Guest-editorial

Special Issue on Soft Computing and Applications

This special issue on Soft Computing and Applications contains a rich set of extended papers originally presented at the IEEE International Workshop SOFA 2005, at Szeged-Hungary and Arad-Romania, in August 2005.

SOFA, an acronym for SOFt computing and Applications, is an international workshop intended to advance the theory and applications of intelligent systems and soft computing.

Soft computing (SC) is a collection of methodologies that are trying to cope with the main disadvantage of the conventional (hard) computing: the poor performances when working in uncertain conditions. The fundamental idea of soft computing is to emulate the human like reasoning. The classic constituents of SC are fuzzy logic, neural network theory and probabilistic reasoning, but new methods are continuously emerging: belief networks, genetic algorithms, anytime algorithms, chaos theory, some parts of learning theory, etc. Due to the large variety and complexity of the domain, the constituting methods of SC are not competing for a comprehensive ultimate solution. Instead they are complementing each other, for dedicated solutions adapted to each specific problem. Hundreds of concrete applications are already available in control, decision making, pattern recognition and robotics. The SC systems are tolerant to imprecision, uncertainty, and partial truth. Their main advantages are tractability, robustness, and low cost implementations. At the same time SC is a major developing vector of the Artificial Intelligence

The first paper, by J. Dombi, and Z. Gera presents the construction of a fuzzy rule based classifier. A three-step method is proposed based on kasiewicz logic for the description of the rules and the fuzzy memberships to construct concise and highly comprehensible fuzzy rules. A genetic algorithm is applied to evolve the structure of the rules and then a gradient based optimization to fine tune the fuzzy membership functions. The introduced squashing function allows not only to handle the approximation of the operators and the memberships in the same way, but also to efficiently calculate the derivatives of the membership functions. The authors show applications of the model on the UCI machine learning database.

The second paper, by V. E. Balas, E. Roventa, and T. Spircu study how fusion agents treat changes of belief state of sensors. Two kinds of fusion are considered: the averaging by convex combination, and Dempster type conjunctive rules of combination. The authors establish that there is no coherent treatment, at the fusion agents' level, that is compatible with both kinds of fusion. To deal with better detection, a mixed structure involving intermediate supervision agents is proposed.

The third paper, by K. Shinkai presents the recent results on the sociometry analysis. According to the data obtained from some simple questionnaires, the author could measure fuzzy relation among the members of a group and observe its human structure by applying fuzzy graph. In this paper it is also describe the decision method applying the fuzzy decision and also it is illustrate its practical effectiveness with the case study.

The next paper by M.M. Balas, J. Duplaix, M. Bouchouicha and S.V. Balas presents the structural modeling of the wind's influence over the heat flow of a greenhouse, starting from recorded data of an experimental greenhouse. The paper is aiming to identify a submodel for the windy dry nights. The modeling method consists in the identification of the sub-models with low order systems with nonlinear coefficients and their optimization using genetic algorithms. The knowledge of the wind's influence over the thermal behavior of buildings and vehicles help to improve the designing of such products. Two case studies are presented: a passive

greenhouse provided with a heat pump/wind generator renewable energy source and a railway coach. The simplicity of such models encourages implementations at micro-controllers /DSP levels.

Corner detection is investigated by A.R. Várkonyi-Kóczy and A. Rövid. Based on the corners the authors determine the most characteristic points of an object and so reconstruct it. In this paper, a new corner detection technique is introduced which is based on fuzzy reasoning and applies a special local structure matrix. Furthermore, by introducing a new attribute associated to the corners, the method efficiently supports the further processing, e.g. point correspondence matching in stereo images or 3D reconstruction of schemes.

The next paper by H. N. Teodorescu and L. I. Fira addresses the issue of prediction performance in a framework based on the analyzed time series predictability. The aim of this paper is to determine which predictors are most suitable for genomic sequence identification. The authors analyze linear predictors, neuronal predictors, and neuro-fuzzy predictors. Several methods to appreciate the predictability of time series are used. All predictors were tested and compared for prediction quality using sequences from HIV-1 genome. The mean square prediction error (MSPE), direction test, and Theil coefficient were used as prediction performance measures. The prediction results obtained with the predictors are contrasted and discussed.

Márta Takács presents how uninorm-based approximate reasoning can be applied, based on similarity measures of fuzzy sets and residuum of uninorms. The investigations are focused on distance based operators, and its represents in the group of uninorms. Considering that the uninorms are parameter-dependent norms, the author can influence the behavior of the system by changing or sliding the parameter values and by this the construction of the uninorm, which is built-in in the inference mechanism. Along with the uninorm parameters, the structure of the fuzzy sets can also be modified in order to improve the behavior of the entire fuzzy-controlled system.

Particle Swarm is a relatively novel approach for global stochastic optimization. M. Mussetta, S. Selleri, P. Pirinoli, R.E. Zich and L. Matekovits propose some variations over the basic algorithm with the aim of a more efficient search over the solution space obtained with a negligible overhead in both complexity and speed. The presented algorithms are then applied to a mathematical test function and to a microwave microstrip filter to show their superior capabilities with respect to the conventional version.

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