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Stock Price Forecasting

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Abstract

The especial importance of capital market in countries is undeniable in economic development via effective capital conduct and optimum resources allocation. Investment in capital market requires decision making in new stock exchanges, and accessing information in the case of future status of capital market. Undoubtedly, nowadays most part of capital is exchanged via stock exchange all around the world. National economies are extremely affected by the performance of stock market, high talent and unknown factors affecting stock market, and this causes unreliability in investment. It is clear that unreliable assets are inappropriate and in other side, for those investors who select stock market as a place to invest this asset is inevitable; thus, naturally all investors struggle to reduce unreliability. The present study compares four different models of predicting stock price, namely, Perceptron network, Fuzzy neural network, CART, Decision tree, and Support vector regression in Iran stock market during 2008 - 2012. Research sample includes 81 firms listed on the Tehran Stock Exchange (TSE). The findings compared in the case of five indicates show that for predicting stock price, using CART decision tree, has lower error than other ones.

***Keywords**: Perceptron network, Fuzzy neural network, CART decision tree, Support vector regression.*

***JEL Classifications:** C10, C13, C18*

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1. Introduction

Decision making is considered as the best solution between all other kinds of solving problems, which needs knowing existing solutions and their measurement methods. For measurement, it needs a criteria to evaluate different parts and finally to select the most suitable and the most desirable one. Prediction is an integral part in decision making process and control. On the other side, prediction is directly related to decision making risk. Decision making in the case of buying new stock of ϕ and selling existing ones, needs some information about future position of stock prices, thus, if the future stock price is predictable via some methods, this economic decision making would be done based on information and thus, losses or risks of investment would decrease (Forghani, 2005).

2. Literature Review

The results of huge development in the field of computer and artificial intelligence is employed for predicting price in stock exchange in different countries, such as artificial intelligence techniques, including neural network, genetic algorithm and fuzzy logic and so, successful results in predicting financial occurrences have been achieved. The idea of using neural networks in economic networks, for the first time was presented by White in 1988. He tried to discover hidden system in historical prices of capital assets to this end, daily returns of IBM Company was used as an especial case and the role of statistics in finance methods and learning methods in neural networks are considered as 2 elements complementing each other (Raei, 2001). After White's study, to predict financial events, several studies were done in several countries including Iran. Khaloozadeh and Khaki (2003) presented 3 prediction methods, and finally, presented suggestive structure of neural networks. Of other studies for comparing neural network results and traditional ones, comparative study of neural network efficiency against technical- analytical indicates inputs for prediction of stock price which can be pointed out is done by Motavaseli and Kashefi (2006). They show better results of considered neural network. Azar & Afsar (2006) focused on the role of fuzzy neural network in stock price prediction and the results showed that ARIMA model has unique characteristics. Chi et al. (2012) by using second type of fuzzy neural model predicted stock price and their results showed efficiency and usefulness of fuzzy neural modeling method in stock price prediction.

In recent years, it is tried to have exact prediction of stock prices. In most predictive models, the system has predicted stock prices, only by using an index (mostly stock price), and has used several indicators as multi input network. Pai and Lin (2005) used ARIMA hybrid model and supported Vector Machines model in Taiwan stock price prediction. Armano et al. (2005) presented neural network hybrid model and genetic algorithm to predict stock index. They used genetic algorithm to control neural network performance. Wang (2007) used non- linear neural network for stock price prediction. He used hybrid asymmetric instability method in artificial neural network to decrease prediction error. His results showed that Grey- GJR- GARCH instability method is superior to other instability methods for prediction.

Chih-Ming Hus (2011) combined neural network and genetic program to present a comprehensive strategy to solve stock price prediction problems. Their results show that suggested hybrid method as a practical and effective tool, is used to predict stock price. Mirzazadeh and Tavakoli (2011) conducted stock price prediction using artificial neural network. The results show that suggested model has high accuracy.

3. Hypotheses and Methodology

According to the objective of the study, the following hypotheses are postulated:

H_1: By using multi layered perceptron network, estimation of stock price error could be decreased more than other methods.

H_2: By using multi layered fuzzy neural network estimation of stock price, error could be decreased more than other methods.

H_3: By using multi layered CART decision tree estimation of stock price, error could be decreased more than other methods.

H_4: By using multi layered support vector, regression estimation of stock price error could be decreased more than other methods.

This study is mathematical- analytical in view of methodology. Basic steps in performing study are as follows:

Selecting and calculating independent variables during 2008 - 2012.

Selected companies include 81 firms listed on the TSE.

3.1 Statistical population and study sample

The population of the study includes all listed companies on the TSE with the following conditions:

The companies should be listed in stock exchange before 2008.

Excluding financial company and banking industry.

Their stock should be at least once transacted in a week.

By considering mentioned criteria, the sample study includes 81 firms.

3.2 Research variables and hypothesis test:

- Independent variable

In performed studies to predict stock price, 13 variables were used; in this study, after estimations, and also using statistical omitting methods, 11 variables are used.

Since the amount of P/E ratio and amount of transacted stocks were 0.929 and 0.547 respectively, and these amounts are more than 0.05, thus in 0.95 confidence level, these variables are not significant and the model is performed, using other variables:

1) Depended variable: stock price prediction

Model description

Models used in this study are as follows:

a. Multilayer perceptron network (MLP)

MLPs are forward neural networks which are amongst highest used artificial neural networks. In MLP, each neuron in each layer would be connected to all pervious layer neurons. These networks are called *fully connected networks* (Menhaj, 2000). Each perceptron, aggregates the total output of all perceptron of previous layers sends it to the next layer (Menhaj, 2000). Thus in each step, weight coefficient learning index would be changed as follows:

$$w_{k+1} = w_k - a_k g_k$$

In which, w_k is network weight coefficient, g_k is network output error gradient, a_k is network learning coefficient. This method, which is called Gradient Descent Algorithm, is performed in two ways which are Incremental mood and Batch mood (Menhaj, 2000). In incremental mood, error gradient, after each observation will account one learning samples and improves weight coefficient. In Batch mood, after a full cycle of learning samples and total gradient measurement this process would be done. In most cases, incremental mood is superior to Batch mood (Menhaj, 2000).

b. Fuzzy neural network (ANFIS)

Recently, fuzzy logic, for modeling and reservoir management is proposed to solve ambiguous properties. However, the main problem of fuzzy logic is that there is no systematic process for designing a fuzzy controller. In other words, a neural network has the ability of environment trained (pairs of input - output), the ordered structure, and the way of interaction, to adjust itself. To this end, Professor Jeng in 1993 presented the ANFIS model, which combines the capabilities of two methods. ANFIS allows the extraction of fuzzy rules from numerical data or expert knowledge is, and comparatively, a rule - making foundation. Moreover, it can convert complex human intelligence; fuzzy systems can adjust (Jeng et al., 1997). The main problems of the ANFIS prediction model are the relatively high time needed, training structure, and determining the parameters. Distinguishing characteristic of ANFIS, providing the algorithm learns, slope gradient method, and the method of least squares is to modify the parameters. Slope gradient method is to be applied to non-linear parameters for the pilot to adjust while the least squares method is to be applied to the next section to determine the linear parameters. Educational process has two steps: First, while the front parts of parameters (membership functions) are assumed to be constant, using the method of least squares parameters (Tally), are determined. Secondly, the error signal spread (Jeng et al, 1997).

c) CART decision Tree

CART uses Gini Index (Breiman, 1984). Gini Index relation is defined as follows:

$$I_{gini} = 1 - \sum_{j} p(c_j)^2$$

In which, $P(c_j)$ is the rate of c class belonged data. This algorithm, firstly accounts Gini coefficient for all primary data using formula1. Then amount of information gain of any feature is obtained using this relation:

$$Gain\ (A) = I_{gini} - I_{res_{gini}}(A) \qquad (1)$$

In which $I_{res_{gini}}(A)$ is calculated using formula 2 and $I_{res_{gini}}$ is the remained amount of disorder in batches, is via using A properties, which is attainable using the help of total property occurrence of each one of divisions. Then, property which has the highest benefit is selected as dividing feature.

$$I_{res_{gini}}(A) = \sum_{j} \left(p(a) \times \left(1 - \sum_{j} p(c_j \mid a)^2 \right) \right) \qquad (2)$$

In which, *a* shows subcategory with selecting Ath splitter feature.

d) Support vector regression (SVR)

This method is deduced directly from Vapnik, under the name SVM; SVMs are used for categorizing problems. Then, their algorithm was developed for regression or data estimation problems. This new algorithm is called SVM (Vepnik, et al., 1997; Semula, 1998).

The description of method is as follows:

Suppose that a set of data $(x_i, y_i)_{1\leq i\leq 1}$ is held in which, $y\in R$ and $x\in R^n$.

It means that any data has *n* dimensions (n-dimensional vector). Similar to any data, we have an amount of *y*. The simplest estimator function is written as $f(x) = w^t x + b$, so that, the relation between vertical data of *x* and output amount of *y* is estimated with best method and least error. In other words, the objective is lowering function risk:

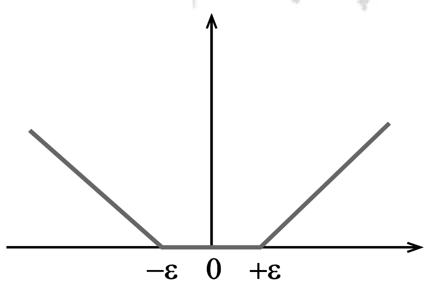
$$R_{emp} = \frac{1}{N}\sum_{k=1}^{N}\left|yk - w^T xk - b\right|_{\varepsilon} \quad \text{Function (1)}$$

The sigma term in above mentioned function is called Vapnik cost function which is as follows:

$$\text{Vapnik cost function } |\ y-\ (x)\ |_{\varepsilon} = \begin{cases} 0 & \text{if } |\ y - f\ (x)| \leq \varepsilon \\ |y - f\ (x)| - \varepsilon & \end{cases}$$

otherwise, Function (2).

Diagram 1: Vapnik Cost function diagram



Our objective is to find vector so that, the following conditions are satisfied:

$$\min_{w,b,\xi,\xi^*} J_P(w,\xi,\xi^*) = \frac{1}{2} w^T w + c\sum_{k=1}^{N}(\xi_k + \xi_k^*)$$

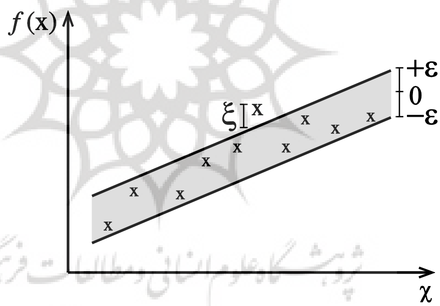
$$yk - w^T xk - b \leq \in + \xi_k \,,\ k = 1,\ldots,N$$

$$w^T xk + b - yk \leq \in + \xi_k^* \,, k = 1,\ldots,N \qquad \text{Function (3)}$$

$$\xi_k, \xi_k^* \geq 0, k = 1,\ldots,N.$$

For better understanding of this problem, consider diagram (2):

Diagram 2: Variation Corridor



According to this figure, while the value of ε should be the fixed point of the border, where possible, it should increase, and at the same time, the crossed section shown in the picture is the tube (or corridor) so that the amount cutting it along the y-axis (vertical axis) does not exceed 2ε. Expressed very simply, we are looking into a tube, as far as possible; to cover all data, but in crossed-section, the y- axis, the value of 2ε is not a violated. In this case, the optimization of the parameter C, indicating a violation, or going out of the tube, shows the amount of noise in the data. This problem, can be solved by using

Lagrange multiplier, after performing the necessary calculations, and simplified equations, the following is achieved:

$$\max_{a,\alpha^*} J_D(\alpha,\alpha^*) = -\frac{1}{2}\sum_{k,l=1}^{N}(\alpha_k-\alpha_k^*)(\alpha_l-\alpha_l^*)x_k^T x_{l-\in}\sum_{k=1}^{N}(\alpha_k+\alpha_k^*)+$$

$$\sum_{k=1}^{N} yk(\alpha k-\alpha_k^*)_{,\dots,N}^{,\dots,N} \qquad \textit{Function}\,(4)$$

So that:

$$\sum_{k=1}^{N}(\alpha_k-\alpha_k^*)=0 \qquad \alpha_k,\alpha_k^* \in [0,c].$$

Finally, the estimator function would be as follows:

$$f(x)=\sum_{k=1}^{N}(\alpha_k-\alpha_k^*)x_k^T x+b$$

In which, α_i and α_i^* are Lagrange polynomials and the solutions of the optimization problem; now, if data is nonlinear, Kernel functions could be used to obtain estimator function, namely:

$$f(x)=\sum_{k=1}^{N}(\alpha_k-\alpha_k^*)K(x,x_k)+b \qquad \text{Function (5)}$$

In which $k(x_i,x_j)$ is a Kernel function and defines the characteristics of the best solution in the optimization problem.

e) Implementation of the model

To implement the model, MATLAB software, version 7.12.0.635 (R2011a), has been used. Also other needs are total data, the training data and test data which are segregated. Thus, 80% of the data as training data, and the remaining 20% as testing and validation data are defined. In this study, the method of K-Fold cross validation, the type of authentication is used, the data is divided into k subsets (partitions), each one, for validation, and k -1 others, is used for training, and the implementation of the second part, again, the K part, to assess, k-1 remaining parts, for learning algorithm k times, the same procedure is executed. However, the data of learning and assessment of learning data, and evaluation of other iterations, it should have minimal overlap, to obtain all the data in the learning process, and evaluation is involved. Also, it should be noted that, given the proportion of each class in each series learning and assessment, is the ratio of the same class in the entire data set.

Before running the model on the data, all the data have been standardized. To this end, by using the following formula the data in the interval [-1, 1] is normalized:

$$\tilde{S}_i = \frac{(S_i - S_{\min})}{S_{\max} - S_{\min}}, \quad i = 1, \cdots, N \qquad \text{Function (6)}$$

Where $S_{\min}$ and $S_{\max}$, respectively are the minimum and maximum values of variables, and $\tilde{S}_i$ is the normalized values of S_i, and N represents the number of samples.

To evaluate the model, five evaluation criteria are used namely: Mean Absolute Error, Mean Squared Error, Normalized Mean Square Error, Mean Absolute Percentage Error, and R^2. This has been applied and calculated by using the following equations:

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - d_i)^2$$

$$NMSE = \frac{1}{n}\sum_{i=1}^{n}\frac{(y_i - d_i)^2}{\bar{y}\bar{d}}, \quad \bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i, \; \bar{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$$

$$MAPE = \frac{100\%}{n}\sum_{i=1}^{n}\left|\frac{y_i - d_i}{y_i}\right|$$

$$R^2 = 1 - \frac{SS_E}{SS_T}, \; SS_E = \sum_{i=1}^{n}(y_i - d_i)^2, \; SS_T = \sum_{i=1}^{n}(y_i - \bar{y})^2$$

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|y_i - d_i| \qquad \textit{Equation } (1)$$

In which, y_i and d_i respectively show real stock prices and stock prices predicted by the algorithm, and n is the size of samples $\bar{y}$ and $\bar{d}$ are average actual and predicted stock prices respectively.

f. Forecasting with Multilayer Perceptron Networks

To apply perceptron neural network to the training data, we have a number of inputs, number of hidden layers and number of neurons in each hidden layer, and the whole internal structure perceptron neural network, which is defined in this research, trial and error One Neural Network Forward, 10-5-1, and back-propagation was chosen. Back-

Table 1: The Prediction Results of Stock Price Using Perceptron Network

Fold	MAD	MSE	NMSE	MAPE	MAE	R2
1	77.29099	226266	0.008925	3.012921	77.29989	0.992111
2	4245.337	24207222	0.759912	171.2878	4231.393	0.247642
3	122.4857	372608.5	0.0128	6.504008	122.7215	0.987705
4	1.170877	21.57442	7.58E-07	0.046522	1.170657	0.999999
5	319.6024	380029.9	0.013511	13.77782	319.671	0.986306
6	12.84421	1554.015	5.37E-05	0.463476	12.55948	0.999949
7	51.86658	29445.32	0.001021	2.762313	51.90002	0.999034
8	9.727354	866.2058	2.73E-05	0.274275	9.730461	0.999973
9	3790.881	29958460	2.0833	67.52319	3284.352	-0.14318
10	211.017	692535.7	0.023638	8.017398	210.7521	0.976789
Aver-age	884.2224	5586901	0.290319	27.36697	832.155	0.804632

propagation algorithm is a gradient descent search algorithm which tries to minimize the mean square of error between the desired output and the target output of neural networks. The error back-propagation to conduct research in space, weight and bias, was applied. The back-propagation algorithm, at each stage, a new output value, compared with the actual value, and the error due to the weight of the modified network is discussed. Each neuron in the network includes a weighted sum of its inputs, a sigmoid transfer function, is filtered. Table 2 shows the evaluation results for Perceptron Network.

In Table 2, time process of learning and measurement of perceptron network is shown.

Table 2: Learning Time and Perception Network Measurement.

Training time (Sec)	Evaluation time (Sec)
12.75842	0.030566
1.66369	0.031107
8.129382	0.030844
46.92172	0.03008
14.42915	0.029928
11.91117	0.030782
6.285443	0.031009
27.26867	0.031031
1.935776	0.030379
13.70953	0.03088
14.50129	0.030661

g. Prediction Using Fuzzy Neural Network

To apply learning data to fuzzy neural network, method parameters should be determined. In table 3, these parameters are shown.

Table 3: Input Parameters of Fuzzy Neural Network

Type	Parameter
Sugeno	Fuzzy type
Hybrid	Optimization Method
Grid Partition	Separation techniques
1000	Cycle No.
5	Membership functions number of the independent variables
Gaussian	Membership function type of the independent variables
Linner	The type of membership function in dependent variable

Table 4: Measurement Results of Stock Price Using Fuzzy Neural Network

Fold	MAD	MSE	NMSE	MAPE	MAE	R2
1	78.11607	35004.33	0.001382	2.315379	77.99947	0.99878
2	80.47855	29759.5	0.000927	1.914379	80.64898	0.999075
3	70.2401	18391.96	0.000634	2.098695	69.97842	0.999393
4	78.06155	23738.78	0.000833	1.939047	76.97994	0.999203
5	74.0733	20944.9	0.000746	2.001339	74.11878	0.999245
6	73.4312	20959.26	0.000724	1.9695	73.59999	0.999316
7	71.87618	27600.63	0.000953	1.984806	71.59247	0.999095
8	1.84693	18801.3	0.000594	1.820493	71.86684	0.99941
9	67.03524	23038.45	0.000992	1.911833	67.12983	0.999121
10	71.85655	22819.1	0.000784	1.811902	71.76916	0.999235
Average	73.70157	24105.82	0.000857	1.976737	73.56839	0.999187

Table 5 shows the measurement results for fuzzy neural network.

Table 5: Learning Process Time and Fuzzy Neural Network

Training time (sec)	Evaluation time (sec)
1520.009	2.000075
1520.023	2.000074
1520.007	2.000072
1520.007	2.000065
1520.01	2.000067
1520.009	2.000067
1520.008	2.000069
1520.008	2.000079
1520.007	2.00008
1520.009	2.000071
1520.01	2.000072

h) CART –aided prediction

Learning data is applied to CART and CART will make an estimator by using data. In tree learning step, first, tree is allowed to develop fully and then, to deal with excessive learning phenomenon, tree pruning will start using validated data. After learning the structure of Tree, it will be saved in computer for calculation. In Table 6 learning process time and fuzzy neural network measurement are shown.

Table 6: The Results of Predicting Rate of Stock Price Using CART

Fold	MAD	MSE	NMSE	MAPE	MAE	R2
1	28.08521	6020.445	0.000237	0.568228	27.64324	0.99979
2	31.82544	5929.721	0.000184	0.56374	31.81061	0.999816
3	33.78729	11275.44	0.000389	0.541446	32.21171	0.999628
4	31.9175	5585.935	0.000196	0.56937	31.77776	0.999812
5	31.01602	4566.076	0.000163	0.599587	30.47545	0.999835
6	29.53936	5481.551	0.000189	0.551265	29.46835	0.999821
7	31.06291	9766.733	0.000337	0.548294	30.33977	0.99968
8	31.2201	7363.141	0.000232	0.534973	30.87263	0.999769
9	25.16068	5501.386	0.000236	0.52908	25.11673	0.99979
10	26.96595	4204.425	0.000144	0.5567	26.87311	0.999859
Average	30.05805	6569.486	0.000231	0.556268	29.65894	0.99978

In table 7, the duration of learning and estimations are shown.

Table 7: Learning Time and CART Estimation

Training time (Sec)	Evaluation time (Sec)
1.049255	0.002357
1.369631	0.003973
1.086367	0.003055
1.111093	0.002558
1.085328	0.002475
1.124765	0.002571
1.086521	0.002458
1.063663	0.002581
1.045142	0.002679
1.073332	0.002557
1.10951	0.002726

i) Prediction using SVR

Learning data apply to SVR algorithm and SVR, using coefficient learning data, attain α_s and then decision function.

$$\max imize - \begin{cases} -\frac{1}{2}\sum_{i,j=1}^{\ell}(\alpha_i - \alpha_i^*)(\alpha_j - \alpha_j^*)\langle x_i, x_j \rangle \\ -\varepsilon\sum_{i=1}^{\ell}(\alpha_i + \alpha_i^*) + \sum_{i=1}^{\ell} y_i(\alpha_i - \alpha_j^*) \end{cases}$$

$$subject\ to \quad \sum_{i=1}^{\ell}(\alpha_i - \alpha_j^*) = 0 \ and\ \alpha_i - \alpha_j^* \in [0, C]$$

$$f(x) = \sum_{k=1}^{N}(\alpha_k - \alpha_k^*) K(x, x_k) + b$$

$$K(x_i^T, x_j) = \exp\left(-\frac{\|x_i - x_j\|^2}{2 \times \sigma^2}\right) \quad \text{Function (7)}$$

In which, k (xi, xj) is called RBF.

Table 8: Stock Price Results Using SVR

Fold	MAD	MSE	NMSE	MAPE	MAE	R2
1	39.78742	54717.77	0.002157	1.30178	39.19522	0.998092
2	41.46662	99308.7	0.003088	1.006185	41.1722	0.996913
3	34.68731	53111.72	0.00183	1.406999	34.04789	0.998247
4	27.80683	3151.914	0.000111	0.810924	27.76773	0.999894
5	38.30543	95490.65	0.003406	0.891197	36.79912	0.996559
6	28.76639	4741.669	0.000164	0.924331	28.63517	0.999845
7	36.72455	50370.54	0.001742	1.216139	36.72499	0.998348
8	26.24521	2496.58	7.88E-05	0.815359	26.21991	0.999922
9	27.93108	12960.48	0.000556	1.066674	27.59216	0.999505
10	31.72045	23290.56	0.000799	0.867685	31.39963	0.999219
Average	33.34413	39964.06	0.001393	1.030727	32.9554	0.998655

In Table 9, the learning time and estimation process are shown.

Table 9: Learning and Estimation Time of SVR

Training time (Sec)	Evaluation time (Sec)
57.2676	0.512143
36.31497	0.533981
36.35785	0.535126
36.4014	0.5888
37.13387	0.585293
35.99649	0.591236
36.89264	0.553817
35.90042	0.579167
37.11067	0.554991
36.53887	0.570692
38.59148	0.560524

4. Conclusion

New credit and monetary policies in one side, and opening capital markets around the world, lead to deepening of globalization process and information revolution in other side, caused that stock exchange and stock in today's world exit from academic textbooks and show themselves as an effective phenomenon in individuals' life.

The more dynamic this movement, the more developed economy would be. In fact, stock is the place of crossing peoples' capitals. Thus it is mandatory that enterprise owners and others be familiar with the structure of stock and stock operation mood. In recent years, some studies in the field of stock price in TSE have begun; and in these studies, predicting stock price using linear and non-linear methods are done, in which, the capacity of stock price prediction in artificial intelligence (neural network, fuzzy neural network etc.) is shown. In recent decade, fuzzy neural networks to solve the problem of complex models determination, using intelligence data factors for academy authors, was so problematic. It is used in many realms. In this study, this process for multilayer perceptron network, fuzzy neural network, CART algorithm, support vector regression, in the case of performance evaluation, 5 criterions were compared. The results show that fuzzy neural network has lesser error than perceptron network.

Algorithms with least error of estimation are presented in Table 10.

Table 10: The Results of the Evaluation of Algorithms, in Order of Performance

Algorithm	MSE	NMSE	MAPE	MAE	R2
CART	6569.486	0.000231	0.556268	29.65894	0.99978
ANFIS	24105.82	0.000857	1.030727	32.9554	0.999187
SVR	39964.06	0.001393	1.976737	73.56839	0.998655
MLP	5586901	0.290319	27.36697	832.155	0.804632

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Appendix

Table 1: Variables and Their Calculation Methods

Variable	Data	Calculation method	Resource
Daily trading volume ratio of the total number of shares	Trading volume, total number of company shares	Total number of shares / turnover	Rahavard Software
Price changes	Price of Today, prices of yesterday	Price of Today, prices of yesterday	Rahavard Software
Lowest Prices	Lowest Prices	-	TSE website
Highest price	Highest price	-	TSE website
First price	First price	-	TSE website
Yesterday price	Yesterday price	-	TSE website
Rate of P/E	Stock price, earnings per share	Stock price, earnings per share	TSE website (Rahavard Software)
Turnover	Turnover	-	TSE website
Number of shares traded	Number of shares traded	-	TSE website
Number of Buyers	Number of Buyers	-	TSE website
Read the Deal	Read the Deal	-	TSE website
Average Price	Average Price	-	TSE website
Last price	Last price	-	TSE website