H_∞ FILTERING METHOD FOR NEURAL NETWORK TRAINING AND PRUNING

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Abstract: An efficient training and pruning method based on the H_∞ filtering algorithm is proposed for feedforward neural networks (FNN). A FNN's weight importance measure linking up prediction error sensitivity obtained from the H_∞ filtering training, and then a weight salience based pruning algorithm is derived. Moreover, based on the monotonicity property of the H_∞ filtering Riccati equation and the initial value of the error covariance matrix, performance of the H_∞ filtering training algorithm will also be investigated. The simulation results show that our approach is an effective training and pruning method for neural networks.

Key words: *H_∞ filtering, feedforward neural network, training, pruning*

Received: December 14, 2006
Revised and accepted: March 1, 2007

1. Introduction

For neural networks (NN) design, there are two crucial problems: one is the choice of a 'fast' and 'robust' training algorithm, and the other is the choice of a suitable or, ideally, minimal NN topology to be adopted. In neural network training, the most common learning algorithm is called Back Propagation Algorithm (BPA) [1], which is essentially a first-order stochastic gradient descent method and shows slow learning speed [2]. Many modified schemes based on the classical nonlinear programming technique have been suggested to speed up the training [3, 4].

Recently, a class of second-order descent methods inspired by the theory of system identification and nonlinear filtering [5] has been introduced to estimate the weights of a neural network. Methods such as the extended Kalman filter

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