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Forecasting Stock Exchange Market and Weather Using Soft Computing

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Abstract— ***Recently forecasting stock market return is gaining more attention, maybe because of the fact that if the direction of the market is successfully predicted the investors may be better guided.Artificial neural networks (ANNs) are used for prediction of financial and macroeconomic time series. ANNs build internal models of the problem and are therefore suited for fields in which accurate mathematical models cannot be formed, e.g. meteorology and economics. The main objective of this paper is to study the use of soft computing in the field of Stock Exchange Market and meteorology. Artificial Neural Network with advanced back -propogation algorithm is used to forecast the daily stock market returns and weather condition in dehradun (U.K.).***

Keywords— Ariticial neural network, backpropogation, soft computing, forecasting

I. INTRODUCTION

A **stock market** is the market that people use to trade (= buy and sell) shares, which are like small pieces of the company that a person can own. The value of the share depends on how many people want to buy it and how many people are selling it.If many people want to buy a stock, the price will go up. If there are more sellers than buyers, the price will go down.People usually trade shares in stocks through a broker. A broker or stockbroker is a person who buys or sells stocks for their customers on the stock market. A broker can also help customers make good choices in stocks. Most brokers have recommendations for most of the stocks, based on the information about companies and what is expected from them. Brokers usually recommend customers to BUY, HOLD or SELL. In time series prediction the task is to forecast the next value (values) in a data set. There are several fields in which time series prediction is of central importance, e.g. meteorology, geology, finance, and macroeconomics. Typically in those fields, there exists no accurate models of the system, and therefore the series are studied from a phenomenological, model-free point of view. In the physical sciences, where models are common, the use of model-free time series prediction is less common. Artificial neural networks (ANNs) are often used for time series prediction because of their ability to build their own internal models. A common method is to train feed forward neural networks (FFNNs) with back propagation

II. BACKGROUND

There is a growing body of literature based on the comparison of neural network computing to traditional statistical methods of analysis [1]. In comprehensive view of neural networks and issues of their comparison to statistics and it also investigates the statistical aspects of neural networks [2]. Weiss et al, offer an account of the classification methods of many different neural and statistical models [3].

A. ANNs gained great popularity in the financial field for their ability to deal with uncertainty and handle noisy data [4]. Previous financial applications for ANN include, but are not limited to, risk assessment for mortgages and fixed investments, prediction of default and bankruptcy, portfolio selection, and economic forecasting [5]. The features of ANNs make it convenient to study stock market behaviors; however, although theoretically ANN can approximate any function, designing a good neural network through calibrating numerous parameters is a significant challenge. Therefore, a universal design does not exist, and different data require different designs. This creates a building process with a tedious trial and error nature [6].

B. ANNs are data-driven and self-adaptive because no assumptions have to be made about the problem before they are built; this makes them ideal for data that is complex and open to interpretation [4]. ANNs learn dynamically through training and then make educated guesses [7]. Theoretically, a correctly designed ANN is able to converge to any optimal result after being trained. ANNs are universal function estimators that can map any nonlinear function [8]. All these features make it very convenient to study stock market behaviors using ANNs.

C. In a theoretical sense, ANNs can approximate any function, but designing a good neural network and calibrating its parameters correctly is a serious challenge, as this is dependent on the specific data set used. Since different data need different designs, the building process can only be accomplished through a tedious trial and error process. Furthermore, given the large computer processing power and memory requirements for ANN training, the trial and error system is limited because researchers cannot attempt countless combinations. Finally, models are dynamically built during the training process of an ANN; therefore, they can be considered a black box that is only used but not

transparent. This makes studying the generated model, as well as analyzing why it made good or bad predictions, nearly impossible [9].

D. The main focus for the artificial neural network technology, in application to the financial and economic fields, has so far been data involving variables in non-linear relation. Many economists advocate the application of neural networks to different fields in economics [10]. According to *Granger* , non-linear relationships in financial and economic data are more likely to occur than linear relationships[9]. New tests based on neural network systems therefore have increased in popularity among economists. Several authors have examined the application of neural networks to financial markets, where the non-linear properties of financial data provide many difficulties for traditional methods of analysis.

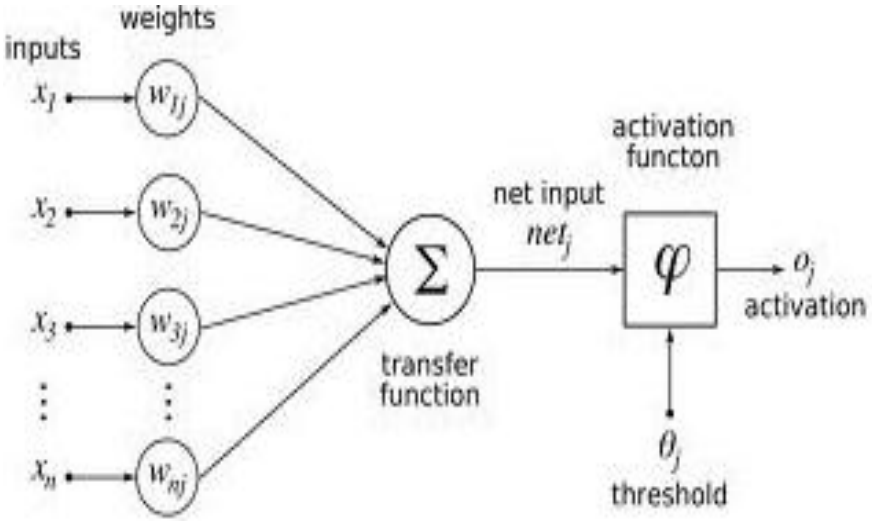

Fig 1: Artificial Neural Network

E. Different author compare neural networks to discriminate analysis with respect to prediction of stock price performance and find that the neural network is superior to discriminate analysis in its predictions. Neural network models perform better than discriminate analysis in predicting future assignments of risk ratings to bonds[8]. *Trippi et al,* apply a neural network system to model the trading of Standard and Poor 500 index futures. They find that the neural network system outperforms passive investment in the index. Based on the empirical results, they favor the implementation of neural network systems into the mainstream of financial decision making [8].

III. ARTIFICIAL NEURAL NETWORKS FORECASTING

Artificial neural networks (ANNs) are flexible computing frameworks and universal approximators that can be applied to a wide range of time series forecasting problems with a high degree of accuracy. However, despite all advantages cited for artificial neural networks, their performance for some real time series is not satisfactory [11]. Improving forecasting especially time series forecasting accuracy is an important yet often difficult task facing forecasters. Both theoretical and empirical findings have indicated that integration of different models can be an effective way of improving upon their predictive performance, especially when the models in the ensemble are quite different. In this paper, a novel hybrid model of artificial neural networks is proposed using different training algorithm in order to yield a more accurate forecasting model than artificial neural networks. As stated earlier, neural networks occupy a large area in financial applications and research. Specifically, stock market forecasting is a very active field of exploration. Researchers have published several works setting guidelines to building good ANNs. Notably, Kaastra and Boyd [12] discuss a step by step approach for the proper building of ANNs for forecasting financial and economic time series. They focus on all the important design parameters of back-propagation feed-forward networks and ways of configuring them starting from preprocessing of data, functions and methods to use, and network configurations to make. Similarly, Zhang et al [13] survey past practices and provide insights on ANN modeling issues.

ANNs with adaptive learning rate to predict long and short term returns. However, Yao et al [14] quote that most of the research material published lacks experimental data or does not use data from real world problems; furthermore, testing a single market or a short time period signifies little and does not provide a complete picture of the performance of ANNs. Finally, they conclude that multiple ANNs could be equally accurate in solving a problem and that building a model construction system to help build the proper ANNs would free researchers from a trial and error basis.

Moving to emerging markets‟ studies, Thenmozhi [15] uses a feed-forward network to forecast Bombay Stock Exchange Index (BSE SENSEX). Inputs to the network are four consecutive closing values and the output is the closing value of the fifth day. After conducting a sensitivity analysis, Thenmozhi concludes that the latest price is of highest importance. Likewise, Desai et al. [16] propose a similar model for forecasting the prices of S&P CNX Nifty 50 Index of India. The input to the ANN is the simple moving average (SMA) of the closing prices; this is after concluding that the SMA provides better results than raw prices. The researchers emphasize that ANNs can be very helpful in forecasting volatile markets of emerging countries. Correspondingly, other applications build similar ANNs for Tehran stock

exchange [17], where the exponential moving average is used as input and different learning algorithms are used for training, the Brazilian stock market [18], Kuwaiti stock exchange index [19], and S˜ao Paulo Stock Exchange [20].

Several research surveys were conducted regarding ANNs and financial forecasting. One such survey compares different applications in an effort to find the best topology for specific problems in financial time series [20]. It is observed that most applications use three layered ANNs, back-propagation, and sigmoid activation functions; however, no "recipe" can be found that relates methodology to topology.The paper concludes by stating that although some guidelines can be given for building ANNs, finding the best is still a matter of trial and error.

IV. PROPOSED WORK

The aim of this research was to investigate the significance of each ANN parameter on different market classifications, and check how their behavior was compared across different markets. This was tackled by following a systematic approach of experimentation.

In order to perform forecasting using soft computing following Steps are followed in the process:-

1. Data preprocessing.
2. Defining the ANN model.
3. Training of ANN.
4. Testing of data

Artificial intelligence prediction techniques have been receiving much attention lately in order to solve problems that are hardly solved by the use of traditional methods. They have been cited to have the ability to learn like humans, by accumulating knowledge through repetitive learning activities. Therefore the objective here is to propose new forecasting techniques via the artificial approaches. to manage demand in a fluctuating environment. In this study, a comparative analysis based on regression technique and ANFIS is presented for prediction of the movie performance in future.

(A). Design of Optimal Neural Network

For, finding the best ANN plan with the minimum error, ANN with neurons, layers and various learning was designed which were compared via their errors together. So that, number of neurons, optimal learning rate and optimal recursive learning, obtained as can be observed through figure 2.

Step1. At first recursive learning method fixed and changes the neurons of hidden layer. This step consists of two sequential steps. After that ANN with one hidden layer was assumed which results in finding number of optimal layers, following that the error and number of optimal neurons found.

Step2. In the second step by using the optimal number of layer and neurons foregoing step ,evaluated ANN performance for different rate of network training then in each test increase the rate of learning in proportion to before test and record these effects on error produced. Then compute the optimal learning rate.

Step3. Step 1 and 2 continues with different recursive learning to get the best learning plan of ANN.

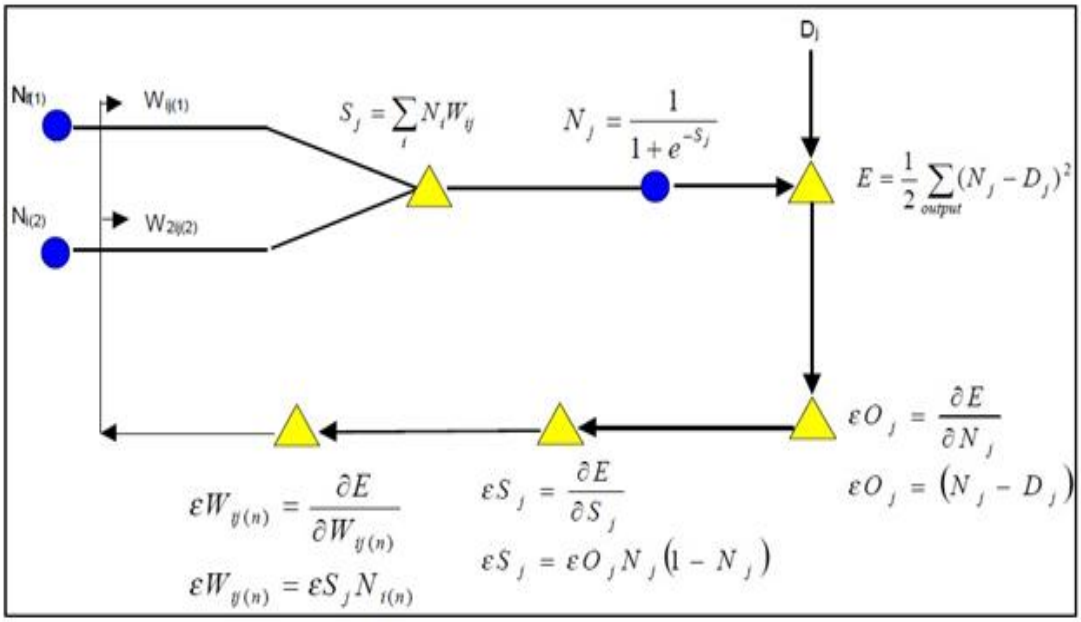

Figure 2 Artificial neural network with backpropogation

(B) Steps for forecasting

The model building process consists of four sequential steps:

1. Selection of the input and the output data for the supervised Advanced Back Propogation training algorithm.
2. Normalization of the input and the output data.
3. Training of the normalized data using advanced BP learning.

4. Testing the goodness of fit of the model.
5. Comparing the predicted output with the desired output

V. Forecasting Stock Exchange Market

The data that will be feed to neural network at the input represents historical data of the S&P500 and NASDAQ.In general terms, these are leading indicators of stock market activity, which have a common fluctuation pattern.Apply this data sets to our neural network model give better accuracy upto 80 %.

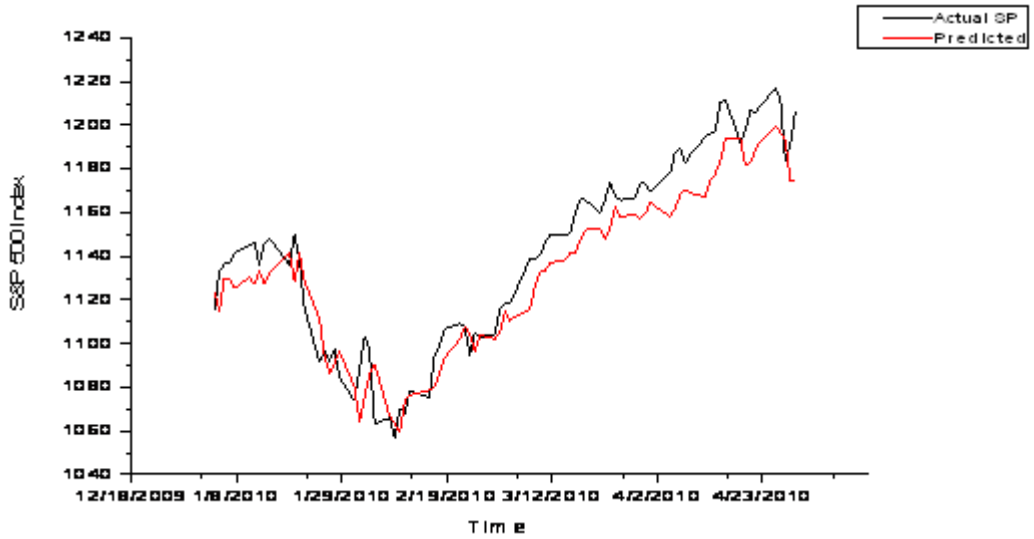

Figure 3 Comparison of actual S&P index with forecasting index

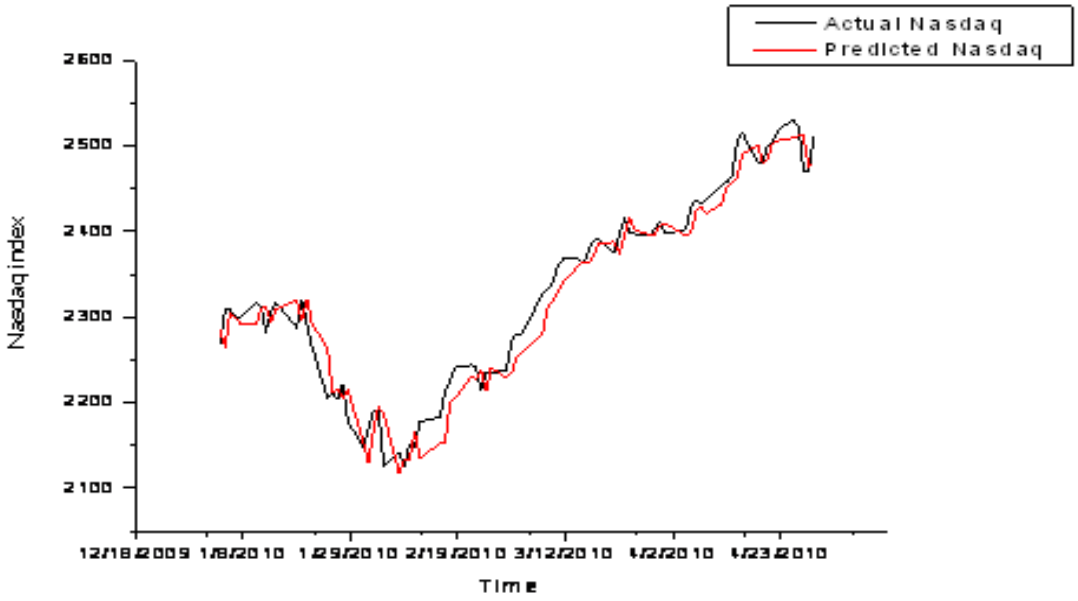

Figure 4 Comparison of actual Nasdaq index with forecasting index

As one can see, the network is able to interpolate the results in a fairly good manner. The error rate summed over the entire training session decreased to a value of ~0.008. Of course, you cannot consider this data as an input to your investment strategy, since past information does not really indicates future returns (a more granular approach should be developed as the fluctuations are dependent of many other strategically data), but for the academically purpose we can consider this as a good result.

VI. FORECASTING TEMPERATURE IN DEHARDUN

In this paper we have collected stock market exchange data sets and weather data set of Dehardun. In Dehradun, Uttrakhand, the months of April to November are identified as the rainfall season with May, June, July, August, and October as the main monsoon seasons. Thus the present study explores the data of these months from 1975 to 2002.The Input parameters are the average Humidity and the average Wind Speed, Average Temperature etc. The data stated above was retrieved from www.Indiastat.com and the IMD website. The unknown values were randomized keeping in mind the average value of the data.

The input and the output data obtained have to be normalized because they are of different units and otherwise there will be no correlation between the input and the output values. First the mean of all the data separately were taken for humidity, wind speed and rainfall.
Let the mean be M.

M= sum of all entries/number of entries

Then the standard deviation, SD, for each of these parameters individually were calculated. Now after having the values of mean and SD for every parameter, the values for each parameter were normalized

Normalized value = (x-M)/SD

After obtaining the normalized data, the next step is to train the input data with Backpropagation Algorith(BPA) and Advanced BPA. The proposed ANN model is basically a three layered ANN back propagation learning. The algorithm takes only 70 percent of the input data for training. For every attempt of training the data, the algorithm selects the training sample randomly from the whole set and not a fixed set of data and so every time you train the data, we get different values of mean square error (MSE) depending upon which 70 percent of the input data is chosen for training.

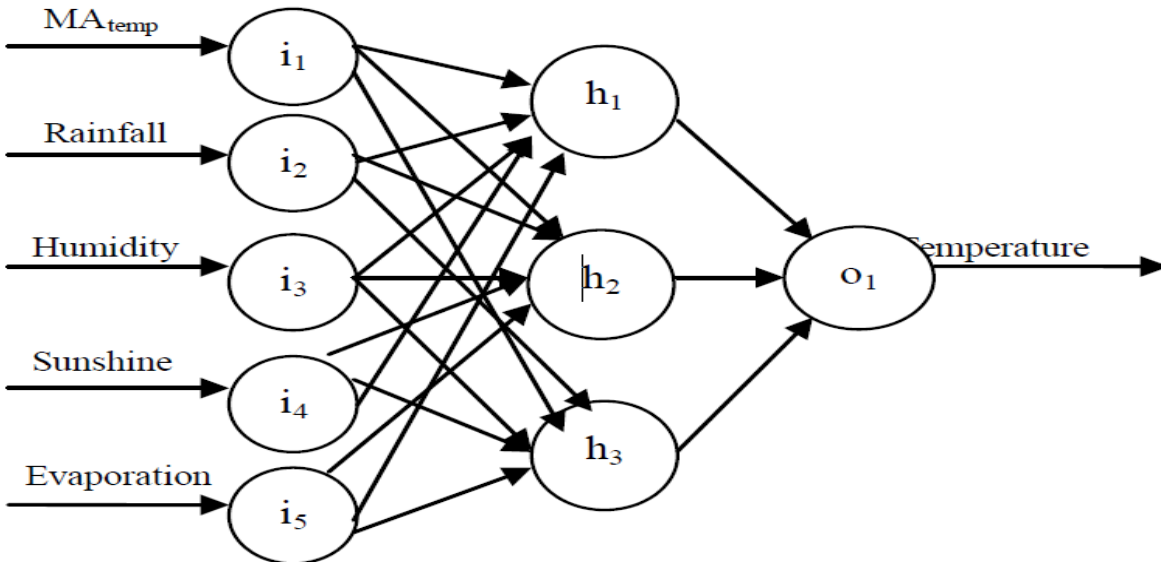

Figure 5 Neural Network Architecture for the Proposed Model.

Testing is done after the training of the data is complete and the error is below the tolerance levels. The BPA keeps 30 % of the input data for testing and validation. After the testing is done, the results are saved in the workspace and a graph is plotted between the actual output and the predicted output so that a comparison can be made. The graph is an efficient way of comparing the two types of data available with us. It can also be used to calculate the accuracy of the model.

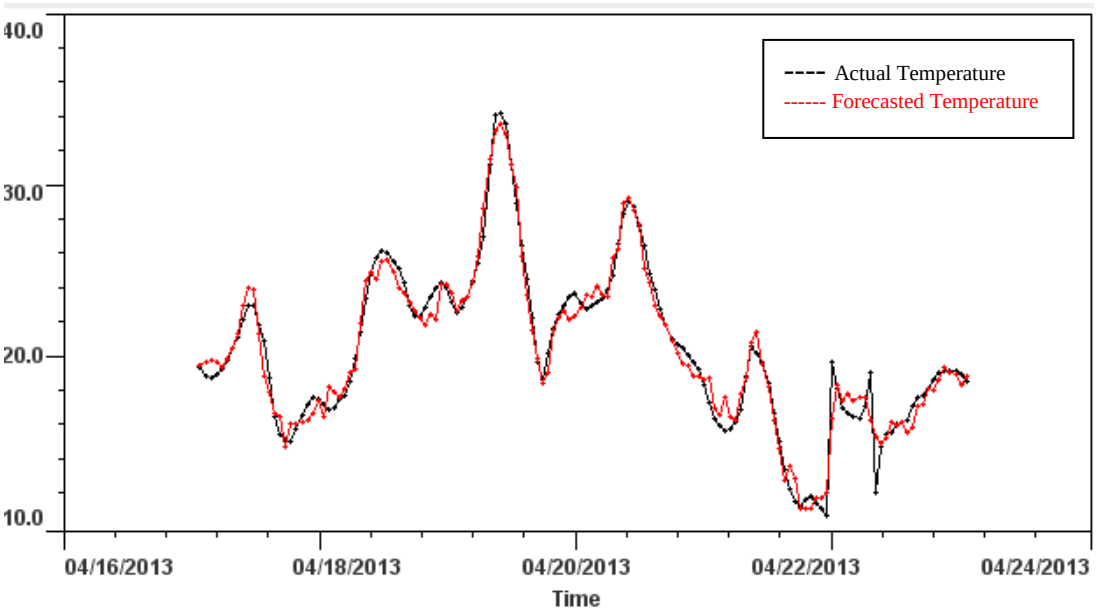

Figure 6 Actual temperature vs. Forecasted temperature

V. CONCLUSIONS

Artificial Neural Network offers qualitative methods for business, economic and medical systems that other traditional methods do not provide. In most cases Neural Network performs better in comparison to traditional methods. With the advancement of technology the Neural Network tools are designed with new an efficient algorithm which in turn increases its efficiency, scalability, effectiveness to predict, classify the unseen data. So, Neural network tools are becoming popular in field of Finance.This research focuses on the Advanced Backpropagation algorithm learning method .The Advanced Back propagation algorithm seeks to minimize the error term between the output of the neural net and the actual desired output value. The error term is calculated by comparing the net output to the desired output and is then feedback through the network causing the synaptic weights to be changed in an effort to minimize error. The process is repeated until the error reaches a minimum value

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