

Guest editorial: special issue on “Intelligent Systems, Design and Applications (ISDA’2009)”

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This special issue includes eight papers focused on recent developments in the field of intelligent systems. The issue is originated from selected high-quality contributions to the ninth international conference on Intelligent Systems Design and Applications, held in Pisa, Italy, 30 November to 2 December 2009. The selected contributions were expanded and subsequently peer-reviewed. Ten were the invited contributions, but only eight were finally accepted after referees’ reports.

The set of papers form a well assorted collection of the techniques composing Soft Computing. They also represent a varied spectrum of hard problems, for which “classical” approaches are not able to produce effective solutions, and for which Soft Computing techniques come to the rescue.

The first paper, “Structural Learning of Bayesian Networks by using Local Algorithms based on the Space of Orderings,” focuses in the structural learning of Bayesian networks. These graph structures are a core component of one of the Soft Computing main constituents, Probabilistic Reasoning. A key problem is finding the optimal structure of such models. This paper provides four related algorithms all of them based on the search in the space of variable orderings, after a given topology is established.

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The second paper, “A Genetic Programming Method for Protein Motif Discovery and Protein Classification,” is concerned with the discovery of certain patterns and features in proteins so that they can be correctly classified and their function predicted. This is quite an important problem in Bioinformatics for which a solution in terms of genetic programming algorithm is proposed. To find effective solutions, specific operators are designed. The performance of the algorithm is contrasted through its application to enzymes extracted from the Protein Bank Data.

In the third paper, “Addressing Data Complexity for Imbalanced Data Sets: Analysis of SMOTE-based Oversampling and Evolutionary Undersampling,” the authors engage with a hot topic nowadays. Focused on imbalanced datasets, the authors study the use of data complexity measures to analyze the behavior of oversampling and undersampling methods. After an extensive and rigorous experimentation, C4.5 and PART algorithms are analyzed. A number of relevant rules characterizing the areas of good and bad performance for those algorithms are derived.

Interval valued fuzzy sets are the core for the image segmentation algorithm proposed in the fourth paper, “An IVFs Based Image Segmentation Methodology for Rat Gait Analysis.” The authors describe and validate a method for the segmentation of a specific kind of images, namely, trying to characterize rat biomechanics behavior.

In the fifth paper, “Obtaining Fuzzy Rules from Interval Censored Data with Genetic Algorithms and a Random Sets-based Semantic of the Linguistic Labels,” genetic algorithms are applied to extract fuzzy rules from interval censored data. Among the merits of this paper are the interpretation of the linguistic labels in terms of random sets based semantic and that the rule learning is conducted through the maximization of the likelihood of the classifier.

The method can be applied to imprecise data and is able to identify conflictive instances in the dataset.

Since Fuzzy Rule-based Systems are a core component of Soft Computing, algorithms to build them are a permanent topic. A key line is towards comprehensible systems. The sixth paper, “HILK++: An Interpretability-Guided Fuzzy Modeling Methodology for Learning Readable and Comprehensible Fuzzy Rule-based Classifiers,” strives the research in this topic by describing and validating an upgrade on the HILK method.

The seventh paper, “Learning Concurrently Data and Rule Bases of Mamdani Fuzzy Rule-based Systems by Exploiting a Novel Interpretability Index,” is also focused on the construction of interpretable fuzzy rule-based

systems, but with a completely different approach. The powerful search performance of Multi-Objective Evolutionary Algorithms is deployed to achieve interpretable fuzzy systems, guided through a new interpretability index.

Finally, the eighth paper, “On Complete Fuzzy Preorders and their Characterizations,” digs into the foundations of theoretical Fuzzy Logic. A complete study and characterization of fuzzy preorders is developed in this paper.

Finally, as Guests Editors of this special issue, we would like to thank all the authors for their contributions and the referees for their necessary, disinterested, and outstanding cooperation as well as for their constructive feedback.

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