SOM BASED STOCK INDEX PERFORMS BETTER THAN NSE-50 INDEX

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ABSTRACT

It is always a difficult task to select stocks that are suitable for a portfolio. The main aim of every investor is to earn maximum possible returns on investment. There are many criteria behind picking stocks like, price-earnings ratio, price book ratio, price sales ratio, price cash flow ratio, and market capitalization. The main issue with any approaches is the proper weighting of criteria to obtain a list of stocks that are suitable for a portfolio. This paper proposes an improved method for stock picking using self-organizing maps. The best of the portfolio constructed by self-organizing maps outperformed the NSE-50 Index by about 14.88% based on one and half month of stock data.

Keywords: *Neural Network, Stocks Classification, Technical Analysis, Fundamental Analysis, Self Organizing Map (SOM), Portfolio.*

1. INTRODUCTION

Selection of stocks that are suitable for a portfolio is a challenging task. Technical Analysis [1] provides a framework for studying investor behavior, and generally focuses only on price and volume data. Technical Analysis using this approach has short-term investment horizons, and access to only price and exchange data. Fundamental analysis involves analysis of a company's performance and profitability to determine its share price. By studying the overall economic conditions, the company's competition, and other factors, it is possible to determine expected returns and the intrinsic value of shares. This type of analysis assumes that a share's current (and future) price depends on its intrinsic value and anticipated return on investment. As new information is released pertaining to the company's status, the expected return on the company's shares will change, which affects the stock price. So the advantages of fundamental analysis are its ability to predict changes before they show up on the charts. Growth prospects are related to the current economic environment. Stocks have been selected by us on the bases of fundamental analysis criteria. These criteria are evaluated for each stock and compared in order to
obtain a list of stocks that are suitable for our portfolio. Stocks are selected by applying one common criteria on the stocks listed on Indian National Stock Exchange (NSE). The purpose of this paper is to develop a method of classification of selected stocks in to fixed number of classes by Self Organizing map. Each of the class is having its own properties; stocks having properties closer to a particular class get assigned to it

2. STOCKS CLASSIFICATION

Stocks are often classified based on the type of company it is, the company's value, or in some cases the level of return that is expected from the company. Some companies grow faster than others, while some have reached what they perceive as their peak and don't think they can handle more growth. In some cases, management just might be content with the level of business that they've achieved, thus stalling to make moves to gain further business. Before investing in a particular company, it is very important to get to know the company on a personal level and find out what the company's goals and objectives are for the short and long term. In order to prosper in the world of stock investing, a person must have a clear understanding of what they are doing, or they shouldn't be doing it at all. Stocks can be a very risky investment, depending on the level of knowledge held by the person(s) making the investment decisions. Below is a list of classifications which are generally known to us- Growth Stocks, Value Stocks, Large Cap Stocks, Mid Cap Stocks, and Small Cap Stocks. Stocks are usually classified according to their characteristics. Some are classified according to their growth potential in the long run and the others as per their current valuations. Similarly, stocks can also be classified according to their market capitalization. The classifications are not rigid and no rules are laid down anywhere for their classification. We classified stocks by taking in account the Shareholding Pattern, P/E Ratio, Dividend Yield, Price/Book Value Ratio, Return on Net worth (RONW), Annual growth in Sales, Annual growth in Reported Profit After Tax, Return on Capital Employed (ROCE) and Adjusted Profit After Tax Margin (APATM) with Self Organizing Map.

3. APPLICATION OF NEURAL NETWORKS IN STOCKS

3.1 overview

The ability of neural networks to discover nonlinear relationships [3] in input data makes them ideal for modeling nonlinear dynamic systems such as the stock market. Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A neural network method can enhance an investor's forecasting ability [4]. Neural networks are also gaining popularity in forecasting market variables [5]. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyze. This expert can then be used to provide projections given new situations of interest and answer "what if" questions. Traditionally forecasting research and practice had been dominated by statistical methods but results were insufficient in prediction accuracy [6]. Monica et al’s work [7] supported the potential of NNs for forecasting and prediction. Asif Ullah Khan et al [8] used the back propagation neural networks with different number of hidden layers to analyze the prediction of the buy/sell. Neural networks using back propagation algorithms having one hidden layer give more accurate results in comparison to two, three, four and five hidden layers.

3.2 kohonen self-organizing map

Self-organizing maps (SOM) belong to a general class of neural network methods, which are nonlinear regression techniques that can be applied to find relationships between inputs and outputs or organize data so as to disclose so far unknown patterns or structures. It is an excellent tool in exploratory phase of data mining [9]. It is widely used in application to the analysis of financial information [10]. The results of the study indicate that self-organizing maps can be feasible tools for classification of large amounts of financial data [11]. The Self-Organizing Map, SOM, has established its position as a widely applied tool in data-analysis and visualization of high-dimensional data. Within other statistical methods the SOM has no close counterpart, and thus it provides a complementary view to the data. The SOM is, however, the most widely used method in this category, because it provides some notable advantages over the alternatives. These include, ease of use, especially for inexperienced users, and very intuitive display of the data projected on to a regular two-dimensional slab, as on a sheet of a paper. The main potential of the SOM is in exploratory data analysis, which differs from standard statistical data analysis in that there are no presumed set of hypotheses that are validated in the analysis. Instead, the hypotheses are generated from the data in the data-driven exploratory phase and validated in the confirmatory phase. There are some problems where the exploratory phase may be sufficient alone, such as visualization of data without more quantitative statistical inference upon it. In practical data analysis problems the most common task is to search for dependencies between variables. In such a problem, SOM can be used for getting insight to the data and for the initial search of potential dependencies. In general the findings need to be validated with more classical methods, in order to assess the confidence of the conclusions and to reject those that are not statistically significant. In this contribution we discuss the use of the SOM in searching for dependencies in the data. First we normalize the selected parameters and then we initialize the SOM network. We then train SOM to give the maximum likelihood estimate, so that we can associate a particular stock with a particular node in the classification layer. The self-organizing networks assume a topological structure among the cluster units [2]. There are m cluster units, arranged in a one or two dimensional array: the input signals are n-dimensional. Fig. 1 shows architecture of self-organizing network (SOM), which consists of input layer, and Kohonen or clustering layer.

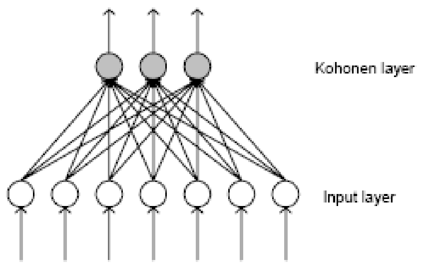

Figure1. Architecture of Kohonen self-organizing map

The shadowed units in the Figure. 1 are processing units. SOM network may cluster the data into N number of classes. When a self-organizing network is used, an input vector is presented at each step. These vectors constitute the "environment" of the network. Each new input produces an adaptation of the parameters. If such modifications are correctly controlled, the network can build a kind of internal representation of the environment.

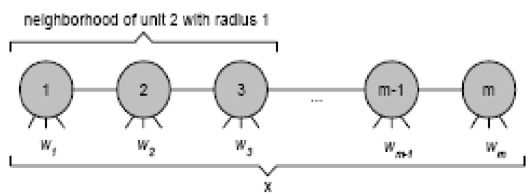

Figure 2. A one-dimensional lattice of computing units.

The n-dimensional weight vectors w_1, w_2,…,w_m are used for the computation. The objective of the clustering for each unit is to learn the specialized pattern present on different regions of input space as shown in Figure. 2. When an input from such a region is fed into the network, the corresponding unit should compute the maximum excitation. SOM may distinctly reduce misclassification errors [12]. Kohonen's learning algorithm is used to guarantee that this effect is achieved. A Kohonen unit computes the Euclidian distance between an input x and its weight vector w. The complete description of Kohonen learning algorithm can be found in [2] and [3].

4. STOCK MARKET INDEX

A stock market index is a method of measuring a stock market as a whole. Stock market indexes may be classed in many ways. A *broad-base* index represents the performance of a whole stock market — and by proxy, reflects investor sentiment on the state of the economy. The most regularly quoted market indexes are broad-base indexes comprised of the stocks of large companies listed on a nation's largest stock exchanges, such as the American Dow Jones Industrial Average and S&P 500 Index, the British FTSE 100, the French CAC 40, the German DAX, the Japanese Nikkei 225, the Indian National Stock Exchange Index and the Hong Kong Hang Seng Index. Movements of the index should represent the returns obtained by "typical" portfolios in the country. Ups and downs in the index reflect the changing expectations of the stock market about future dividends of India's corporate sector. When the index goes up, it is because the stock market thinks that the prospective dividends in the future will be better than previously thought. When prospects of dividends in the future become pessimistic, the index drops.

4.1 composition of stock market index

The most important type of market index is the broad-market index, consisting of the large, liquid stocks of the country. In most countries, a single major index dominates benchmarking, index funds, index derivatives and research applications. In addition, more specialised indices often find interesting applications. In India, we have seen situations where a dedicated industry fund uses an industry index as a benchmark. In India, where clear categories of ownership groups exist, it becomes interesting to examine the performance of classes of companies sorted by ownership group. We compared NSE-50 Index with our portfolio. We choose NSE-50 Index for comparison because it is regarded to be the pulse of the Indian stock market. NSE-50 Index is a price index and hence reflects the returns one would earn if investment is made in the index portfolio.. It is calculated using the "Free-float Market Capitalization" methodology. As per this methodology, the level of index at any point of time reflects the free-float market value of 50 component stocks relative to a base period. The market capitalization of a company is determined by multiplying the price of its stock by the number of shares issued by the company. This market capitalization is further multiplied by the free-float factor to determine the free-float market capitalization. The calculation of NSE-50 Index involves dividing the Free-float market capitalization of 50 companies in the Index by a number called the Index Divisor. The Divisor is the only link to the original base period value of the NSE-50 Index. It keeps the Index comparable over time and is the adjustment point for all Index adjustments arising out of corporate actions, replacement of scrips etc. During market hours, prices of the Index scrips, at which latest trades are executed, are used by the trading system to calculate NSE-50 Index every 15 seconds and disseminated in real time.

NSE-50	ABB Ltd., ACC Ltd., Ambuja Cements Ltd., Bharat Heavy Electricals Ltd., Bharat Petroleum Corporation Ltd., Bharti Airtel Ltd., Cairn India Ltd., Cipla Ltd., DLF Ltd.,Dr. Reddy's Laboratories Ltd., GAIL (India) Ltd., Grasim Industries Ltd., HCL Technologies Ltd., HDFC Bank Ltd., Hero Honda Motors Ltd., Hindalco Industries Ltd., Hindustan Unilever Ltd., Housing Development Finance Corporation Ltd., ITC Ltd., ICICI Bank Ltd., Idea Cellular Ltd., Infosys Technologies Ltd., Larsen & Toubro Ltd., Mahindra & Mahindra Ltd., Maruti Suzuki India Ltd., NTPC Ltd., National Aluminium Co. Ltd., Oil & Natural Gas Corporation Ltd., Power Grid Corporation of India Ltd., Punjab National Bank, Ranbaxy Laboratories Ltd., Reliance Communications Ltd., Reliance Industries Ltd., Reliance Infrastructure Ltd., Reliance Petroleum Ltd., Satyam Computer Services Ltd., Siemens Ltd., State Bank of India, Steel Authority of India Ltd., Sterlite Industries (India) Ltd., Sun Pharmaceutical Industries Ltd., Suzlon Energy Ltd., Tata Communications Ltd., Tata Consultancy Services Ltd., Tata Motors Ltd., Tata Power Co. Ltd., Tata Steel Ltd., Unitech Ltd., Wipro Ltd., Zee Entertainment Enterprises Ltd,

Table 1: List of companies of NSE-50 Index

4.2 our portfolio formation

The companies belongs to above specified index are not necessarily always performs better than the companies which are not the part of the index. According to our approach our portfolio includes the companies belongs to the best class of our classification method by using SOM.

5. EXPERIMENTAL RESULTS

The system has been developed and tested on Windows XP operating system .We have used Visual Basic and Microsoft Access as front end and back end tool. Simulation data was sourced from Indian National Stock Exchange (NSE).From the 2007 compendium of Top 500 Companies in India we selected 100 companies as per their Shareholding Pattern, P/E Ratio, Dividend Yield, Price/Book Value Ratio, Return on Net Worth (RONW), Annual growth in Sales, Annual growth in Reported Profit After Tax, Return on Capital Employed (ROCE) and Adjusted Profit After Tax Margin (APATM), with these inputs SOM divides them into different classes. As the SOM are more relevant to the problem where stocks of different companies are to be compared on some common parameters and arranges in the form of different classes. Out of these classes we included stocks belonging to the best class in our portfolio to take maximum return on investment on 31/10/2007 data. After that we compare our portfolio return from 01/11/2007 to 14/12/2007 for the period of one and half month. We have found that our portfolio gives 14.88% more returns in comparison to NSE50 Index as shown in Figure. 3.

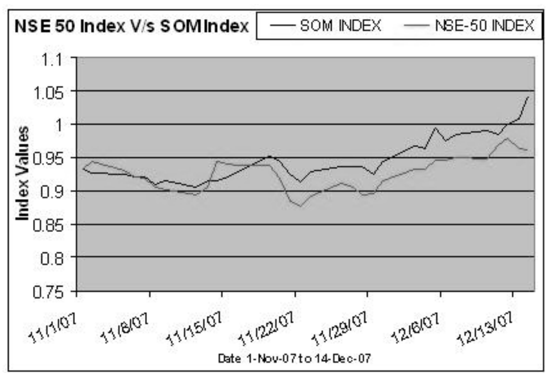

Figure 3. Comparison chart between NSE50 Index and SOM INDEX

6. CONCLUSION

This paper compares the performances of the stocks included in our portfolio through SOM classification with NSE-50 Index. The result shows that the performance of stocks belonging to the best class among the classes generated by SOM gives maximum returns on investment. Stocks belonging to our portfolio and NSE50 Index are compared on some common parameters and it has been found that the portfolio formed by SOM classification method gives 14.88% more returns in comparison to NSE50 Index

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