CHAPTER - 8

CONCLUSION

APPLICATION OF NEURAL NETWORKS IN INVESTMENT MANAGEMENT
8.0 CONCLUSION

In the study, investment decisions were taken using signal generated from a Neural Network model. The model is tested on a number of daily data series and most of the tested series recorded positive profit. The profitability is compared using “Buy and Hold” strategy and found performance of the Neural Network based trading model is generally better than Buy and Hold strategy.

To supplement above findings additional tests were carried out using monthly data of 24 more financial series for the period March 1996 to March 2002. Similar methodology as applied to daily data analysis is used in these additional tests. The results of these additional tests are in line with the findings of the study using daily data.

In an efficient market, as per “weak form” of Efficient Market Hypothesis, it is not possible to earn positive profit using past price data. But the Neural Network model used in the study has shown chances of making positive trading profit using price data alone. The results may be suggestive of some “inefficiency” and of the adequacy of Neural Network model to detect these.

Although Neural Network approaches were successful, there are a number of issues that need further investigation.

- **Network Architecture**: The work in the study used a simple multilayer network with one hidden layer. It may be checked whether performance improves with more hidden layers and more nodes in hidden layer.

- **Inputs**: Although the precise form of the features input to a Neural Network is not very crucial, considerable improvement in accuracy can be achieved by using inputs that content more relevant information pertaining to output. We have only used moving averages as inputs as a number of studies have documented usefulness of moving averages (in various forms and combinations). There are
many other indicators both Technical analysis indicators and Fundamental analysis ratios that are widely used in investment decisions. Inclusion of some of these as input to the network may improve the accuracy of Neural Network output.

- **Online training:** The work in the study is built on a single model that is fixed and evaluated on past data. The data set is divided into blocks of 100 days. To keep training period and forecasting period separate, the weights obtained from block as a result of training is used in the next block. Thus results were applicable to out of sample data. However the choice of 100 days as block period is arbitrary, chosen for ease of calculations. A better approach would be to calculate weights online after receipt of each period’s data. This will enable tracking changes of underlying system on daily basis.

- **Dead Data:** All the training and testing of the model was carried out on “dead” data; using a real time system may present a number of additional problem. The transactions in the study are carried out at closing prices but carrying out transaction exactly at closing prices may not always be possible. Transactions at intra-day prices are not tested in the study.

Neural Network model can generate better investment decision, if there is ‘some’ predictability in the data series. No forecasts are possible if data series exhibit pure ‘random walk’. When tested using a simulated random series, profitability is found negative after transaction cost.

Neural Networks are supposed to “learn” relationships from past data and exhibit some capability for generalisation beyond the training data. These characteristics of neural network can be effectively used while taking investment decisions.
Neural Network technology is an emerging area of artificial intelligence with growing application in diverse fields. This approach is particularly suitable for investment management where much is assumed and little is known about the nature of the processes determining asset prices.