AN INVESTIGATION OF FEEDFORWARD NEURAL NETWORKS WITH RESPECT TO THE DETECTION OF SPURIOUS PATTERNS

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Abstract

This thesis investigates feedforward neural networks in the context of classification tasks with respect to the detection of patterns that do not belong to the same categories of patterns used to train the network. This refers to the problem of the detection and/or rejection of *spurious* or *novel* patterns.

In particular, the multilayer perceptron network (MLP) trained with the back-propagation algorithm is examined in this respect and different strategies for improving its performance in the detection of spurious patterns are considered. The problem is investigated from different points of view that vary from the modification of the multilayer perceptron network with different configurations that make it more intrinsically able to detect spurious information, to the introduction of novel auxiliary mechanisms which, when integrated with the MLP network, can provide an overall enhancement in the system's rejection capabilities.

These different network configurations are examined with respect to the characteristics of the decision regions constructed by the networks in 2-D classification problems, and the implications of these constructions for general pattern rejection are discussed. The technique of inversion in multilayer networks through gradient descent is used to observe the degree of visual correlation between the input patterns recognised as valid by the networks and training class prototypes. Practical experiments on the classification of handwritten characters are employed as a test environment for the different approaches described.

Radial basis function networks (RBFs) are also examined in the same context and an experimental comparison is made between RBFs and the different MLP configurations studied.