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Editorial

Hybrid intelligent algorithms and applications

Hybridization of intelligent techniques, coming from different computational intelligence areas, has become popular because of the growing awareness that such combinations frequently perform better than the individual techniques coming from computational intelligence (neurocomputing, fuzzy systems, rough sets, evolutionary algorithms, etc.).

Practical experience has indicated that hybrid intelligence techniques might be helpful to solve some of the challenging real world problems. In a hybrid intelligence system, a synergistic combination of multiple techniques is used to build an efficient solution to deal with a particular problem.

The 3rd International Workshop on Hybrid Artificial Intelligence Systems (HAIS'08) was held in Burgos, Spain, from 24 to 26 September 2008. The Workshop was organized by the Applied Computational Intelligence Group (GICAP) in collaboration with the Biomedicine, Intelligent Systems and Educational Technology Group (BISITE) of the University of Salamanca. HAIS 2008 established a broad interdisciplinary forum where researchers and practitioners from many fields interacted with each other and with leading academics and industries in areas where the application of hybrid intelligent techniques could be found beneficial.

This special issue comprising of four papers is focused on hybrid intelligent algorithms following different approaches and their real world applications. Papers were selected on the basis of fundamental ideas/concepts rather than the direct usage of well established techniques. The papers are organized as follows.

The first contribution, by Duro et al. [1], is related to the area of cognitive and intelligent robotics, which is moving from the single monolithic robot control and behavior problem to that of controlling robots with multiple components or multiple robots operating together, and even collaborating, in dynamic and unstructured environments the authors provided a general overview of the current state of multi-component robotic systems, focusing on some insights regarding on how hybrid intelligent approaches could provide key contributions to some advancements in the robotics field.

Many pattern recognition tasks and hybrid intelligent systems require analysis and exploration of a vast amount of data, often highly dimensional, in order to extract useful information and discover meaningful patterns and rules. The curse of dimensionality has prompted the search for a suitable, smaller and featured representation of raw data sets. The topic of dimensionality reduction and manifold learning has recently attracted a great deal of attention with a number of advanced techniques being proposed. The second paper, by Yin et al. [2], provides an overview of this emerging topic and discusses various recent advances, such as kernel principal component analysis, principal manifold, isomap, local linear embedding and Laplacian Eigenmap. It further elaborates the biologically inspired SOM model and its metric preserving variant ViSOM, with applications to face recognition.

Data mining starts with large amounts of individual data, and generates general knowledge that is applicable to the individual data items, hence involving an integration of both induction and deduction in real-world applications. Depending on different application domains, tasks, and data types, different techniques have been developed for both induction and deduction. Most of these techniques are evolved from fields such as statistics, machine learning, artificial intelligence, and pattern recognition. Along with the emergence of more and more complex real world problems, immensely growing data volumes, and the increasing requirements of multi-disciplinary research, there are more data mining applications nowadays that need to be implemented by designing a hybrid system that integrates more than one technique together. The third paper, by Zhang et al. [3], attempts to build a hybrid framework, in which both inductive and deductive reasoning methods are involved for a two-stage processing in noisy data mining.

In the sequel, Grosan et al. [4] propose a new approach for multiobjective optimization, which aggregates objective functions and uses a line search method in order to locate an approximate efficient point. Once the first Pareto solution has been obtained, a simplified version of the former one is used in the context of Pareto dominance to obtain a set of efficient points, which will assure a thorough distribution of solutions on the Pareto frontier. In the current form, the proposed technique is well suitable for problems having multiple objectives and requires the functions to be continuous twice differentiable. When compared to some of the popular evolutionary multiobjective optimization approaches, the proposed approach not only assures a better convergence to the Pareto frontier but also illustrates a good distribution of solutions.

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