indeterminate value, which is the basis of neutrosophic logic, neutrosophic probability, neutrosophic statistics and interval valued neutrosophic theory. The article addresses the issue of uncertainty during the data granulation process using the proposed model. The motivation behind the research work presented in this paper is to propose a systematic methodology by using granulation that is capable of identifying the data uncertainty produced by merging two different information granules in a data space. The authors describe the models with results that show their efficacy with a better generalization performance as compared to other recent modelling attempts on the same data set.

P. Maji and P. Garai present a feature selection method based on fuzzy-rough sets by maximizing both relevance and significance of the selected features in their paper "On Fuzzy-Rough Attribute Selection: Criteria of Max-Dependency, Max-Relevance, Min-Redundancy, and Max-Significance". The proposed method selects a subset of features or condition attributes from the whole feature set by maximizing the relevance and significance of the selected features. Both relevance and significance of the features are computed using the concept of fuzzy positive regions of fuzzy-rough sets. As a result, the only information required in the proposed feature selection method is in the form of fuzzy partitions or information granules for each condition attribute. The effectiveness of the attribute selection method, along with a comparison with existing feature evaluation indices and different rough set models, is demonstrated on a set of benchmark and microarray gene expression data sets.

The article "Developing fast predictors for large-scale time series using fuzzy granular support vector machines" by J. Ruan, X. Wang and Y. Shi develops fast interval predictors for large-scale, nonlinear time series with noisy data using fuzzy granular support vector machines FGSVMs). Six information granulation methods are proposed which can granulate large-scale time series into subseries. The authors have designed two new indicators: average prediction range(APR) and average covering ratio(ACR), for measuring the prediction performance of FGSVMs, which can be used as performance measurement indicators of other granular learning machines and interval prediction techniques. The authors examined the effectiveness of FGSVM predictors and showed advantages of FGSVMs with several data sets.

In the article "Granulation, Rough Entropy and Spatiotemporal Moving Object Detection", by D. Chakraborty, B. Uma Shankar and S.K. Pal, the authors describe a new spatio-temporal segmentation approach for moving object(s) detection and tracking from a video

1568-4946/$ – see front matter
http://dx.doi.org/10.1016/j.asoc.2013.06.025

sequence. The authors perform spatial segmentation using rough entropy maximization, where they use the quad-tree decomposition, resulting in unequal image granulation, which is closer to natural granulation. A three point estimation based on Beta distribution is formulated for background estimation during temporal segmentation. The authors show the superiority of the method to several related methods.

L. Eciolazaa, M. Pereira-Farina and G. Trivino authored the article "Automatic Linguistic Reporting in Driving Simulation Environments" in the context of linguistic data summarization based on granular linguistic models. The article develops an application for the linguistic descriptions of driving activity in a simulation environment based on fuzzy logic. The approach is based on computational theory of perceptions, which provides a framework to develop computational systems with the capacity of computing with the meaning of natural language expressions, i.e., with the capacity of computing with imprecise descriptions of phenomena in a similar way humans do it. The paper develops the concept of granular linguistic model of a phenomenon. Work performed in this contribution can be used for the automatic evaluation of onboard devices. The authors used real time-series data from a vehicle simulator to evaluate the performance.

These articles provide a wide range of methods with various characteristic features and different applications based on granular soft computing. We hope that the publication of this issue will encourage further research activities and motivate developing novel approaches for uncertainty handling and to address challenging issues encountered in real life problems.

In closing, we would like to thank all the authors who submitted research manuscripts to this issue, as well as the anonymous reviewers for the time spent to evaluate manuscript and provide constructive comments and suggestions. We would like to extend a special note of appreciation to Prof. Rajkumar Roy, Editor-in-Chief of the Journal of Applied Soft Computing, and Mavis Li, Samyuktha Moorthy, Bandee Teresa, Rebecca Capone and Rochzanne Cervantes, the publication supporting team for their constant support. One of the guest editors, Prof. S.K. Pal, acknowledges the J.C. Bose National Fellowship.

Sankar K. Pal
Center for Soft Computing Research, Indian Statistical Institute, 203 Barrackpore Trunk Road, Kolkata 700 108, India

Saroj K. Meher
Systems Science and Informatics Unit, Indian Statistical Institute, 8th Mile, Mysore Road, RVCE Post, Bangalore-560059, India
E-mail addresses: sankar@isical.ac.in (S.K. Pal), saroj.meher@isibang.ac.in (S.K. Meher)