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SPECIAL ISSUE:

SIGNAL PROCESSING & SOFT COMPUTING

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Signal Processing (SP) is a key issue in real world applications of Soft Computing (SC). Indeed, SP could be considered as the interface that allows SC to reach virtually any application and have real impact in almost any aspect our lives. The potential of the synergic combination of SP and SC is therefore formidable. This *Special Issue on Signal Processing & Soft Computing of Intelligent Automation and Soft Computing (IASC)* illustrates this asseveration. Here you can find powerful SP and SC tools such as Fractals, Wavelet Transform (WT), Artificial Neural Networks (ANNs), Fuzzy Logic (FL) and many others, applied synergistically in the development of novel proposals in technologies and applications such as: Medical and Biomedical Analysis and Diagnosis, Speech Processing, Image Processing, Automated Recognition, Health Monitoring, Texture Classification, Soil Science, etc. Such a variety of modern methods and high impact applications are articulated in the following contributions:

1- This paper presents a brief review of handling missing data, including the new Multi-Task Learning (MTL) systems. Moreover, a Multilayer Perceptron (MLP) approach for incomplete pattern classification based on MTL is proposed. This network learns in parallel the classification task (main task) and the different tasks associated to each incomplete feature (secondary tasks). Unknown values are imputed while training, being these missing data imputation process oriented by the learning of the classification task. Experimental results show the effectiveness of the proposed approach.

2.- Proposes the GKPFCM algorithm, that provides the membership values and the typicality values from which a knowledge base is generated through two Fuzzy Logic (FL) models, and this can be used in order to classify new data and to determine if these new data are typical, atypical or noise.

3.- A new pruning algorithm formed by combining the Statistical Stepwise Method (SSM) with the Iterative Pruning (IP) algorithms is proposed. This proposed algorithm (SSIP) is used to simultaneously remove unnecessary neurons or weight connections from a given feed-forward neural network (NN) in order to "optimize" its structure. The performances of the algorithms are compared using two real world applications, brain disease detection and texture classification, and the superiority of the SSIP pruning algorithm is demonstrated. This new algorithm can eliminate approximately 59% of the links in the initial oversized network in order to improve performance by approximately +39% and +26% for the sensitivity of learning, and generalization, respectively.

4.- A non-linear analysis of the electroencephalogram (EEG) background activity is developed to obtain a better understanding of abnormal dynamics in the brain. The aim of this study was to analyze the regularity of the EEG time series of Alzheimer's disease (AD) patients to test the hypothesis that the irregularity of the AD patients' EEG is lower than that of age-matched

controls. Approximate Entropy (ApEn). ApEn is a non-linear method that can be used to quantify the irregularity of a time series. The decreased irregularity found in the EEG of AD patients in the parietal and occipital regions leads us to think that regularity analysis of the EEG with ApEn could be a useful tool to increase our insight into brain disfunction in Alzheimer's disease.

5.- Most soil parameters as the spatial variability of preferential pathways for water and chemical transport in field soils show complex variations at different scales that cannot accurately described with stationary assumptions. This is why multifractal formalism or the wavelet transform reveals as useful tools for classifying and quantifying the spatial variability of these preferential pathways, as visualized through dye infiltration experiments on Soil Images acquired after dye infiltration soil near College Station, Texas.

6.- In this paper, two versions of the WT are analyzed: the Discrete Wavelet Transform (DWT) and the Wavelet Packets (WP). The DWT is implemented by means of a filter bank with a fixed structure that provides a valid base to represent signals. The WP is a generalization of DWT that provides a library of bases, so that the best one can be chosen to represent the signal. Although WP is superior than the DWT from a theorical view, WP has not been extensively used yet.

7, 8 and 9 present new advances in speech technology. Two novel applications of ANNs in Speech Recognition and Text-to-Speech systems are here presented. A novel strategy to dynamically calculate the hypothesized search space, using ANNs as the estimation module and designing the input feature set with a careful greedy-based selection approach is proposed. The main achievement has been a statistically significant relative decrease in error while getting a relative decrease in average computational demands. The double objective is to get accurate predictors for both the fundamental frequency curve and phoneme duration by minimizing the model estimation error in a Spanish text-to-speech system. The proposed system predicts prosody with very good results that clearly improves a previous rule-based system. Practical advances in enhanced interfaces at home are presented in the second paper, having all them integrated into a new interface for controlling a Hi-Fi audio system, thus significantly increasing its ergonomics. The main goal of the last work is to extend traditional Principal Component Analysis (normally applied on static features) to a classification task using a dynamic representation. The method was applied to detect the presence of pathology in the speech using two different voice disorder databases, obtaining high classification rates that remained after a relevant subset feature selection. The proposed scheme substantially reduced the feature space dimension without decreasing the accuracy in the detection. Besides, with the proposed method is possible to identify which original dynamic features were relevant for the pathological voice detection task.

Finally, in the field of ANNs, a novel and original contribution that promises to improve a high number of ANNs application results, is presented. The Metaplasticity property of biological synapses is interpreted in this paper as the concept of placing greater learning emphasis on less frequent training patterns. The hypothesis of an improved training when few training patterns are available is then tested on the MLP with Backpropagation (BP) training. The results obtained show a much more efficient training, while improving, or at least maintaining, the ANN performance.

I wish to thank Editor-in-Chief Mo Jamshidi for giving me the opportunity of serving IASC as Guest Editor of this Special Issue. It has been a real pleasure. I also express my gratitude to all members of editorial office, the authors and to the independent reviewers that had made possible this issue. We hope that this Special Issue will be of high interest to the reader, as we consider that are the contributions contained in it.

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