Abstract

Stock market prediction and portfolio optimization are two important building blocks of the financial sector. Financial sector plays a very crucial role in the well-being and economy of developed countries having the highly privatized economy. It also helps to reduce the vulnerability, risk and enhance the ability of people to access basic amenities, such as education, food and health easily, hence affects poverty reduction positively. In recent years, the rapid growth in cross-border international portfolio investments reflects the globalization of financial markets. Stock market forecasting helps to design better portfolios for investment managers, individual investors, institutional investors and much more who invests their money in stocks. Stock Market prediction and portfolio designing research offers many opportunities and challenges.

The main aim of this thesis is to predict the Indian stock markets and then recommend a portfolio optimization method with the help of soft computing and mathematical techniques. The work of this thesis is divided into six chapters. The highlights of each chapter are given as follows:

Chapter 1 and 2 are the introductory chapters. A brief account of the related studies carried out by various authors in the field is presented in chapter 1. In chapter 2, we have included some of the key theories and methodologies relevant to the thesis. The material presented in this chapter are mostly standard definitions and results obtained from the literature.

Chapter 3 investigates the predictability of stock markets BSE30, Hang Sang China Stock Index (HS), Japan Stock Index (NIKKEI) and Taiwan Weighted Index (TWI) using ANFIS combined with subtractive clustering technique. In this process, we compare stock markets with variable numbers of data clusters. Optimized subtractive clustering is used to cluster the data and create fuzzy membership functions. Finally, a hybrid learning algorithm has been used to combine least square method and back propagation gradient descent method for training the fuzzy inference system.

Chapter 4 deals with the choice of predictive variables in stock market prediction. We have used financial sectors as predictive variables. Regression analysis has been
employed for the selection of sensitive variables and then dimensions of data have been reduced by using principal component analysis. After the selection of input variables, a hybrid model is proposed in which fuzzy c-means (FCM) clustering method and adaptive neuro-fuzzy inference system are used for fuzzification and for defining fuzzy relations. For the evaluation purpose, the proposed model is compared with existing models. The results have shown that the proposed model gives a satisfactory prediction of the stock market index.

In chapter 5, an attempt has been made to aggregate high dimensional data into one useful forecasting factor. Higher dimensional data can not be easily processed by existing forecasting models because the model will become more complex with the increase of data dimensions. So to tackle this issue, a minimal variability OWA operator has been used to aggregate values of high dimensional data into a single attribute. After that two algorithms have been proposed. In the first algorithm, a hybrid network based fuzzy inference system combined with subtractive clustering is used to forecast BSE30. In the second algorithm, fuzzy inference system combined with fuzzy c-means clustering is used to forecast BSE30. Further, the proposed models have been compared with some existing models. Results have shown that proposed models give better forecasting than existing models.

The goal of chapter 6 is to help fund managers, investors, portfolio managers and stock market traders in taking their decisions by providing them the investment knowledge for maximizing profit while minimizing risk. We have used financial ratios for the construction of the portfolio. Firstly, more efficient ratios are selected by applying a clustering technique, then a rule-based fuzzy expert system is developed to rank the stocks and finally, a linear programming model is developed to design a portfolio for investors. The proposed model has been evaluated using two data sets of BSE30. One data set has been taken from recession period and one from growing market. The results have been tested with the benchmark index of BSE30 and compared with another existing approach in literature. It is observed that the proposed expert system gives relatively better results over some existing methods for portfolio design.