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Editorial

Guest Editorial: Hybrid intelligent fusion systems

This special issue covers topics related to information fusion in the context of hybrid intelligent systems which are becoming popular due to their capabilities in handling many real world complex problems, involving imprecision, uncertainty, vagueness and high-dimensionality. They provide us with the opportunity to use both, our knowledge and raw data to solve problems in a more interesting and promising way. This multidisciplinary research field is in continuous expansion in the artificial intelligence research community.

One of the most promising areas of classifier systems is that of combined classifiers, which is currently the focus of intense research. Information fusion helps to overcome limitations of traditional approaches based on single classifiers thereby opening new areas of research.

Accordingly, the current issue presents a survey and five research papers dealing with recent aspects of the hybrid systems where information fusion plays a relevant role. The issue includes comments on one of the articles and the author response to the comments.

The special issue starts with the survey article by Wozniak et al., in which the authors introduce along with a short overview about the recent history, the state-of-the-art, and some key research areas of hybrid intelligent systems related to pattern recognition and optimization.

Three of the five research papers focus on hybrid classifiers, while the other two are related to data fusion for hybrid modeling. More specifically, the first paper, by Lin and Jiang, presents two new hybrid weighted averaging operators for aggregating crisp and fuzzy information, whose desirable formal properties are studied in depth. Additionally, three special types of preferred centroid of triangular fuzzy number are defined with respect to the proposed operators and two novel decision algorithms are developed. The paper content, thanks to prior-to-print online access, has been the subject of a fruitful discussion which is reflected in the comments by Wang arguing on the non-monotonicity of the aggregation operators, and the reply by Lin providing additional proofs of their monotonic properties.

The next paper, by Olatunji et al., also follows a fuzzy approach proposing a combination of type-2 fuzzy logic systems and extreme learning machine to model permeability of carbonate reservoir. The comparative computer experiments show that the hybrid classifier outperforms conventional artificial neural networks and support vector machines for the problem under consideration.

Appearing third is the study, by Tsai, which describes a novel hybrid financial distress model based on combining the clustering technique and classifier ensembles. The author uses both techniques to develop different types of bankruptcy prediction models. Up to 21 different models are produced as combination of unsupervised and supervised classification techniques. Tests evaluating prediction accuracy show that the SOM and the traditional MLP provide the best results.

In the next article, by Hernández et al., an innovative information fusion process of ecological and remote sensing data is proposed. It is based on spatial interpolation methods to provide high resolution accurate estimations of the Leaf Area Index (LAI) which is a critical input variable for dynamical models of the biomass, based on the modelling of the interactions between the soil, the atmosphere and the vegetation models. The information sources used are the in situ field measurements, the remote sensing images and the altitude data obtained from digital elevation maps.

The last research paper, by Kaburlasos and Pachidis, elaborates on the properties of a lattice computing approach based on intervals numbers to deal with disparate data types in a unified framework. Fusion of heterogeneous information sources is achieved on the basis of lattice theoretical formalization. Besides, authors propose an ensemble of fuzzy lattice reasoning classifiers, involving information fusion at the classifier output level in a lattice computing framework. The approach is successfully tested in a real industrial application of beverage brewing control.

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