

COMPARATIVE ANALYSIS OF SOME PREDICTIVE MULTI-LAYERED NEURAL NETWORK MODELS

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Abstract

Multilayer back-propagation neural networks are the network structures build with distinct layers. Due to some inherent challenges of single-layered network

in solving some nonlinear problems, it is desirable to have hidden layer(s) with adequate number of neurons; as this would give more processing power to the network. The main objective of this study was to unveil the architecture that can produce most accurate predictive model among the multilayer back-propagation neural networks that is being considered. This study specifically measures and compares the accuracies of the models created using the feed-forward back-propagation, cascade-forward back-propagation and Elman back-propagation neural networks. The required data sets for implementation were retrieved from the online public repositories. Experiments were conducted and repeated using two sets of different data in order to establish the consistencies of the network outputs. Findings from this study are based on a number metrics, and the results show that, among the three architectures being considered, the predictive model created using the feed-forward neural network architecture records the lowest error and found to converge at the lowest epoch.

Keywords: multilayer networks, prediction model, feed-forward, cascade-forward, neural network, back propagation, epochs.

1.0 INTRODUCTION

An artificial neural network, is a type of artificial intelligence that attempts to mimic the way the human brain processes and stores information (Taylor, 2006). Neural networks therefore, represent a brain metaphor for information processing. The neural network models are not an exact replica of how the brain actually functions; rather, it is a biologically inspired technique. The multilayer perceptron is a type of neural network architecture that basically consists of one or more hidden layers. It is a system of interconnected neurons or nodes. Multilayer perceptron neural network is a model representing a nonlinear relationship that maps patterns or structure of the input vector to the output vector.

Perceptron network is mainly suitable for solving linear problems. When there is an increase in the complexity of a problem, the tendency to understand the theoretical knowledge that surrounds such problem decreases. This sudden decrease may be due to ill-defined interactions that exist between systems, thus, problem of this nature requires statistical approaches (Gardner & Dorling, 1998). However, multilayer perceptron have shown to be effective and can be used as an alternative approach to the statistical method (Schalkoff, 1992). The MLP techniques make no prior assumptions concerning the data distribution.

A number of variations of artificial neural network exist and they are much related to the nature of the task assigned to the network. The way neurons are modelled also varies; studies have shown that in some cases, these models are closely correspond to biological neurons, and for instance, (Gluck & Bower, 1988; Granger, Ambrose-Ingerson, Staubli, & Lynch, 1990) and in other cases, the models depart from biological functioning in a way that is very significant. Also, neural network can be trained to learn the patterns in the data and in the process, the relationship between the input and the output patterns are established. The multilayer perceptron is also capable of generalizing when simulated with a set of untrained data.