Chapter 7

Conclusions and Future Scope

7.1 Conclusions

Finally, we conclude the findings of the present research work. In this thesis, we have examined different techniques to forecast the Indian stock market index using Adaptive Neuro Fuzzy Inference System (ANFIS) and designed a portfolio method for stock market investors with the help of linear programming. To search for efficient and new input variables, we collected monthly stock data from different aspects of Indian stock market index Bombay Stock Exchange (BSE30) and National Stock Exchange (NSE). The more natural groups of data were formed with the help of clustering technique, we have used Fuzzy C-Means (FCM) and subtractive clustering. When the data was vast and complex, we reduced the dimensions of data with the help of techniques such as Principal Component Analysis (PCA) and Ordered Weighted Averaging (OWA) operator. To check the validity of proposed models, the results were compared with existing methods in the literature. The empirical results have shown that the proposed models can successfully forecast the returns of the stock market.

For portfolio construction, we studied the financial performance of companies listed on BSE30. Financial ratios have the ability to explain how well a business is performing. So financial ratios were used to analyze the behavior of enterprises. A rule-based fuzzy expert system has been proposed to support investors and portfolio managers in their investment decisions. Then, based on preferences of investors, we
recommended a portfolio model with the help of linear programming technique. We have compared the results with benchmark index of BSE30 to check the validity of proposed portfolio technique, and results have shown that this method can help investors in their investment decisions. From the presented analysis, the following observations are made:

- ANFIS uses the combination of gradient descent and least square method to optimize the parameters of the membership functions, so it quickly adopts the past trends of the stock prices and gives better forecasting when the trends are very fluctuating.

- Artificial neural networks define fuzzy relationships, so there is no need to use complex fuzzy group relationship tables or complicated matrix operations, which helps to reduce the computational complexity.

- These soft computing techniques provide a solid foundation in solving complex nonlinear problems.

- Power of decision making can be extended with the use of minimal variability OWA operator, as they can adjust the weights according to the situation of the decision maker.

- It can also be concluded that this study is quite suitable, and provides more accurate modeling solution in comparison to other forecasting techniques.

### 7.2 Future Work

To improve the performance of prediction modeling and portfolio designing, it is important to research further aspects of the stock market. Specifically, future research work can be extended in following directions:

- For the better understanding of data, pre-process it (i.e., noisy data filtering) with the help of statistical techniques.

- Use other technique with optimization functions for clustering to get more accurate clustering results.
• Optimize the parameters of the ANFIS using genetic algorithms for better forecasting results.

• In this thesis, MPT has been used in designing of a portfolio. A Further area of research is to extend the MPT structure using other factors.

• The portfolio is designed for risk averse and risk-prone investors. This can be extended to risk neutral investors.

• The results of the portfolio in this thesis is based on the stock market, but there is lots of scope for future research to recommend portfolio using other assets. This will provide diversification and reduce the risk of investment.