CHAPTER 0

ARTIFICIAL NEURAL NETWORK AND STATISTICS

0.1 ARTIFICIAL NEURAL NETWORK AND STATISTICS

Artificial Neural Networks (ANNs) have recently received a great deal of attention in many fields of study. The excitation stems from the fact that these networks attempt to model the capabilities of the human brain. On practical level, human brain has many features that are desirable in an electronic computer. The human brain has the ability to generalize from abstract ideas, recognize patterns in the presence of noise, and quickly recall memories.

From a statistical point of view, neural networks are interesting because of their potential use in prediction and classification problems. Neural networks are being used for a wide variety of applications, where statistical methods are traditionally used. In particular, these are found to be useful in classification problems such as identifying water sonar contacts (Gorman and Sejnowski, 1988), and predicting heart problem in patients. In time series applications, they have been used in predicting stock market performance (Hutchinson, 1994).

They have been used to predict software faults during testing by using Principal Component Analysis (PCA) (Khoshgoftar and Szabo, 1996). They have also been used in several nonparametric and robust classification procedures (Vowdouri-Maniati, Kurz, and Kowalski, 1997). As a Statistician or users of Statistics, we would normally solve these problems through statistical techniques such as Discriminant analysis, logistic regression, multiple regression and time series model such as Autoregressive Integrated Moving Average (ARIMA) model and other forecasting methods. It is therefore time to recognize neural networks as a alternative tool for statistical data analysis and hence here we are making an effort towards this direction.

Below, we present the Chapterwise summary of the dissertation :

0.2 CHAPTERWISE SUMMARY

Starting with discussion on biological neural network, Chapter I introduces a general structure of ANN. It provides an overview of what neural network can accomplish. Brief historical remarks on ANN development are presented, followed by some applications of ANN which are reported in the literature.

Chapter II introduces the elementary ANN model called as "M-P Neural Network" with its implementation using logical

operators. Section 3 of this Chapter covers a single layer ANN with continuous activation function. The Chapter ends with the analysis of networks and their learning rules.

Chapter III covers the foundation of multilayer feedforward neural networks. Also, the training method of multilayer network called as 'back-propagation training method' is discussed and illustrated with example. We conclude this Chapter by discussing the significance of various network parameters.

Chapters IV and V, are devoted to applications of ANN model in statistical data analysis as an alternative tool. In particular, Chapter IV covers the use of ANN models in Discriminant analysis as well as in Regression analysis with some illustrations. Chapter V provides an application of ANN in testing of hypothesis problems. Suitable illustrations are given in the Chapter.

Since the software on ANN is available in the market for high prices, we could not afford it and we therefore developed the same here. The Appendix contains essential algorithm and software developed in 'C' language for training single layer and multilayer feedforward ANNs. The list of references is given at the end.

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