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Stock Market Prediction Using Artificial Neural Network

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Abstract :Stock price prediction is the act of forecasting the future value of a company stock. For forecasting in capital markets, there existdifferent methods like regression, time series and genetics algorithm.From non-liner methods which might be used in different forecasting bases are Artificial Neural Networks ANN.This paperimplements artificial neural network for the stock market prediction.Using historic data and various factors affecting stock values network is trained. Techniques such as Feedforward and Backpropagation are used to reduce the error in predictions.The aim of this paper is to provide a nonlinear prediction system for Stock Market.

Keywords: Artificial Neural Network;feedforward; backpropagation; stock market prediction;stock index.

1. Introduction

1.1. Stock Market

Predicting the behavior of a stock market has been a big challenge for researchers since many years. They combined various techniques in order to fulfill their goal to find a better moment to buy/sell a stock and to discover which will be the direction of a stock's trend.

There are two kinds of stock; shares and stocks. Both share and stock are issued by a company, which ennobles its holder to be company's one of holder. Company issue the shares through Initial Public Offering (IPO) or can be leverage from the stock market. Owning anequitymeans one can earn a part of the company's gain called dividend. Also, by purchasing and selling the equities, investor earns capital gain. Stock exchange is an organization which provides "trading" platform for stock brokers and traders, to buy and sell stocks and other securities, thus providing a marketplace.

An index is a statistical measure of the changes in the overall market. Indexshows the measuring the performance of a group of companies overall time period. The changesin the prices in a market or section of a market are captured in price indices called stock market indices, e.g., the SENSEX, the Nifty.

1.2.Natural Neural Network

Artificial NN draw much of their inspiration from the biological nervous system. The brain is connected by nerves to the sensors and actors in the rest of the body. The brain is consists of very large number of neurons, about 100 billion in an average. These can be seen as basic building bricks for the central nervous system[2]. The neurons are interconnected at points called synapses.

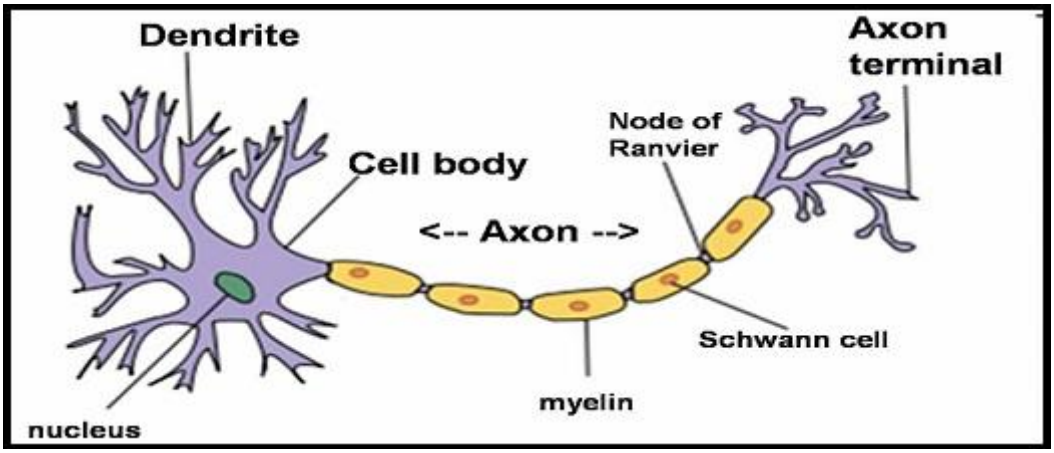

Figure 1. A sample of a natural neuron.

The neuron can be divided in three major parts: the cell body (soma), the dendrites, and the axon, see figure 1.

The cell body contains the organelles of the neuron and also the 'dendrites' are originating there. Dendrites are thin and widely branching fibers, reaching out in different directions to make connections to a larger number of cells within the cluster. Axon is a single and long fiber, which transports the output signal of the cell as electrical impulses along its length. There is only one axon per neuron.

At the dendrites each neuron receives electrochemical inputs from the other neuron. If the sum of these inputs has enough potential to activate the neuron, it transmits the electrochemical signal by the axon, and this signal is received by the other neurons of dendrites which are attached to any of axon terminals. This is the model on which Artificial Neural Networks are based [2].

1.3. Artificial Neural Network

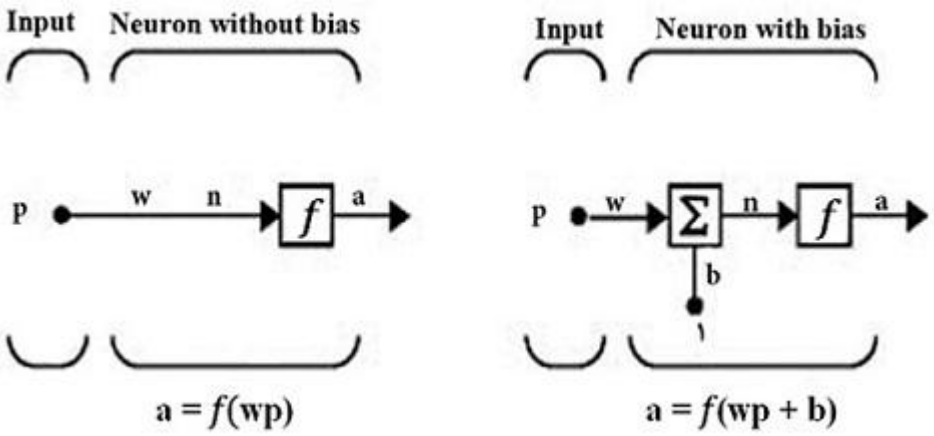

Figure 2. Mono – input neuron.

In figure, 2 the input scalar (P) is multiplied to scalar (w) weight and then is sent to the add up operator, the best input is (1) which is multiplied to deviance (b) and then is sent to add-up operator and the output add-up is (N) which is sent to mobile function of (F) to gain the output neuron of (a) finally, By comparing this network with the biological sample it can be concluded thatweight (w) is in accordance with synapses, the add-up operator is in accordance with body of the cell and the neuron output (a) is in accordance with Axon (Martin T. Hagan et al., 2002). Samples of neural networks are shown in figures 3 and 4.

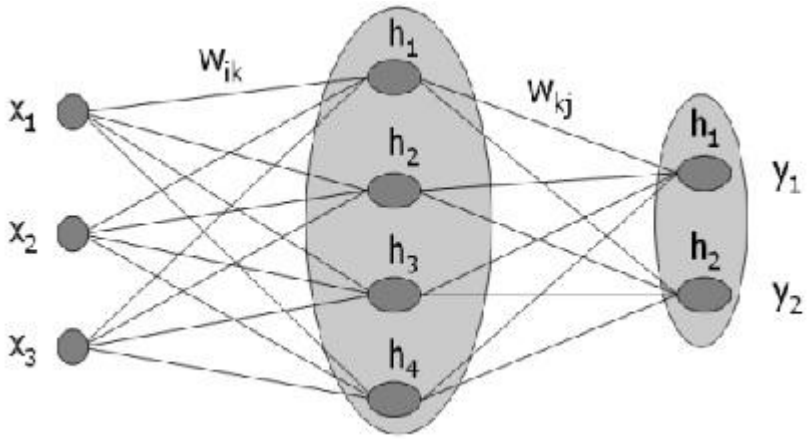

Figure 3. A sample of a neural network with 3 inputs and 2 outputs.

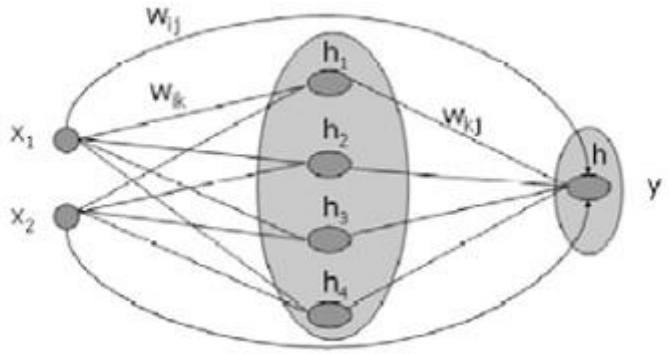

Figure 4. Another sample of a neural network.

2. Results and Discussion

2.1. Input Data

In input data the economic effects of these data on the shares of Iran khodro is discussed.

Table 1. Input information.

Input data	Name of the considered data from 1996 to 2004
X1	As the data of year
X2	The unemployment rate of youth
X3	The value of external basic materials used
X4	Ratio of educated-employed individuals to total employed individuals
X5	The number of industrial permits
X6	Ration of investment to added value
X7	Added value
X8	Production value of industrial workplaces
X9	Insured individuals by social security organization
X10	Income from oil and gas
X11	Liquidity
X12	Ration of investment to added-value
X13	The value of industrial work places export
X14	Value of trading (import)
X15	Value of trading (export except oil)
X16	Rate of American dollar
X17	Annual percentage of inflation
X18	Price of golden coin
X19	Number of international passengers enter the air port
X20	Number of construction permits issued by municipality
X21	Shortage of budget of government
X22	The index of goods price and services in use in urban zones of Iran

2.2. Output Data

Output data are those kinds of data which receive response as per the input data of the neural network.

2.3. Sampled Model of Neural Network

This model consists of 3 layers, the first layer includes 22 neurons, middle layer includes 9 neurons, and the output layer includes 4 neurons. This neural network starts to learn, considering the received inputs and data at the output, In this sampling the results repeat every 50 times and the rate of training is regulated on 0.005, the learning algorithm is regulated on TRAIN GD, in figure 7 an example of this sampling is presented by MATLAB software.

Table 2. Output information.

Output data	Name of the considered data from 1996 to 2004
Y1	The latest price if Iran Khodro shares
Y2	Changers in price of shares of Iran Khodro
Y3	The lowest Price of Iran Khodro shares
Y4	Higher Price of Iran Khodro shares

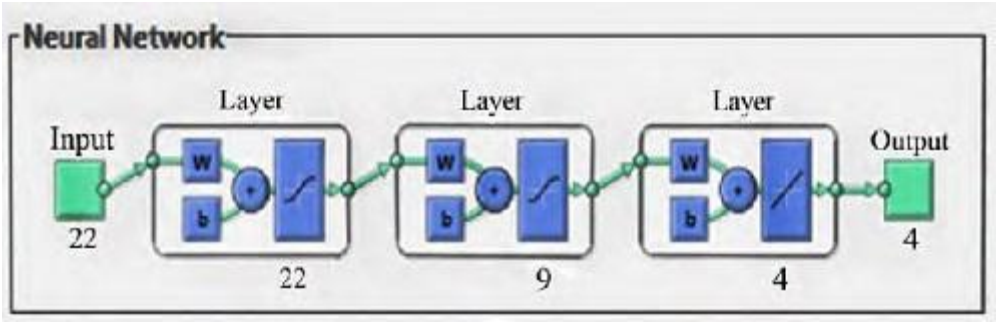

Figure 7. Sampled model of neural network.

2.4. Normalizing Input Data

To improve the function of network which usually takes place before the network training, data's are normalized. This is done to drive the features of data, in this sampling the following formula is used for normalizing data.

$$Xn=(X0 - X)/ S$$

Which Xn, X0, X, S are normalized data, original data, medium of data, deviation respectively.

2.5. Accuracy of Forecasting

To reach the accuracy of forecasting mean square of errors (MSE) is used.

$$MSE=\frac{\sum_{i=1}^{n} e_i^2}{n} \quad (1)$$

In this formula (1), n is the number of forecasting and errors, square of errors shows how much that the sampled neural network was successful in learning data and to what extent the output of network is close to reality. In figure 8, the more data are placed over each other shows that the neural network is trained better. In figure 9 we discussed an interval of figure 8 which shows the network training, figure 10 shows that the more data are close to line the network has passed training more successfully.

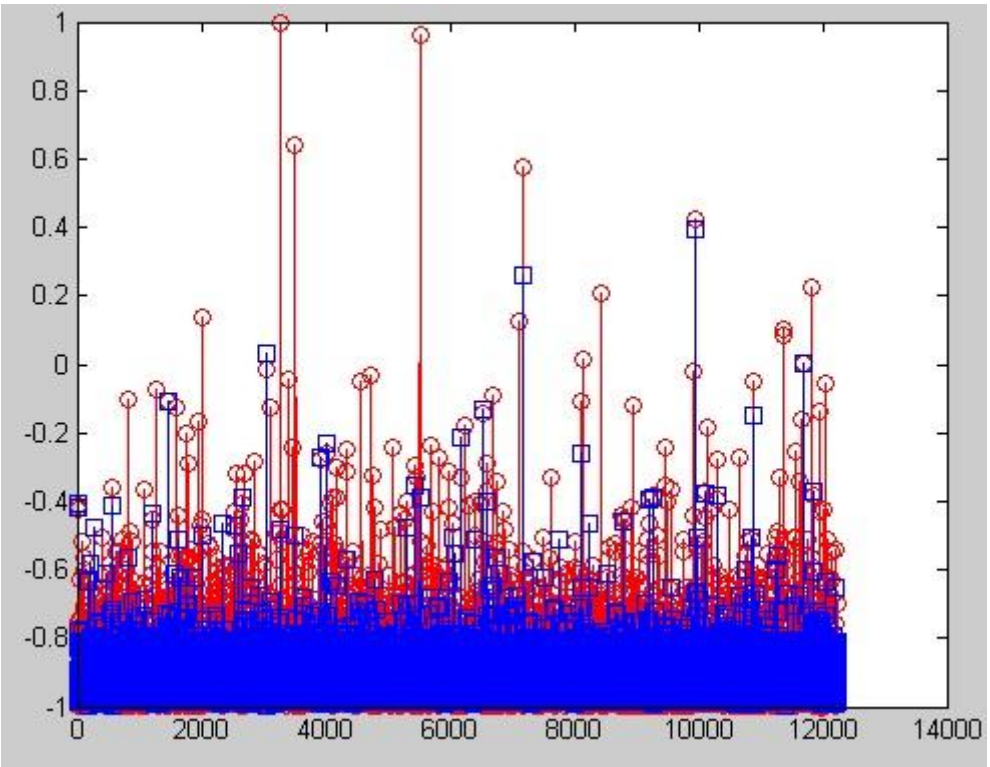

Figure 8. Trained data.

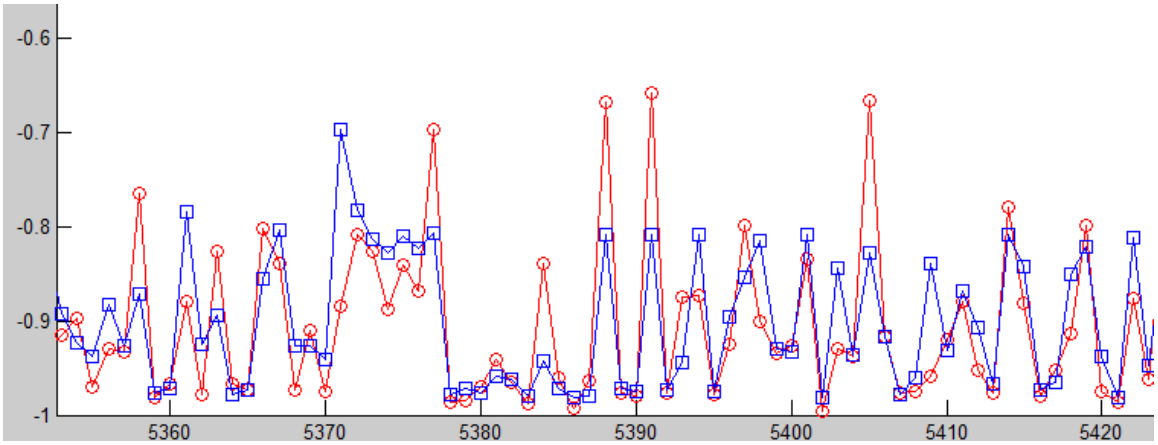

Figure 9. A part of trained data

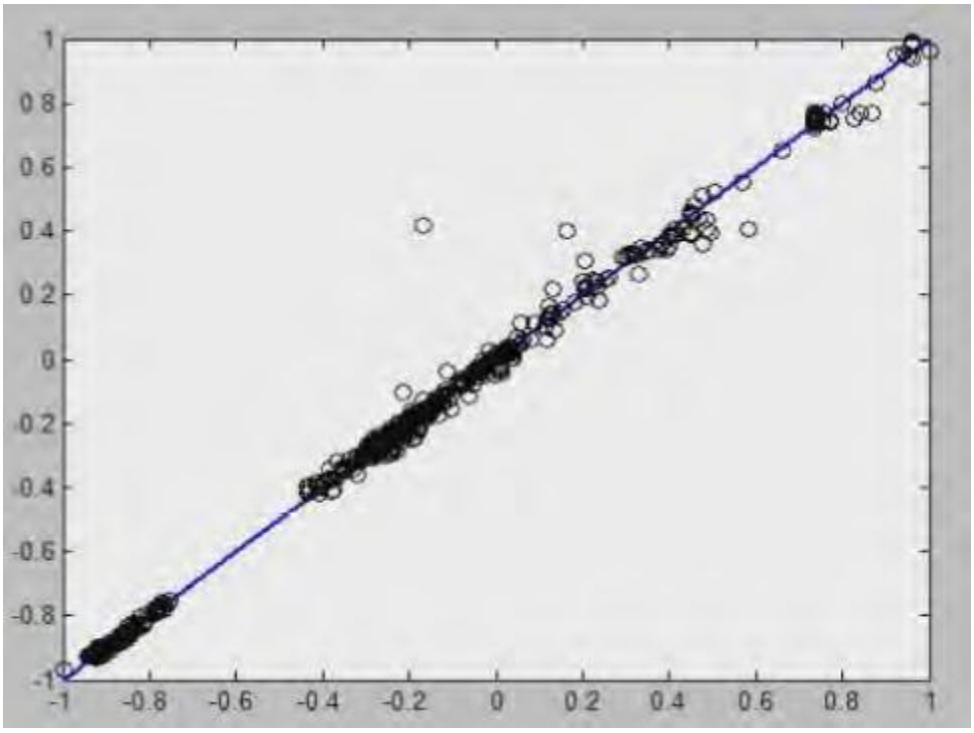

Figure 10. Another type of trained data.

3. Conclusion

With respect to the presented neural network model in this survey, we may conclude that, neural networks comparing to other forecasting methods such as Arima, and considering the capabilities of artificial neural network in learning, errors can be minimized tangibly using these networks.The MSE gained with this method is proper and the shares of Iran khodro in Stock market can be discussed using this method and necessary decisions shall be made while sudden swings happen. This is a method for proper decision making and investment tool in economical fields of country.

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