Journal of Novel Applied Sciences
Available online at www.jnasci.org
©2015 JNAS Journal-2015-4-4/501-507
ISSN 2322-5149 ©2015 JNAS

Automatic Algorithm Design by Neural Network and Indicators in Iran Stock Transactions

Roohallah Bahmani Zargari[1*], Mansur Aminilari[2] and Mohsen Bashiri[3]

1- MA Department of Computer, Broujerd Branch, Islamic Azad University, Broujerd, Iran
2- Assistant Professor, Department of IT and Computer College of Engineering, Marvdasht branch, Islamic Azad University, Marvdasht, Iran
3- Assistant Professor, Department computer College of Engineering, Tehran Branch, Sanati Sharif University, Tehran, Iran

***Corresponding author*:** Roohallah Bahmani Zargari

ABSTRACT: By predicting the situation of market in the future an investor can determine its position, situation and the rate of his investments, in a way that the efficiency of his/her assets reach to its maximum. The advanced technology of computer has made a vast revolution in the field of financial markets and trade approach. This technology has made two important and interrelated changes in this area. One is using computer by investors for automat zing trade processes and the other is reconstructing financial markets and furnishing them with system the electronic limit order book. With this kind of order book, there is no need for physical presence in the salon of stock market trades. In this research, we have tried to offer the best prediction of the movement trend in the next day share price by using technical analysis (stock exchange diagram analysis) and cascade forward, learning by three layer supervised learning, artificial neural networks and levenberg-marquardt learning algorithm, weight learning function and delta rule), math metical rules, trade rules,Geometric devices(trend line), survey devices (indicators) such as Ichimoku Cloud indicator and relative strength index (RSI) and also geometrical tools. In doing so, an efficient and profitable algorithm is offered to do the selling and buying processes automatically (with the management of investor).

***Keywords*:** Technical analysis, cascade forward neural network, algorithmic trades, indicator.

INTRODUCTION

By increasing competition in trade environments, financial managers have turned to programmed algorithms. On the two sides of this game, buyer foundation and seller foundations are placed. The buy side or buyers society, are financial management firms whose work is to buy trade services (from seller organization). Seller organization or the sell side refers to the agencies who offer financial services to financial management firms. These services include buying stocks, offering consultation and financial researches investment banks and employers are the main members of this society.The two thinking school which prevails the share market literature, are fundamental analysis and technical analysis. Fundamentalists believe that stock exchanges have an inert value and market work forces make sure that the price of each share covers this value in the long term. On the other side, specialists believe that past prices of each share (and price changes), size and the volume of share trade tend to follow the same pattern. As a result, systematic analysis can bring about extra ordinary profits in the short term generally supply and request forces, determine share prices. Perhaps, technical analysis is the only technical for an investor to use form. Fundamental analysis requires all fundamental factors due to the high volume of information and time that it needs obtaining. These factors are costly and timely for small stock holders. On the other side, these small stock holders (investors) have no access to secret information, a low competitive margin is provided for fundamental analysis.

A Review of Past Research

Technical analysis emerged with Charles down and William Hamilton's perspectives and articles (1900-1902). A review of literature on this topic manifests those numerous researchers who worked on this field. Before the systematic constitution of this method of analysis, brown and Jennings (1989) showed the value of technical analysis associated whit signals and prices.

In his research, Sweeny (1988) concluded that depending on the level of transactions expenses, filtering rules (filtering rules and mobile mean rules are the two transactional rules of technical analysis), lead to a more or less profitable result.

Lakonishok and Lebaron (1992) used mobile mean rules and concluded that these rules will also make profitable results.

Lerich and Thomas (1993) and Kho (1996) also investigated the mobile mean strategy and concluded that the mentioned strategies are helpful.

Ratner and Lill (1993), in some of Asian and Latin American countries, reached to this result that the use of technical analysis methods will lead to profitable results. Menig and Matno and Goro (2010) concluded that mobile mean rules are of more prediction ability and they are able to get more efficiency. Mang and Manzure and Chew (2012) proved the better function of mobile mean method and partial power index comparing with selling and maintenance method in Singapore stock exchange.in his research, Amiri (1995),concluded that technical analysis method can be implemented in Tehran stock exchange market to analyze the shares. Khanloo (1996) reached to this result that various methods of technical analysis which were used in the world financial markets, are also applicable to some extent in Iran stock market.

The results of Gholamzade and Norush's research (2000) showed that the process of making annual profit by those Iranian firms which were under investigation was mobile mean method. In predicting shares profitability, Mehrani and Karami (2008) used historical information (both financial and non-financial) to distinguish successful firms from unsuccessful ones. In their research, Sadeghisharif and sultan Zareii (2011) concluded that technical analysis methods are helpful and profitable for analyzers and investors of Tehran stock exchange market.

Designing the Suggested Neural Network

In the stock market, lots of data are declared daily as shares characters. The parameters which we consider as input variables in this model, includes five important data in time period of one day; 1) The open price of share 2) The close price of price of share 3) The low share price 4) The high share price 5) Close gold price. Since, for modeling with artificial neural networks, test-error data are required, the information of a 2 year period (2011-2013) about total index of Tehran stock exchange market was considered suitable for this research. This information which was extracted daily and online from formal site of Tehran stock exchange market (www.irbourse.com), constituted the basic data base of this research.

The aim of classification is to know how the situation of the considered share for selling or per chasing, will be in future. In this research, using trend rule (up trend, down trend, sideways trend) and circumstances of previous days occurred in the market, were considered as a standard for data classification. By referring to past data and evaluating the market atmosphere and above cited cases, an investor decides to calibrate share and per chase it in the incoming days.In order to classify data, we have divided them in to 3 classes based on their characteristics (Table1).

Table 1. Data Classification

Class characteristics	Class number
The best time for buying share	1
No buying and selling	2
The best time for selling share	3

Up to this section, a set of 5 variables as the network input and a classification of 1 to 3 are determined for the output.

Various models and architectures were examined for determining the suitable topology of neural network. By changing the number of hidden layers, the main prediction model was selected. Finally, the optimum number of layers was calculated as four layers (one input layer, two hidden layers, and one output layer) and the number of neurons was considered as (5-6-1).

Compared to the output parameters which we defined for the network, the considered network has one output per minute. Up to this part, we can observe an overall representation of the structure of optimized neural network to predict the movement trend of the share under investigation (figure 1).

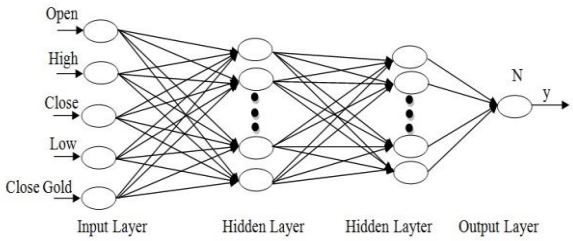

Figure 1. An Overall Representation of the Structure of optimized Neural Network

After developing the data base related to training, and defining the suitable number of layers and neurons, now it is time to select the type of network. To do so, in this research, we used the cascade forward network with multi-layered supervisor for the first time (multi layered networks are far more efficient and stronger than unit layered networks to solve problems)(figure 2).

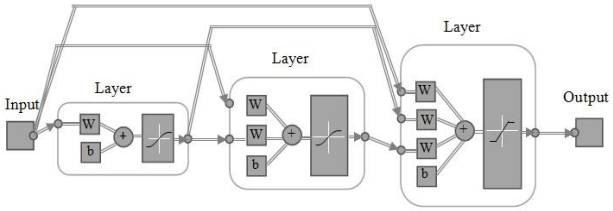

Figure 2. The Structure of Nodes in the Cascade Forward Network

Generally, if we want to describe the body of neural network designed in this paper, we can show it in the following figure (3).

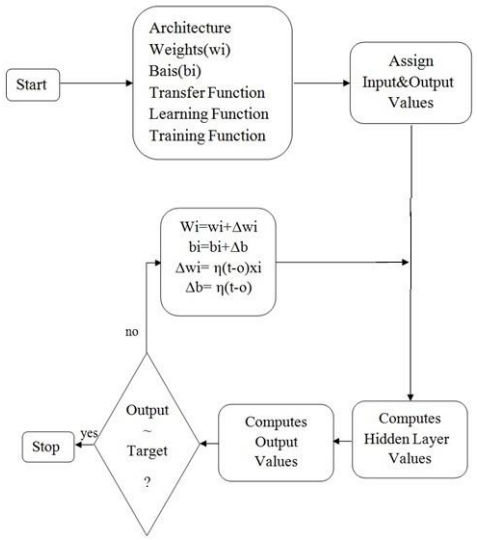

Figure 3. The body of suggested neural network

Now, we illustrate the summary of neural network specifications and parameters (in this research) in the table (2).

Table 2. A Summary of Parameters and Specifications of Neural Network

Parameters	Explanation
The structure of neural network	Cascade forward
Type of neural network	Feed forward
Learning (training) algorithm	Levenberg – Marquardt algorithm
Bias and weight learning function	Delta ruler (stochastic gradient)
Error function	Mean square error (MSE) and root mean square error (RMSE)
Number of hidden layers	2
Number of nodes in the hidden layer	6
Validation check	6
Hidden layer transfer function	tan sigmoid
Output layer transfer function	Symmetric saturating function
Number of training data	530
Number of examination data	131

Investigating the Value of Real Data and Prediction

After training the network, now it is time to test the network for the new data in order to evaluate the precision rate of simulation output with the target value. According to figure (4), we can observe the graph of network output with the obtained target value.

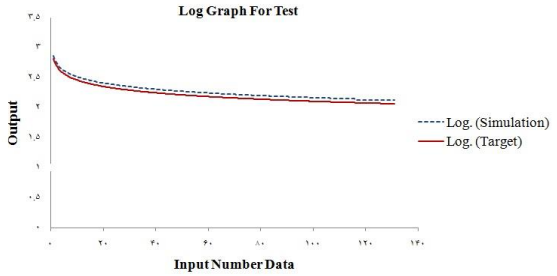

Figure 4. The graph diagram of network output with a target value of test data

Designing the Proposed Trade Algorithm

Indicators are used for clarification of the market's movement type. According to figure 5, we draw Ichimoku indicator lines for confirmation and subsequently the relative strength index line for announcing movement warnings on the diagram of the market's past days (the total index diagram), to have a glance at the market. Consequently we will design the sell and buy signals for our algorithm.

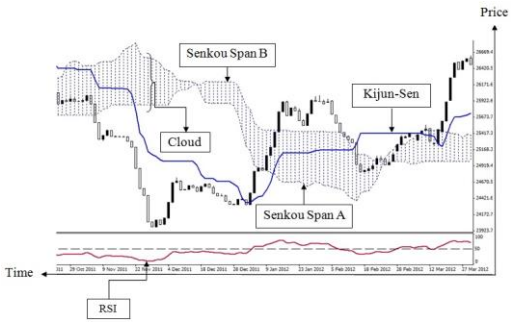

Figure 5. Drawing the indicators line on the total index data

The Proposed Buy Signal

If the neural network output is numerical value of one and (the best time for buying share), the daily information of close price of each share will be based on the candle of previous day, sits above the line "kijun-sen" and the line "kijun-sen" sits over the "ichimuko cloud" indicator and lines of this indicator are calculated in the following range:
Tenkan-Sen= Over Last 9 Periods
Kijun-Sen= Over Last 26 Periods
Senkou Span B= Over Past 52 Time Periods, Sent 26 Periods Ahead
Senkou Span A: (Tenkan Line+Kijun Line)/2 Plotted 26 Time Periods Ahead

Cloud = Senkou Span A and B
The relative strength index (RSI) of indicator is bigger than number 50.
RSI >50
The signal buy is transmitted and the point “stop loss” lies on the line “kijun-sen”.

The Proposed Sell Signal

If the neural network output is numerical value of three and (the best time for selling share), the daily information of close price of each share will be based on the candle of previous day, lies below the line “kijun-sen” and the line “kijun-sen” lies below the “ichimuko cloud” indicator and lines of this indicator are calculated in the following range:
Tenkan-Sen= Over Last 9 Periods
Kijun-Sen= Over Last 26 Periods
Senkou Span B= Over Past 52 Time Periods, Sent 26 Periods Ahead
Senkou Span A: (Tenkan Line + Kijun Line)/2 Plotted 26 Time Periods Ahead
Cloud = Senkou Span A and B
The relative strength index (RSI) of indicator is smaller than number 50.
RSI <50
The signal sell is transmitted and the point “stop loss” lies on the line “kijun-sen”.

The Body of Proposed Algorithm

Generally, if we want to investigate the body of proposed algorithm in this research, we had better to look at the body of algorithm in figure 6.

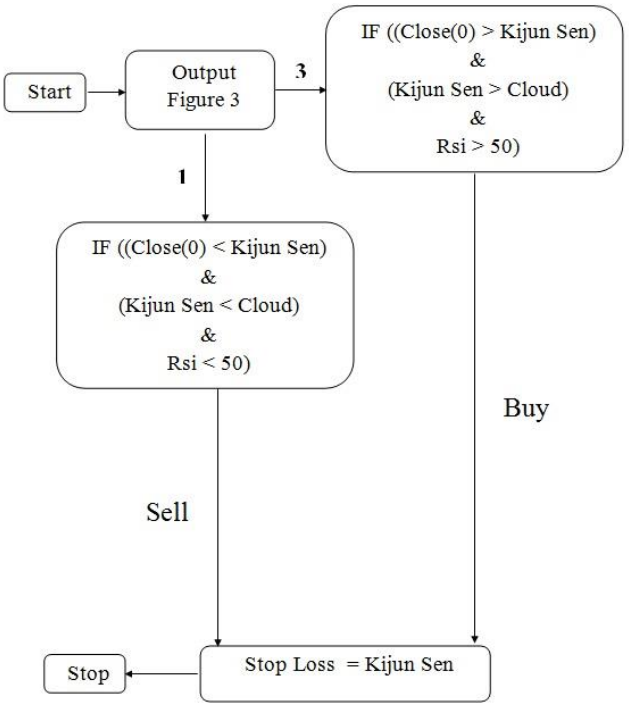

Figure 6. The body of proposed algorithm

Investing the Outputs of Trade Algorithm

In this section, the implementation stages of the proposed trade algorithm are observed step by step according to table 3. Where trade time is represented by the parameter “Data”, the type of trade signal during selling or buying with the parameter “Type”, the number of trade with parameter “Order”, the share price with parameter “Price”, the loss limit value with parameter “S/L”, the profit rate with parameter “Profit” and account residual with parameter “Balance”.

Table 3. step by step output of proposed algorithm

Date	Type	Order	Price	S / L	Profit	Balance
2010.03.07	buy	1	12221.3003	0.0000		
2010.05.31	s/l	1	14061.7500	14061.7500	104964647.24	2252448294.24
2010.06.01	buy	2	14109.0003	0.0000		
2010.06.12	s/l	2	14054.3500	14054.3500	-3116815.33	2249331478.92
2010.06.12	buy	3	14060.7435	0.0000		
2010.10.12	s/l	3	18479.5500	18479.5500	252013636.63	2501345115.54
2010.12.18	buy	4	18414.3003	0.0000		
2010.12.19	s/l	4	18227.4000	18227.4000	-10659307.63	2490685807.91
2010.12.22	buy	5	18353.1003	0.0000		
2011.05.01	s/l	5	24780.2000	24780.2000	366550721.44	2857236529.35
2011.05.08	buy	6	25525.1412	0.0000		
2011.05.08	s/l	6	25522.2000	25522.2000	-167742.67	2857068786.68
2011.05.09	buy	7	25752.7003	0.0000		
2011.05.25	s/l	7	25663.1500	25663.1500	-5107232.81	2851961553.87
2011.07.18	sell	8	24348.9000	0.0000		
2011.07.23	s/l	8	24693.5500	24693.5500	-19651623.90	2832309929.97
2011.07.23	sell	9	24691.6887	0.0000		
2011.07.23	s/l	9	24693.5500	24693.5500	-106129.55	2832203800.42
2011.09.03	buy	10	25822.0003	0.0000		
2011.10.15	s/l	10	26742.4500	26742.4500	52495147.13	2884698947.55
2011.10.15	buy	11	26742.9245	0.0000		
2011.10.15	s/l	11	26742.4500	26742.4500	-27061.71	2884671885.84
2011.11.23	sell	12	24881.0000	0.0000		
2012.01.03	s/l	12	24355.4500	24355.4500	29966288.65	2914638174.49
2012.03.04	buy	13	25418.2003	0.0000		
2012.03.04	close	13	25415.0061	0.0000	-182171.78	2914456002.71
2012.03.04	buy	14	25417.9003	0.0000		
2012.03.06	close	14	25307.9000	0.0000	-6273542.26	2908182460.45
2012.03.10	buy	15	25417.4799	0.0000		
2012.03.12	s/l	15	25389.3000	25389.3000	-1607157.24	2906575303.21
2012.03.25	buy	16	26281.9003	0.0000		
2012.05.12	s/l	16	26856.1000	26856.1000	32747801.11	2939323104.33
2012.05.23	buy	17	27091.2003	0.0000		
2012.05.26	s/l	17	26977.7500	26977.7500	-6470302.27	2932852802.06
2012.05.26	buy	18	26978.8079	0.0000		
2012.05.26	s/l	18	26977.7500	26977.7500	-60334.21	2932792467.85
2012.06.30	sell	19	25053.7000	0.0000		
2012.08.25	s/l	19	24461.4000	24461.4000	33772284.21	2966564752.06
2012.09.24	buy	20	27126.6003	0.0000		
2013.01.28	s/l	20	36645.1500	36645.1500	542862457.49	3509427209.55
2013.02.09	buy	21	37527.5821	0.0000		
2013.02.09	s/l	21	37424.9500	37424.9500	-5853319.27	3503573890.28
2013.02.09	buy	22	37527.5822	0.0000		
2013.02.25	s/l	22	37635.9000	37635.9000	6177590.68	3509751480.95
2013.03.02	buy	23	37803.3003	0.0000		
2013.03.02	s/l	23	37635.9000	37635.9000	-9547182.62	3500204298.33
2013.03.16	buy	24	38047.2003	0.0000		
2013.03.17	s/l	24	37676.6500	37676.6500	-21133243.99	3479071054.34
2013.03.18	buy	25	38040.7003	0.0000		
2013.05.19	s/l	25	43021.6000	43021.6000	284070948.43	3763142002.77
2013.05.21	buy	26	43074.1003	0.0000		
2013.05.21	close	26	42841.0000	0.0000	-13294188.43	3749847814.34
2013.05.26	buy	27	43486.2003	0.0000		
2013.09.01	close	27	58561.0000	58476.7000	859746788.51	4609594602.85
2013.09.01	buy	28	58758.1276	0.0000		
2013.09.04	s/l	28	58744.8000	58744.8000	-760099.52	4608834503.34
2013.09.14	buy	29	59233.7729	0.0000		
2013.09.14	s/l	29	59210.4000	59210.4000	-1333004.45	4607501498.89
2013.09.15	buy	30	59223.0973	0.0000		
2014.01.12	s/l	30	86715.0500	86715.0500	1567922510.24	6175424009.13
2014.01.14	buy	31	87112.9003	0.0000		
2014.01.15	close	31	87102.6000	86967.5000	-587446.95	6174836562.18
2014.03.02	sell	32	80105.0000	0.0000		
2014.03.05	close	32	78449.9003	81582.9000	94372198.08	6269208760.26

RESULTS AND DISCUSSION

Generally, the results of this research can be expressed as follows:

- The first finding of this study understands the complexity and procedure of price variations in Tehran stock market.
- By technical analysis, Tehran stock market can achieve an acceptable prediction.
- Optimum exploitation of the indicators “relative strength index (RSI) ” and “Ichimoku Cloud” with the mentioned input (entry) variables can result in the best profit and the best consequence for investors.
- Modeling indicators with proposed parameters and consequently achieving the new trade algorithm have brought about a desirable success in predicting the total index.
- By designing an automatic and secure trade algorithm, investors are encouraged to invest their capital in Tehran stock market and consequently flourish the economics of the country.

- The time behavior of stock market (based on a daily extent) is not a stochastic process, instead, it is a non-stochastic process which can be predicted to considerably. Although this time behavior is a non-stochastic process, but it has many complications and it needs a network with many hidden neurons and layers. While increasing the number of hidden neurons and layer leads to higher precision of the network, however, this increase is limited and above that limit, the efficiency of network will be decreased.
- Among the previously designed neural networks, the neural network with the feed forward cascade architecture and five input parameters, two hidden layer and 6 hidden node (with a 5-6-1 architecture), transfer function of tan-sigmoid in hidden layers and symmetric saturating function in the output layer, levenberg-marquardt training algorithm and weight learning function, delta bias with the validation check of 6, epoch=37,MSE=0.0154, R=0.9840 and RMSE=0.1261, is the best network modeled for predicting the total index of stock market.

At present, the best method to predict the price in Tehran stock market by investors and those who expect a profitable transaction (trade) in a short term period, are focusing on variations of past prices in the market.

REFERENCES

Amirihanzaki H. 1997. “Investigating the role of technical analysis in the analysis of stock”, MA thesis, Tehran management college, Iran.

Arab Mazar A. 2000. “General Economics Measure”, first edition, Kavir Publication, Tehran, Iran.

Banz R and Breen W. 1986. “Sample-Dependent Results Using Accounting and Market Data: Some Evidence”, Journal of Finance, No. 41, PP.779-793.

Capital Markets Consortium. High Frequency Trading: Market Structure, Technology and Regulation. 9 December 2009, New York.

Jahankhani A. 2010.”Investing effective factors in share price and a review of change trend in share price of Tehran stock market”, background, no.65, pp: 13-16.

Lotfiali 2009. “Technical indices”, First Edition, Term publication, Tehran, Iran.

Rao SK. 2007. Algorithmic Trading: Pros and Cons. Tata Consultancy Services. 2006 - 2007.

White H. 2012. Economics Prediction Using NN: The Case of IBM Daily Stock Returns. Irwin Professional Publishing, PP. 469-481.