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Editorial

Complex learning in connectionist networks

The appropriate choice of a learning algorithm is a central issue in neural network (connectionist network) design. In the literature, a number of such learning methods are available and are broadly classified as supervised, unsupervised and reinforcement learning. This special issue introduces novel complex learning procedures for handling different types of data in several application domains. The six papers in this special issue represent a selection of extended contributions from the World Congress in Nature and Bio-Inspired Computing (NaBIC). Articles were selected on the basis of fundamental ideas and concepts rather than the direct usage of well-established techniques. The special issue is aimed at practitioners and researchers from the academia and industry who are engaged in the development of advanced learning methods from a theoretical perspective and also for data analysis and solving real-world problems. The papers are organized as follows.

In the first contribution, Kirmse and Petersohn propose a new meta-learning approach consisting of supervised clustering algorithm to generate an initial rectangle based generalization of the training data and these labeled clusters are then used to produce a large margin hyper-rectangle model. Authors also illustrate a large margin supervised clustering scheme, which also introduces the principle directly into the supervised clustering process.

Li et al. in the sequel address the novelty detection problem using several distinct characteristics of the outliers and the normal patterns. Authors envisage that the appropriate decision boundary segregating the outliers and the normal patterns usually lies in some low-density regions of the data space and the resultant optimization problem to learn the decision boundaries is solved using mixed integer programming. A cutting plane algorithm together with multiple kernels learning technique is proposed to solve the convex relaxation of the optimization problem.

In the third paper, Naeini et al. illustrate a novel model called learning by abstraction by using supervised and unsupervised learning algorithms. The developed model can be useful in semi-supervised learning problems where some knowledge about the high level category of some training instances is known. In the learning mode, the nearest classes are located and merged into a new abstract class and a new learner is trained to perform the classification task in this abstract level. In the recall mode, for classifying a new instance, an ensemble model based on Dempster–Shafer's theory and Bayesian model is illustrated.

Frolov et al. in the fourth paper solve the problem of discovery of hidden structures in high-dimensional binary data using two new expectation–maximization Boolean factor analysis algorithms, which maximize the likelihood of a Boolean factor analysis solution. Authors also introduce an informational measure of Boolean factor analysis efficiency and the performance is illustrated using the bars benchmark problem.

In the fifth paper, Hemanth et al. propose a modified counter propagation neural network and modified Kohonen learning approach to make the conventional neural network design iteration-free to improve the convergence rate besides yielding accurate results. The performance of these networks is illustrated using abnormal brain image classification problem.

The implementation of crossover operator is often a great challenge to construct large-scale neural networks using evolutionary algorithms. In the final paper, Azzini et al. present a similarity based crossover operator for the evolutionary design of neural network architecture. The crossover operator starts by looking for a local similarity between the two individuals in the population. The contribution of each neuron of the layer selected for the crossover is computed, and the neurons of each layer are reordered according to their contribution. Then, each neuron of the layer in the first individual is associated with the most similar neuron of the layer in the other individual, and the neurons of the layer of the second individual are re-ranked by considering the associations with the neurons of the first one. Finally, the neurons above a randomly selected cut point are exchanged to generate the offspring of the selected individuals.

Hope our readers will enjoy reading this special issue and find the contents very valuable. I would like to thank all the peer-reviewers for their diligent work and efficient efforts. We are also grateful to Prof. Tom Heskes (Editor-in-Chief of Neurocomputing) and Dr. Vera Kamphuis (Editorial Assistant of Neurocomputing) for the wonderful support and opportunity to organize this special issue.

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