CHAPTER 1

INTRODUCTION

1.1 Preamble
Trading profitably in stocks consistently is a challenging task. It has been the belief that becoming a successful trader requires expertise gained from years of experience and a capability to spot the underlying trends from stock price movements. This makes it exceedingly difficult for a layman to trade profitably in stocks as he/she neither has the skills nor the experience. Recommender systems that can assume the role of the ‘expert’ and recommend when to buy/sell stocks can potentially help a layman generate returns through stock trading which are higher than that obtained through other forms of investments such as fixed deposits, bonds etc. The incorporation of expert knowledge into the stock trading recommender systems is one of the major issues that need to be addressed while designing such systems. An attempt has been made in this study to explore novel approaches to integrating expert knowledge into a stock trading recommender system and address some of the issues involved in designing such systems.

From the survey of literature on the subject over the past century starting with (Cowles, 1933), considering over a hundred different articles (presented in chapter 2), it is observed that stock trading recommender systems can be broadly classified into three categories. First category of recommender systems rely on fundamental analysis, ie. on utilization of macroeconomic data such as the money supply and industrial production etc. and stock specific data such as the P/E ratio, P/D ratio, dividend yields etc. in order to identify undervalued and overvalued stocks. Indicators from National Bureau of Economic Research (NBER) were also employed for the purpose by earlier systems, as seen in (Lempert, 1961) and (Umstead, 1977). However, the efficacy of such systems is significantly dependent on the knowledge of the system designer. It is also observed that these techniques are suitable for trading in stocks over a long time horizon of several months or years and hence might not be suitable for investors interested in short-term profits. The second category of stock recommender systems employs technical analysis to identify underlying trends in financial data and/or forecast the future values. These identified trends and the forecasts obtained are then used to formulate stock trading rules. The advantage such systems offer is that trades can be carried out over a much shorter span, of the order of a week or even on
a daily basis. However, large numbers of technical indicators exist. Selecting the optimal set of technical indicators and identification of the optimal technical indicator parameters under the given market conditions is a challenging task. Typically, traders relying on technical analysis for trading tend to select from their experience, a combination of technical indicators under the given market conditions using which they obtain the trading rules. The parameter selection of each technical indicator has also been traditionally, subjective in nature.

Third category of recommender systems is more recent in its origin and employs soft computing techniques to ‘learn’ patterns from the historical stock price data and use this ‘knowledge’ to forecast future prices or offer trading recommendations. It is observed from the literature survey that soft computing based techniques tend to outperform the traditional techniques. Hence, only soft computing based techniques are considered in the present study.

1.2 Research Objectives
This research work focuses on study of different approaches towards building soft computing based stock trading recommender systems. The research objectives are stated as follows:

(a) Identify the major issues in the design of recommender systems for generating stock trading recommendations from a detailed survey of literature generated over the past century in the field of financial engineering.

(b) Explore possible solutions to the identified issues using four different soft computing based approaches: time series forecasting, clustering, classification and temporal association rule mining; resulting in the development of soft computing based stock trading recommender systems which can consistently outperform the conventional buy and hold (B&H) strategy.

1.3 Outline of the Thesis

The thesis is organized to address the objectives as stated above. Chapter 2 presents a short survey of literature, with over a hundred articles being considered, with main focus being on the application of AI techniques. An attempt has been made in chapter 2 to analyze the literature with focus on following major aspects: end application of the forecasting task (price or index value forecasting, predicting buy/sell points, forecasting the movement direction of stock/index, etc.), selected target (particular indices/stocks considered along with the respective time frames), the
forecasting technique selected (statistical techniques, signal processing, AI techniques etc.), the
input features selected (daily returns, P/E ratio etc.) and the results reported. Limitations of the
technique/system presented in each surveyed article, as revealed in the study, are also presented.

In Chapter 3, a novel time series forecasting based stock trading recommender system
incorporating a novel technique for selection of the input data to obtain improved forecasting
performance from soft computing based forecasting systems is presented.

A novel approach towards design of stock trading recommender systems by incorporating
concepts from chaos theory and clustering techniques is presented in chapter 4.

An alternate and novel approach to designing a one-day-ahead stock trading recommender
system by transforming the issue of generating trading recommendations, typically viewed as a
time-series forecasting problem, into a classification problem, is presented in chapter 5.

In Chapter 6, a novel temporal association rule mining based recommender system which can
mine temporal association rules from the stock price time series and generate trading
recommendations, is presented. The conclusions and possible future work are presented in the
last chapter (Chapter 7).