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EDITORIAL

Guest editorial: Thematic issue on 'Adaptive Soft Computing Techniques and Applications'

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1 Adaptive soft computing and applications

In the last 20 years, we have witnessed the remarkable progress in computational-intelligence modelling for various applications. However, a majority of these researches make one fundamental assumption that sufficient and representative data are provided in advance for training. Because this assumption often does not hold in many real applications, recent efforts on adaptive soft computing techniques, such as evolving connectionist systems (ECOS), incremental learning and other adaptive learning models aim to relax the "sufficiency" requirement by continuously updating a model which keeps learning from data streams. ECOS addresses the learning from a data stream or chunks of data whose underlying distribution changes over time, by training a neural network continuously and adapting its structure and functionality through repeated interactions with the environment or other learning systems. Similarly, incremental learning develops the ability of a computational model to continuously accumulate knowledge learned over time from noisy and/or incomplete data. In practice, incremental learning is also featured by one-pass property, which enables the algorithm to work with real time data streams presented only once to the learning machine. Other adaptive soft computing techniques—usually known as concept drift algorithms, make assumptions such as restriction on the type of changes in the distribution, have been reported with promising results for applications satisfying specific assumptions.

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2 Papers submitted and selected for this issue

The response to the call for papers was very encouraging; a clear and positive indication that topics related to adaptive soft computing issues command great attention from researchers. Every submission is peer-viewed by at least two anonymous experts in the field and one of the guest editors. The papers are selected based on the novelty and potential impacts of the submissions as well as the clarity in paper presentation, reflected in the response from reviewers. Following the Springer review protocol, the review of papers was organized by the Guest Editors, and the final decision is made by the Editor-in-Chief directly. Finally, five papers which passed the two round review process are selected to be included in this thematic issue. The first three papers are mainly about methodology research, and the remaining two papers are on application oriented studies.

The first paper in this thematic issue, titled "Architecture for development of adaptive on-line prediction models," by Petr Kadlec, presents an architecture for the modelling of adaptive soft computing. The architecture enables both incremental learning and life-long learning by defining a unified modular environment based on ensemble methods, local learning, and meta learning.

In the paper "Optimal Incremental Learning under Covariate Shift," by Koichiro Yamauchi, learning strategies under covariate shift is studied in an incremental learning environment. A model-selection criterion is proposed to reconstruct an incremental-learning method by predicting the input

density for newly presented learning samples and reinforcing the learning with isolated ones.

The paper "Solving Maximum Fuzzy Clique Problem with Neural Networks and its Applications," by Malay Bhattacharyya and Sanghamitra Bandyopadhyay, differs from the other papers in its emphasis on the maximum clique problem solving. The idea is to reduce the original problem to an unconstrained quadratic 0-1 programming problem, and use a neural network endowed with a mutation ability of genetic adaptive systems to solve the reduced problem.

The paper "A Vision Architecture for Unconstrained and Incremental Learning of Multiple Categories," by Stephan Kirstein, Alexander Denecke, Stephan Hasler, Heiko Wersing, Horst-Michael Gross, and Edgar Körner, constructs an integrated vision architecture capable of incrementally learning several visual categories from natural hand-held objects. In contrast to most visual categorization approaches, where typically each view is assigned to a single category, the proposed method allows labelling objects with an arbitrary number of shape and color categories.

Finally, the paper "Fast Reinforcement Learning for Simple Physical Robots," by Pitoyo Hartono and Sachiko Kakita, introduces a simple two-layered neural network implementing a novel and fast reinforcement soft computing method with application to robotics. The developed technique is successfully implemented in the obstacle-avoidance experiment of physical robots running in real world environments.

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