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Stock Market Forecasting Using Artificial Neural Networks

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Abstract

Forecasting events have always been of great interest for human beings. The basic example of this process is forecasting the weather and environmental disasters. Forecasting is the process of collecting information in order to complete and expand them suitably for future. Today, globalization of economic and competes in this regard for observing investors and recognition of profit making and trusting markets, such as currency and stock market, which are highly complex, is one of the most important umbrages of investors. For forecasting in capital markets such as stock or currency, there exist different methods, like, regression, time series, genetics algorithm and fundamental analysis. From non-liner methods which might be used in different forecasting bases are Artificial Neural Networks ANN. ANN are one of the newest inventions of mankind which are used in variety of different scientific fields. Use of investors of technology and computer algorithms for forecasting has caused more profit and better business opportunities. ANN is a part of dynamic systems which by processing on data of time series, drive the roles and science of these data and register it with the structure of the network. This system is based on computational intelligence which copies the human's mind feature in processing. In this survey, besides discussing the ANN for analyzing and processing data and also studying new methods, it is concluded that ANN are an appropriate model for forecasting capital markets such as stock and currency.

Keywords: Artificial Neural Networks (ANN), Capital Market, Processing, Ability to Learn, Forecasting.

Introduction

Forecasting shares in markets such as stock is of great importance among investors and analysis of this field, Complexity of stock markets and being it effected by political and economical and social events has made the process of forecasting even more difficult (Fagner et al., 2013).

In the last two decades most researchers and surveyors have faces to ANN for predicting this market (Jonathan and Ticknor, 2013).

The ability of these networks to drive pattern from data is one of the reasons of tendency of surveyors to these networks.

History of Neural Networks

- 1940s

Creation of Neural Networks at the outset of 40s by Waren Mc Clatch and Walts has been occurred, They designed networks which were the very first neural networks, these surveyors have found out that increase in neurons causes an increase in the computational capability, one of the features of Mc Clatch-Pitz neuron is that when the network input to a neuron is more than threshold

of that neuron, then that unit of neuron is infused, the networks based on this type of structure are used as logical circuits (Laurent and Faustt, 1993).

- 1950s-1960s

This decade is known as the golden decade of neural networks.

Frank Ronbalt and a few other researchers have presented and expanded neural networks as Pros Petron Networks (Laurent and Faustt, 1993).

- 1970s

This decade is called as the silent decade of this theory, Minisky and Papert have determined some limitations for Mono-Layer Pros Petron networks, these limitations have caused a decrease in fans of the theory, and one of the limitations was the unsuccessfulness of mono-layer Pros Petron in computing simple functions such as XOR. However the researches on neural networks were still on (Laurent and Faustt, 1993).

- 1980s

In this decade are-interest to neural networks has raised, John Hopfield, winner of Nobel Prize in the field of Physics and the member of Californian Institute of Technology played an important role in recognition and re-attention of neural networks (Laurent and Faustt, 1993).

Natural Neural Networks

There exists a great similarity between the structure of an artificial nerve a natural nerve (brain Cell) each natural neuron consists of Dandride, Soma, Axon.

Understanding a natural neuron gives us a great cognition for understanding an artificial neuron.

Dandrids which are of a vast majority receive signals from other neurons and these signals which are produced from a chemical process make electrical pulse and this chemical process might be effective on the frequency of the received signal, this process is exactly like the process which takes place in artificial neural networks by weights (Laurent and Faustt, 1993).

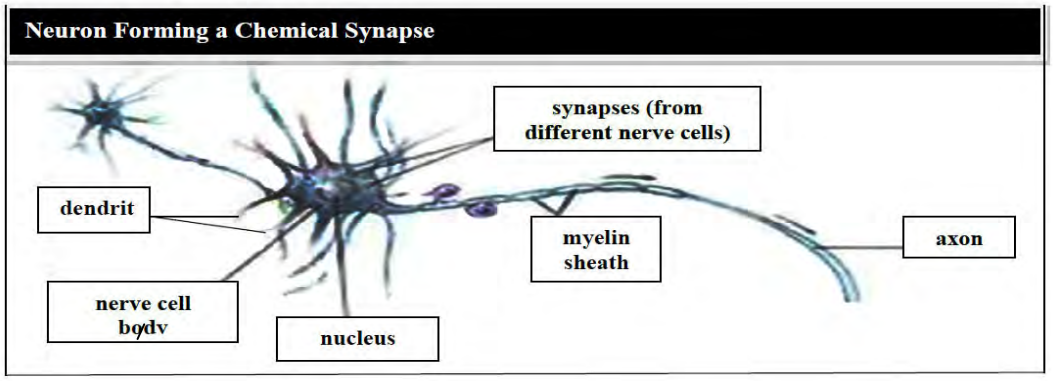

Figure 1. A sample of a natural neuron.

Structure of Artificial Neural Network

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 that weight (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.

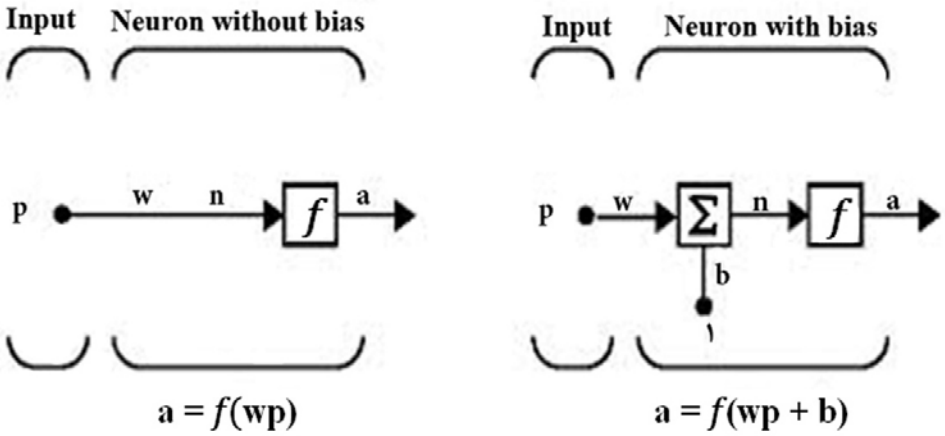

Figure 2. Mono – input neuron.

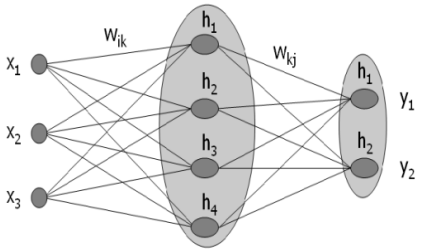

Figure 3. A sample of a neural network with 3 inputs and 2 outputs.

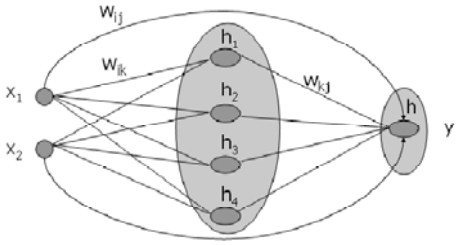

Figure 4. Another sample of a neural network.

Examples of Neural Network Functions

- ***Processing Signals***

ANN is of great functionality with regard to processing signals, one of this functions regarding processing signals is to remove the noise of telephone lines which is still used. The Adeline network is a kind of network which is used for achieving this objective (Lu Xi et al., 2014).

-***Medical Science***

One of the samples of neural networks functions in medicine was done by Anderson and colleagues in mid 1980s (Laurent and Faustt, 1993).

Today considering the vast capacity of medical data and their complexity, the need for a functional tool for driving valuable science, hidden in these types of data for recognition and predicting the disease and treatment can be effective.

Using neural networks which are introduced for predicting the disease can do the predicting process of the diseases more precise those simple present methods (Nima Torbati et al., 2014).

- ***Business***

Neural network has great functions in business; we may note the company of Nestor which used these networks for evaluation of loans given to its customers (Laurent and Faustt, 1993).

If neural networks are trained in a proper manner they can be used better than statistical models which exist in the field of business, in 1996 two researchers named Tafler and Trigers noted the role of methodology of neural networks in accounting and concluded that this is a better model for accounting during their survey (Moosmayer et al., 2013).

Materials and Methods

In this survey we aim to forecast the shares of Iran Khodro, using ANN, for this kind of forecast a time series is needed which these data are collected from the Statistic Organization of Iran.

This forecast takes place using MATLM Software, data are studied from year 1996 to 2004 using sampling of neural networks, in this sampling 22 data are set as input and 4 as output.

Figure 5 are the daily data regarding the latest prices of Irankhodro shares at stock market of Tehran, figure 6 shows the transaction capacity of Irankhodro shares at Stock market of Tehran.

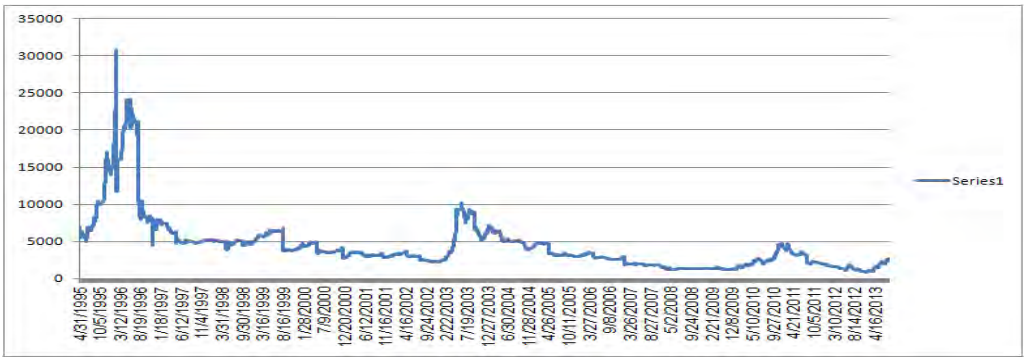

Figure 5. The latest changes in stock price changes of Iran Khodro from 1995-2013 which is registered in a daily manner.

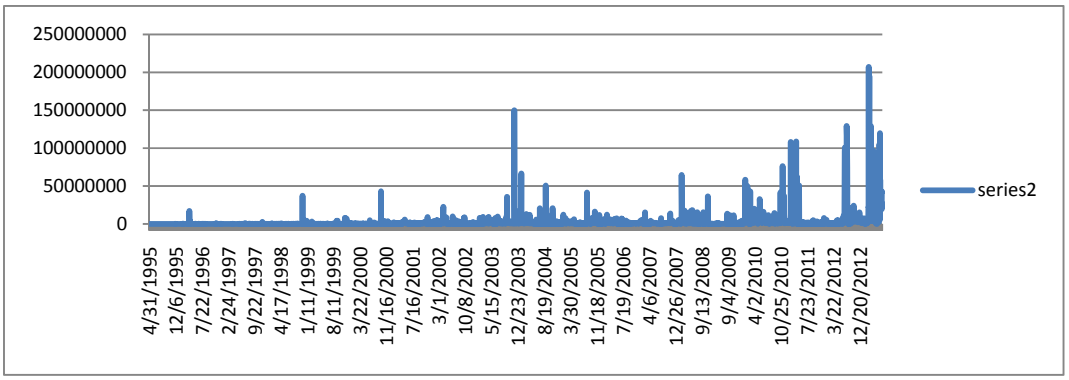

Figure 6. The transferred capacity of Iran Khodro shares in Tehran's stock market from 1995 to 2013 min a daily manner.

Results and Discussion

- ***Input Data***

In input data the economical 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
X_1	As the data of year
X_2	The unemployment rate of youth
X_3	The value of external basic materials used
X_4	Ratio of educated-employed individuals to total employed individuals
X_5	The number of industrial permits
X_6	Ration of investment to added value
X_7	Added value
X_8	Production value of industrial workplaces
X_9	Insured individuals by social security organization
X_{10}	Income from oil and gas
X_{11}	Liquidity
X_{12}	Ration of investment to added-value
X_{13}	The value of industrial work places export
X_{14}	Value of trading (import)
X_{15}	Value of trading (export except oil)
X_{16}	Rate of American dollar
X_{17}	Annual percentage of inflation
X_{18}	Price of golden coin
X_{19}	Number of international passengers enter the air port
X_{20}	Number of construction permits issued by municipality
X_{21}	Shortage of budget of government
X_{22}	The index of goods price and services in use in urban zones of Iran

- ***Output Data***

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

- ***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
Y_1	The latest price if Iran Khodro shares
Y_2	Changers in price of shares of Iran Khodro
Y_3	The lowest Price of Iran Khodro shares
Y_4	Higher Price of Iran Khodro shares

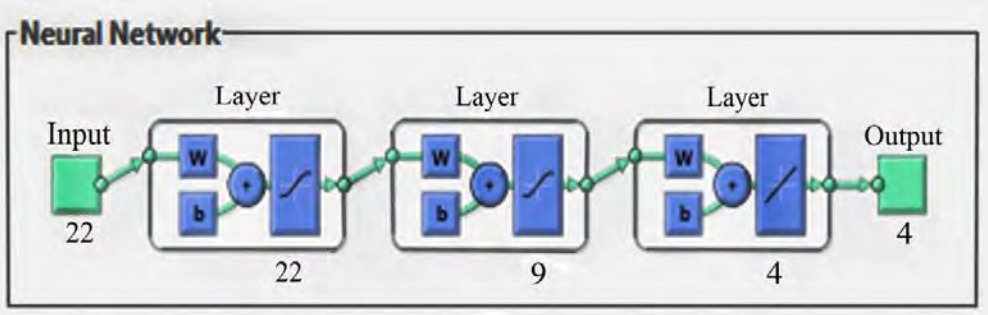

Figure 7. Sampled model of neural network.

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.

$$X_n = (X_0 - \overline{X})/ S$$

Which X_n , X_0 , X , S are normalized data, original data, medium of data, deviation respectively.

Accuracy of Forecasting

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

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

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 net work 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.

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.

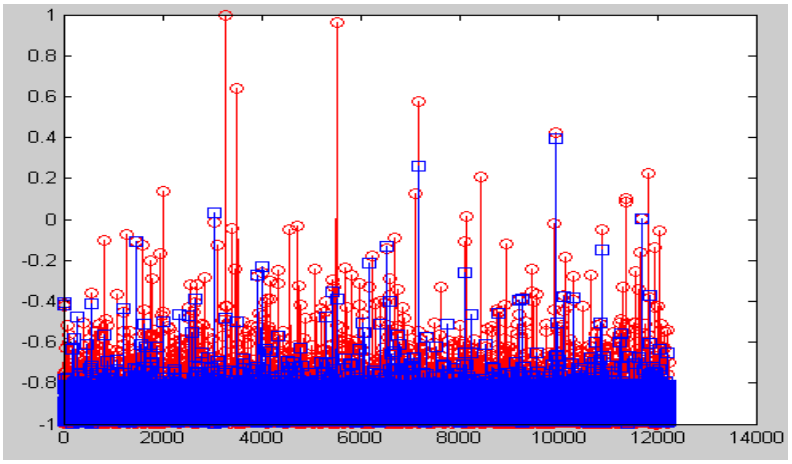

Figure 8. Trained data.

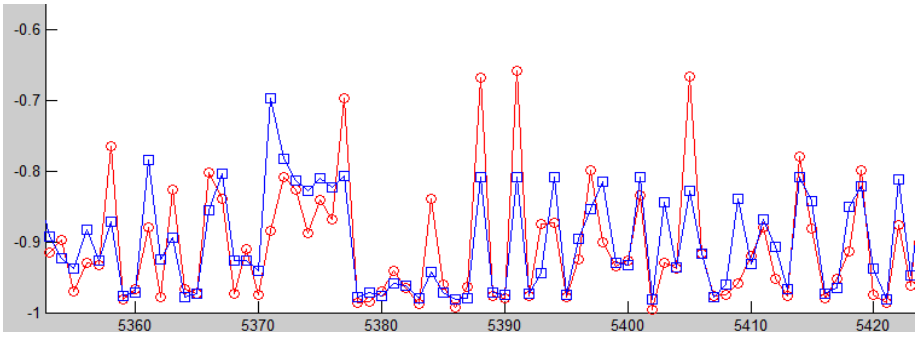

Figure 9. A part of trained data

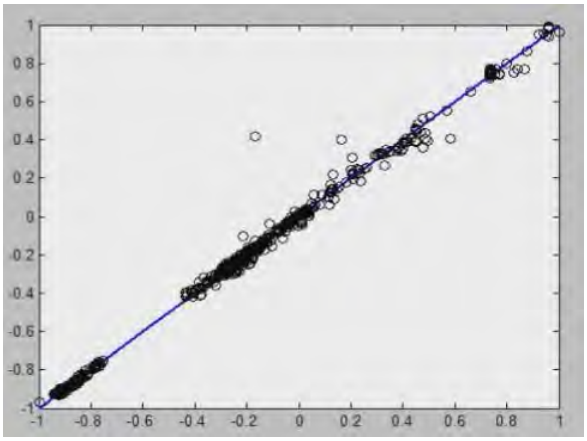

Figure 10. Another type of trained data.

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