Neural Comput & Applic (1998)7:97–98

Neural Computing & Applications

Editorial

The nine contributions to this issue of *Neural Computing & Applications* include authors from UK, France, Egypt and India.

The first paper is from Alan Soper at the University of Greenwich, who uses a high order version of the well-known Hopfield architecture to perform vector quantisation. The differences in this approach to the conventional Hopfield network are the lack of constraints on the energy state in the network, and the optimisation capability of the model in both small and large data sets. The application area described by the author is in image processing, but I believe that readers will find the modification of the Hopfield architecture, the optimisation performance of the model, and the comparison with genetic algorithms as an optimisation technique, of great interest.

The second paper is by Bertrand Heyd and colleagues at the Ecole National Supérieure des Industries Agricoles et Alimentaires in France. The authors evaluate a learning algorithm based on a modified simplex method for training multi-layer networks. The technique offers an alternative for neural network developers to the "classical" approaches in training multi-layer networks, and the authors show that the method performed better than standard back-propagation for a number of example problems. There have, of course, been many variations on the theme of training multi-layer networks, including modifications and extensions of back-propagation; however it is as an alternative approach that this paper will interest readers.

Dimitri Dracopoulos, of Brunel University, tackles an application area which has been the focus of much development in the neural community – robotic control. The particular aspect of this field that the author addresses is path planning, and he applies multi-layer perceptrons to the problem. The paper is particularly interesting because it extends and compares with a previous study on this subject by Houillon and Caron, who failed to train MLPs successfully to perform this task. Why the earlier attempt did not succeed is unclear; however the authors here show not only that it can be done, but also that it can be done with a high degree of accuracy and reliability – at least to the problem they tackled.

The fourth paper is also from Brunel University, and also tackles a control problem. The focus of this paper is the use of fuzzy logic – a very well established technique in control engineering – and evolutionary reinforcement, and the process which is controlled is vectored-thrust turbine engine. The author, H. Nyongesa, describes how the technique used fuses neural networks, fuzzy logic, and genetic algorithms into a single intelligent control strategy for this process. The paper also highlights two features of evolutionary reinforcement learning – constrained optimisation and explicit memory – which the author claims give advantages over other training techniques.

Continuing the theme on fuzzy logic, the next paper is from R. Sutton and P. Craven at the University of Portsmouth, who apply the adaptive network-based fuzzy inference system (ANFIS) architecture to the design of autopilots for autonomous underwater vehicles. ANFIS combines a chemotaxis tuning methodology, less prone than back-propagation to becoming stuck in local minima, with fixed fuzzy rules. The authors simulate the dynamic yaw characteristics of such vehicles, and use the ANFIS technique to devise autopilots which show improved performance over those designed using other techniques.

The sixth paper is by Ashraf Abdelbar at the American University in Cairo. It shows how superior generalisation can be achieved using a high order neural network – specifically, the recently-developed HONEST (High Order Network with Exponential Synaptic Links). This architecture is a generalisation of the better-known Sigma-Pi high order network, and the author and his team applied HONEST to a public domain dataset, the abalone shellfish data from the UCI Repository. This is useful since it is a benchmark problem and will allow readers familiar with the data to make their own comparisons on the efficacy of the approach employed.

Once again fuzzy logic is a feature of the next paper, by Joseph Downs and his colleagues at the University of Sheffield. Here the authors have developed a decision support tool for the diagnosis of breast cancer using fuzzy ARTMAP networks as the underlying model. Many NC&A readers will be familiar with other work done in this area, particularly by Lionel Tarassenko and his team at Oxford. The approach in this paper involves "pruning" networks to an optimal size to maximise accuracy, sensitivity and specificity, and "cascading" the pruned networks separate those cases which are "certain" and "suspicious". Readers will be interested in the authors' conclusions on the effectiveness of their pruning approach, and the "self-discovery" by the model of generally valid sets of rules for the domain.

The penultimate paper in this issue is from T. J. Suh and I. I. Esat at Brunel University. The authors using what they describe as a "divide and conquer" strategy, for solving large-scale combinatorial problems. They apply their approach to the classical travelling salesman, N-queen, and tiling problems, and also introduce the Grossberg Regularity Detector (GRD) neural network architecture. The GRD is combined with Hopfield networks in this strategy, which shows how two functionally different neural networks can be combined to solve large-scale problems, where the GRD is used to classify the problem into smaller sub-groups, which were then optimised using the Hopfield networks. Although clearly the travelling salesman problem has been solved using Hopfield networks (and other optimisation techniques) alone, the authors believe that this strategy is better since it can deal with larger-scale problems more efficiently.

Finally, S. Nath Sarbadhikari and his colleagues at the Indian Statistical Institute in Calcutta, who tackle another problem which has vexed researchers over the years, that of fingerprint classification. Here the authors exploit the directional features in fingerprints, using fast Fourier transforms of the fingerprint images in up to eight directions. They then use multi-layer perceptrons to perform the classification task, with five classes of fingerprint type. Readers will be interested in the pre-processing techniques which are detailed to extract the salient features from what are often noisy images, particularly the use of one-dimensional FFT.

The papers presented here contain the fruits of many years of effort for the authors. I hope that you will find them enjoyable, interesting, and stimualting.

JOHN MACINTYRE
Editor-in-Chief