Abstract

For representative modelling, the neural network structure should be optimal. Further, structure optimization can reduce hardware and memory requirements, increase speed of training, and enable easier knowledge extraction.

This thesis seeks to contribute to the development and application of numerically and computationally robust orthogonal transformation based methods for structural optimization in neural networks.

A typical problem in structural optimization is to find a specific set of important nodes and weights in a neural network model. The present work contributes to the application of orthogonal transformation scheme of modified form of QR with column pivoting factorization for selecting an optimal model from an over sized neural network.

For a network to be parsimonious, the hidden nodes should ideally perform distinct functions. This thesis proposes a contribution in the development of a new method of optimizing the network structure through assigning specific training patterns for the hidden nodes. The assigned target patterns lie in orthogonal subspaces and are optimal in successive assignment sense.

A combination of several trained networks has been found to improve the generalization performance, and fault tolerance in neural networks. In the thesis a new successively constructed modular network is proposed. Here, each individual network module is trained against the optimal training patterns assigned. Further, the structure optimization in the proposed architecture is addressed.

The thesis concludes with applications of the proposed structure optimization methods for launch vehicle systems modelling and control.