A Type-2 Fuzzy Model for Stock Market Analysis

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Abstract—In this paper, a type-2 Fuzzy Rule Based Expert System is developed for analysing the stock markets. Interval type-2 fuzzy logic system permits us to model rule uncertainties and every membership value of an element is interval itself. The proposed type-2 fuzzy model applies the technical and fundamental indexes as the input variables. The fuzzy rule based model is tested on the stock market of an automotive manufactory in Asia. The proposed model can forecast the stock price variation. This can help the investors the select the best portfolio.

I. INTRODUCTION

Two common analytical approaches to stock market analysis are fundamental and technical analysis. A fundamental analysis relies on the statistics of the macroeconomics data such as interest rates, money supply, inflationary rates, and foreign exchange rates, as well as the basic financial status of a company. After taking all these factors into account, the analyst can then make a decision to sell or buy a stock. A technical analysis is based on the historical financial time-series data. However, financial time series exhibit quite complicated patterns (for example, trends, abrupt changes, and volatility clustering) and such series are often nonstationary, whereby a variable has no clear tendency to move to a fixed value or a linear trend.

During the last decade, stocks and future traders have come to rely upon various types of intelligent systems to make trading decisions. Lately, Artificial Neural Networks (ANNs) have been applied to this area (Aiken and Basit, 1999; Chang, et al. 2004; Chi, et al. 1999; Kimoto and Asakawa, 1990; Lee, 2001; Yao and Poh, 1995; Yoon and Swales, 1991). These models, however, have their own limitations owing to the tremendous noise and complex dimensionality of stock price data and besides, the quantity of data itself and the input variables may also interfere with each other. Therefore, the result may not be convincing.

Other soft computing methods are also applied in the prediction of stock price. These approaches are to use quantitative inputs, like technical indices, and qualitative factors, like political effects, to automate stock market forecasting and trend analysis. Kuo, et al. (2001) used a genetic algorithm based Fuzzy Neural Network to measure the qualitative effects on the stock price. They applied their system to the Taiwan stock market. Aiken and Basit (1999) used a FNN trained by a Genetic Algorithm (GA) to forecast three-month US Treasury Bill rates. They concluded that a Neural Network (NN) can be used to accurately predict these rates. Thammano (1999) used a neuro-fuzzy model to predict future values of Thailand's largest government-owned bank. The inputs of the model are the closing prices for the current and prior three months, and the profitability ratios. The output of the model was the stock prices for the following three months. Baba et al. (2000) used NNs and GAs to construct an intelligent decision support system (DSS) for analyzing the Tokyo Stock Exchange Prices Indexes (TOPIX). The essential feature of their DSS is that it can project the high and low TOPIX values four weeks into the future and suggest buy and sell decisions based upon the average projected value and the current-value of the TOPIX. Kim and Han (2000) used a NN modified by a GA to predict the stock price index. In this instance, the GA was used to reduce the complexity of the feature space, by optimizing the thresholds for feature discretization, and to optimize the connection weights between layers. They concluded that the GA approach outperforms the conventional models.

Abraham et al. (2001) investigated hybridized soft computing techniques for automated stock market forecasting and trend analysis. They used principal component analysis to preprocess the input data, a NN for one-day-ahead stock forecasting, and a neuro-fuzzy system for analyzing the trend of the predicted stock values. Abraham et al. (2003) investigated how the seemingly chaotic behavior of stock markets could be well represented using several connectionist paradigms and soft computing techniques. To demonstrate the proposed technique, they analyzed the 7 year’s Nasdaq-100 main index and 4 year’s NIFTY index values. They concluded that all the connectionist paradigms considered could represent the stock indices behavior very accurately.

Chang et al. (2006) developed a hybrid model by integrating Self Organization Map (SOM) neural network, Genetic Algorithms (GA), and Fuzzy Rule Base (FRB) to forecast the future sales of a printed circuit board factory. Chang and Wang (2006) combined fuzzy theory and back-propagation network into a hybrid system, which can be applied in the sales forecasting of Printed Circuit Board (PCB) industries. Chang and Liu (2006) developed Takagi-Sugeno-Kang (TSK) type fuzzy rule based system for stock price prediction. Their TSK fuzzy model applied the technical index as input variables and consequent part is a linear combination of the input variables. The fuzzy rule based model is tested on the Taiwan Electronic Shares from the Taiwan Stock Exchange.