

*Original Research*

# Stock Price Index Prediction Using Adaptive Neural Fuzzy Inference System

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## Abstract

This paper aims to predict stock prices using open, high, low, close variables using artificial neural networks, especially the adaptive fuzzy neural inference system (ANFIS). Each stock has a different pattern and can be predicted if you have complete data. This study is limited by stock data for 2012-2019. The survey was conducted to collect stock data from the Yahoo Finance website. The stock data used is data from 2001-2018. Learning patterns of data patterns using the Adaptive Neural Fuzzy Inference System (ANFIS) were compared with regression analysis, Mean Square Error (MSE) and Mean Prediction Error. The results show that stock price predictions using the Adaptive Neural Fuzzy Inference System (ANFIS) have a small error rate (below 1 percent). The stock price at closing is determined by the open price and the volume of the stock. The value of the highest price of the stock and the lowest value of the stock follows the determined value of the opening price. This paper contributes to existing research in economics, especially stock investment and Financial Technology.

**Keywords:** Prediction of Stock Price Index; Adaptive Neural Fuzzy Inference System (ANFIS); Artificial Neural Network; Financial Technology

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## Introduction

The implementation of Revolution 4.0 is the application of theory using a computer. Financial Technology uses computers as tools to complete statistical calculations, accounting applications, and so on. With the advancement of Neural Network technology, computers are expected to be able to make predictions such as price predictions, gold price predictions, export investment predictions, competition predictions, and so on.

In this study, the Neural Network algorithm will be used to predict future value patterns on past stock values. We can determine what predicts future prices using the Efficient Market Hypothesis (HPE), which is the most important theoretical pillar of economic literature, by examining past financial assets that failed to produce the desired results. The reason for this is unknown, given the Brownian motion observed in the distribution function of the financial time series, which exhibits the characteristics of a random, independent, and Gaussian distribution (Hu et al., 2018). Predictions using a combination of technical analysis and fuzzy logic show better accuracy than conventional technical analysis (Goykhman & Teimouri, 2018).

The results of the profitability of stock price forecasting have been saved using combined technical analysis with genetics and low forecasting accuracy. The disadvantages of using genetic algorithms are improved by adding technical indicators, time scales, and increasing forecasting accuracy (Patel et al., 2015). Stock price forecasting using Artificial Neural Networks and Genetic Algorithms has been proven to predict stock prices, the challenge is to determine the relationship between the old and the new with the goal of predicting stock prices or stock returns in the near future (Wang et al., 2011).

### *Econometric model.*

Linear regression, autoregressive (AR) moving average, conditional auto-regression heteroscedasticity (ARCH), and conditional auto-regressive heteroscedasticity (CAH) are just a few examples of statistical models that can be used to analyze data (GARCH). The assumption that financial series must be met in order to ensure the accuracy and dependability of the results is one of the most important considerations when assessing the use of these models (Lahmiri, 2018).

### *Model based on machine learning.*

This is a model that is built using artificial intelligence techniques. This field makes use of a variety of techniques, including artificial neural networks, genetic algorithms, fuzzy logic, supporting vector machines, random forests, and crowd particle optimization (Zahedi & Rounaghi, 2015).

This model is frequently used because it allows for the use of a variety of different data types (qualitative and quantitative); In addition, as opposed to econometric models, this method is not subject to the same rigid assumptions as they are (Asadi, 2019). This model is more suitable for dealing with problems with nonlinear, non-stationary characteristics than econometric models (Gunduz et al., 2017). To get better results in predicting stocks, the Hybrid algorithm will be tested which is the result of a

combination of the Backpropagation Network algorithm and the SOM algorithm and financial time series data (Göçken et al., 2016). In this study, this study uses the Adaptive Neural Fuzzy Inferences System (ANFIS) and financial time series data to estimate stock prices on the Indonesia Stock Exchange.

## Literature Review

### *Agency Theory*

Agency theory discusses the separation between company owners (principals) and company management (agents). Due to the fact that the principal and agent are two distinct parties, a conflict of interest exists between them. The owner of the company serves as a source of capital for the organization. Meanwhile, the agent is the management in charge of running the company. Both have an interest in maximizing each other's benefits so there is no guarantee that agents will always act in the company's interests (Dănescu et al., 2015).

In the context of such a relationship, owners and managers are assumed to be rational economic actors and act solely with self-motivation. Therefore, there is often a conflict of interest between owners and managers. This conflict of interest occurs because of asymmetric information between the owner and manager so that the manager can do something in his or her interest and ignore the interests of the owner (moral hazard) (Sedmíhradská, 2015).

There are two types of information asymmetry such as moral hazard and reverse selection (Larcker et al., 2017). Moral hazard is an action taken by an agent that is inconsistent with the principal's interests. Meanwhile, adverse selection is a situation where parties from within the company take advantage of selling inside information that can lead to errors in decision making. Principals can do several things to address this agency problem. The costs incurred to solve agency problems are called agency costs. The amount of agency costs incurred depends on how much the principal sees the agency problem in the company (Packham, 2018).

Agency fees consist of:

1. Monitoring Expenditures (supervision costs), namely costs borne by the head master to monitor the behavior of agents such as costs incurred to establish audit and control systems to limit abuse by management.
2. Bonding expenses (agreement fees), i.e., the price is borne by the agent, with the ultimate burden (i.e., reduced profits), to establish and comply with the mechanisms that guarantee that the agent will perform in the Principal's best interests.
3. Opportunity costs are costs incurred by the company to see opportunities for profit.
4. Structuring expenses (cost structure) are costs incurred as a result of the organization's structured compensation to provide incentives for managers to put in their best efforts to maximize maximum profit.

- a. Additional costs for dealing with agency problems related to form values (Boučková, 2015):
- b. An audit system to limit management authority.
- c. Different types of agreements stipulate that managers do not abuse their power.
- d. Changes to organizational systems to restrict managers from explaining undesirable practices

### *Theory of Signaling*

The theory of signaling examines how the success or failure signals of management (agents) are conveyed to the owners of the company (actors). The theory of signaling explains that signaling is carried out by management in order to reduce asymmetric information.

The company has expressed a desire to share financial statement information with third-party organizations. As a result of an imbalance in information between the company (management) and outside parties, where management knows the company's internal information relative to and more rapidly than outside parties for instance, shareholders and creditors, the impetus for this initiative is created.

Outsiders take steps to protect themselves due to a lack of information about the company. They do so by assigning the company a low value. Businesses can increase their value by reducing asymmetric information. One way to accomplish this is to provide reliable financial information to outsiders, which will alleviate uncertainty about the company's future prospects. Improved performance reports will increase the company's value.

Management's motivation to reveal account statements will serve as a signal of prosperity for the company's owners or shareholders is expected. Following the public release of the company's published financial reports, it will be possible to determine the rate of dividend yield and the direction of the company's stock.

The presence of positive financial statements indicates that the company has been performing satisfactorily over time. When a company issues a good signal, the market will respond favorably because the market response is highly dependent on the fundamental signals issued by the company. If an investor believes that a company has the potential to add more value to its invested capital than it would if the capital were invested elsewhere, the investor will invest their capital. In order to determine the profitability of the company, investors look to the financial statements that the company issues.

A good relationship will continue if the owner or investor is satisfied with the management's performance, and the signal receiver also interprets the company's signal as a positive signal. It is clear that measuring the company's financial performance is critical in the relationship between management and shareholders or investors..

### *Financial Statements*

The company will prepare financial statements that can describe all the results of the company's activities. The financial statements are prepared with the intention of providing information about the results of operations, financial position of various factors that cause changes in financial position to various parties with an interest in the existence of the company so that investors can consider buying and selling their shares on the stock exchange.

Financial statement analysis has the following objectives:

1. To ascertain the financial position of a business over a specified time period, including its assets, liabilities, capital, and operating results over multiple periods.
2. To find out what shortcomings the company does not have.
3. To find out the strength of the company.
4. To verify what future corrective actions should be taken in light of the company's current financial position.
5. To ascertain future management performance whether it is necessary or not fresh because it is considered a success or failure.
6. Can also be used to compare the results achieved by similar businesses.

Based on the description above, until the author's understanding that the financial statement analysis is to obtain a view of the financial position of the business in the future. By analyzing financial statements, the information read from financial statements will become broader and deeper. The relationship between one item and another can be an indicator of the company's financial position and achievements and show evidence of the correctness of the preparation of financial statements.

In order to perform financial statement analysis, it is necessary to use the appropriate analytical methods and techniques. Finding the best analytical methods and techniques to use is important because it allows financial statements to deliver the best possible results. The results of the analysis of financial statements will provide information about the company's weaknesses and strengths.

There are two types of financial statement analysis methods that are commonly used (Goykhman & Teimouri, 2018), namely:

1. Static Analysis
2. Dynamic Analysis

The explanations of the two methods are as follows:

1. Static Analysis

Static analysis is the examination of financial statements for only a single period of time. The comparison is made between posts that were created during a specific time period. The information obtained is only for a single period, and there is no indication of progress from one period to the next.

## 2. Dynamic Analysis

Dynamic analysis is a type of financial analysis that involves comparing financial statements from different time periods. As a result of this investigation, we will be able to see how the company has progressed from one period to another.

In addition to the methods used to analyze financial statements, there are several types of financial statement analysis techniques. The types of financial reporting techniques are as follows:

- a. Comparative Analysis of Financial Statements
- b. Trend Analysis
- c. Percentage Analysis
- d. Analysis of the Source and Use of Funds
- e. Analysis of the Source and Use of Cash
- f. Ratio Analysis
- g. Gross Profit Analysis
- h. Break-even Analysis

The explanation of each financial statement analysis technique is as follows:

1. Comparative analysis between financial statements, an analysis conducted by comparing financial statements for more than one period. That means at least two periods or more. From this analysis we will know the changes that occur. Changes that occur in the form of an increase or decrease in each component analyzed. From this change, it can be seen that any progress or failure in achieving the predetermined targets.

2. Trend analysis, analysis of financial statements which are usually expressed in a certain percentage. This analysis is carried out from period to period so that it will be seen whether the company has changed and how much the change is calculated as a percentage.

3. Percentage analysis per component, the analysis is carried out to compare the components in the financial statements, both in the balance sheet and income statement.

4. Analysis of sources and uses of funds, analysis conducted to determine the source of company funds and use of funds in a period. This analysis is also to determine the amount of working capital and the factors that influence changes in the amount of working capital for even an long period of time.

5. Analysis of the source and use of cash, is an analysis used to determine the source of the company's use of cash and the use of cash in the market.

### *Stock Price Forecast*

Forecasting methodologies can be classified into three types, which often coincide. Three types of analysis exist: financial analysis, technical analysis, and technology techniques.

### *Analysis of Fundamental*

Fundamental analysts are interested in the companies that provide the foundation for the stocks they follow. Additionally, they look at the company's past performance and its ability to produce credible financial statements. Many performance ratios, for instance the price to earnings ratio (P/E ratio), are developed to assist fundamental analysts in determining the validity of a stock.

Fundamental analysis in the financial markets seeks to ascertain a stock's real value, which can then be correlated to the price at which it has swapped in order to ascertain whether or not the stock is undervalued in the market. Finding the true value can be accomplished through a variety of methods that all follow a fundamentally similar principle. The basic assumption is that a business is only worth the sum of its potential earnings. This future gain must also be discounted to its present value in order to be accounted for.

Investment managers frequently employ fundamental analysis because it is the most reasonable and method that is objective for analyzing public information that are available, such as financial statement analysis, and it is the most accurate.

In addition to bottom-up enterprise analysis, fundamental analysis can refer to top-down analysis, which begins with a global economic analysis, progresses to a country-level analysis, then to a sector-level analysis, and finally to an enterprise-level analysis.

### *Analysis of Technical*

Technical statistic analysts are unconcerned with a company's fundamentals. They are attempting to forecast a stock's price movements solely on the basis of historical market sentiment. Various techniques are used in conjunction with patterns, including exponential moving averages (EMA). Technical analysis is more frequently used for particular strategy development than for lengthy strategy development. As a result, it is much more widespread in the commodity and foreign exchange markets, where investors are more concerned with short-term price movements. Several fundamental assumptions underpin this analysis. In the first place, everything important about an undertaking is already priced into the stock; in the second place, prices are changing

and, lastly, history (price), which is due primarily to market sentiment, tends to repeat itself. This analysis is supported by several assumptions.

### *Machine Learning*

With the introduction of digital computers, stock market forecasting has moved from the realm of science to the realm of technology. Genetic Algorithms (GA) and Artificial neural networks (ANN) are two of the most widely used techniques in machine learning. (Patel et al., 2015) ANN can be thought of as a mathematical function that approximates other mathematical functions. The feed network, which uses a reverse diffusion error algorithm to update weights, is the most frequently used type of artificial neural network when it comes to stock price forecasting. Backpropagation networks are the most common name for these types of networks. The Elman, Jordan, and Elman-Jordan networks are examples of RNN and TDNN (time delay neural network), respectively.

When using ANNs for stock forecasting, either of two approaches is typically used to forecast different time perspectives: the independent approach and the combined approach. The independent approach uses an ANN for each period, for example, one day, two days, or five days, as opposed to the dependent approach. It has the advantage that the forecasting error of the network for one time horizon will not have an impact on the error for another period of time—because each period of time is usually treated as a separate problem of a shared approach, which involves grouping multiple period of time together so that determined at the same time. As a result of using this approach, the forecast error for one time horizon can be shared with the forecast error for another time horizon, resulting in decreased performance. As a result, the shared model has more parameters to be fitted, this increases the risk of override.

In order to predict future lows, an ensemble of artificial neural networks (ANN) will use price lows and time lags. The predicted lows and highs are then used to determine whether to buy or sell at a specific price. Individual "low" and "high" networks' outputs can also be fed into the final grid, which will also include volume, cross-market data, and summary price statistics, resulting in the final ensemble output that will trigger a buy, sell, or change market direction decision. ANN and stock prediction have revealed that a classification (as opposed to forecast function) approach. Buy ( $y=1$ ) and sell ( $y=-1$ ) outputs provide quantitative outputs such as low or high prices have a higher predictive reliability.

### *Market Prediction Data Source*

Tobias Price et al. has developed an identify method of online market movements precursors using a trade strategy based on the volume of Google Trends search to identify on-line market movements precursors. They found that the volume of search for financially pertinent search terms will probably increase before significant financial market losses. Three of these terms ( $|z| > 1.96$ ) are statistically significant at the 5 percent level. The term "debt" is the most effective in the negative direction, followed by "color".

Recent research indicates that the Twitter messages' communal intensity is related to the market's performance. The methodology used in this study, on the other hand, has been criticized (Bollen & Mao, 2011). Stock message boards activity has been mined in order to forecast returns on various asset classes. Text mining is used to forecast the Dow Jones Industrial Average's stock price movement using corporate (Gálvez & Gravano, 2017).

### *Market Mimicry*

The New England Complex Systems Institute (NECSI) are employing the latest statistical analysis tools developed by complexity theory conducted a study to predict market crashes (Goykhman & Teimouri, 2018). Since the beginning of time, market crashes have been blamed on panic, that might or might not be merited by outside reports. According to the findings of this study, rather than external crises, it is the market's internal structure that is primarily to blame for the crash.

The number of distinct shares that fluctuate in price simultaneously has been shown to be a proxy for market mimicry, or the extent to which investors look to one another for market cues. When the level of mimicry is high, many stocks tend to move in the same direction as one another, which is a major source of concern.

### *Aspect Structuring of Time Series*

Aspect Structure (JAS), is a trend forecasting technique that has been successfully applied to a variety of stock market and datasets of political and economic time series. With this aspect, you can overcome the difficulties which arise when confronted with multidimensional data because the strong variables are either too various or unmeasurable to be considered into account and used to make estimates. A single major influence variable on the time series, referred to as the "primary factor," is identified and observed, as changes in trend takes place during periods of decreasing relevance in the main variable, according to this method of analysis. There's a good chance the deviation from the mean in this example is not due to the so-called "background factor." While this method is unable to account for the multivariate nature of the background factors, it is capable of measuring their effect on a time series at a specific point in time without actually measuring them. These observations can be used to make educated guesses about the future.

### *ANFIS*

As the name suggests, ANFIS (Adaptive Neuro-Fuzzy Inference System) is a network configuration in which the overall input-output behavior is controlled by a modified set of parameters. Multilayer perceptrons are a type of neural network structure that has multiple layers (MLP). Using a mathematical model, the ANFIS node is capable of forecasting financial time series datasets (Wan & Si, 2017).

Analytic fuzzy logic and neural networks are combined in ANFIS. The application of ANFIS is accomplished through the use of membership functions and the operation of the entire network with fuzzy numbers. Figure 2 illustrates the operation of the

membership function in greater detail: When the proposed ANFIS is applied, the input is 2 (financial condition, managerial overconfidence), and the output is 1 (corporate bankruptcy). ANFIS can quantify the effect of each of these variables on the index using quantitative data by using a mathematical model of the index (figure 1).

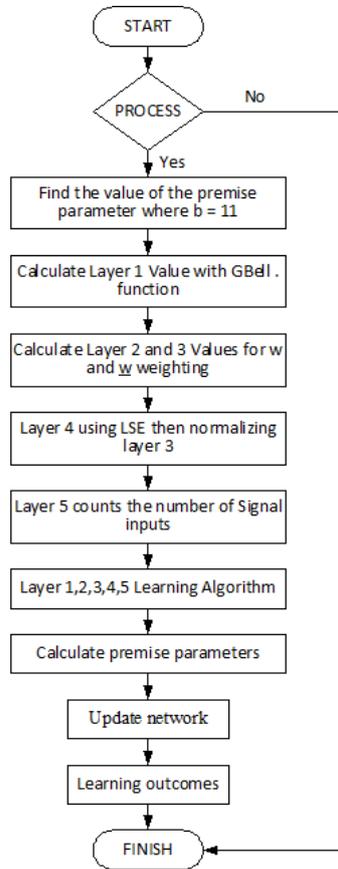


Figure 1. ANFIS Flowchart

Multiple layers comprise the ANFIS system's overall operation. A fuzzification process will be applied to the first layer of data input for each period during the periodization process. According to the classification scheme chosen, the input data is transformed into fuzzy sets in this process (only two types of fuzzy are used in this study: high and low).

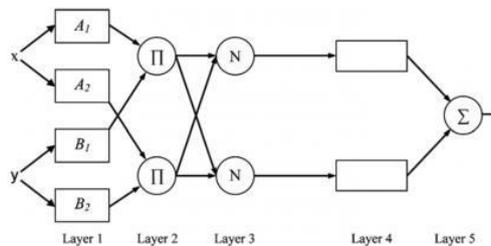


Figure 2. ANFIS Chart  
 Source: (Jang et al., 2005)

The input will be calculated using a fuzzy membership function as part of this process in order to change the traditional input set (crisp) to a specific level. The membership function that was used was of the Bell type, and it had two parameters, namely the mean and the variance. These parameters are referred to as premise parameters in the ANFIS method because they are used in the ANFIS method. Fuzzy rules are established by the inference engine process (fuzzy inference system) in the second and third layers, which are then used by subsequent calculation processes.

Since the ANFIS system is a single-input system, this process does not require any calculation. The output nodes of this layer are the same as the output nodes of the previous layer. The normalized activation level is displayed in each vertex of the third layer of normalized activation. Defuzzification is performed at layer four, where calculations are carried out in order to convert the fuzzy results into sharp output forms. LSA calculations are carried out in this layer in order to obtain the values for the following parameters. The summary process of the two outputs is carried out at layer 4 in layer 5, which is the final layer. The fuzzy system is located at the layers 1, 2, 3, and 4 of the ANFIS system. The hidden nodes of the neural network system are determined by the fuzzy system, which is also known as the fuzzy system. The following is a breakdown of each layer's explanation:

**1<sup>st</sup> layer:**

Adaptive nodes each perform a specific function, which are as follows:

$$n1a = \text{Bell}(x; a1, b1, c1)$$

$$n2a = \text{Bell}(x; a2, b2, c2)$$

A is the fuzzy set membership level parameter A (which is equal to one of the fuzzy set membership levels A1, A2, or B1), and it determines the membership level of the given input. A1 is the fuzzy set membership level parameter A (which is equal to one of the fuzzy set membership levels A1, A2, or B1), and it determines the membership level of the given input x. According to the bell function, the parameters of the membership function A can be approximated as follows:

$$\mu_A(x) = \frac{1}{1 + \left[ \frac{(x - c_i)^2}{2a} \right]^{b_i}} \dots\dots\dots(1)$$

The set of parameters is denoted by the letters ai, bi, and ci. The parameters in this layer are referred to as the premise parameters, and they are defined as follows:

**2<sup>nd</sup> layer:**

Each node in this layer is labeled n3a and n4a, and they are non-adaptive (have fixed parameters) and only pass the result from the first layer to the next. Because the system only has a single input, there is no AND inference in this case. As a result, the output on the second layer is as follows:

$$n3a = n1a \dots\dots\dots(2)$$

$$n4a = n2a \dots\dots\dots (3)$$

**3<sup>rd</sup> layer:**

Each node in this layer is labeled with the numbers n5a and n6a, which indicate that it is also non-adaptive. A normalized activation level is displayed for each vertex, which is in the form:

$$n5a = n3a / (n3a + n4a) \quad n6a = n4a / (n3a + n4a)$$

$$A = \begin{bmatrix} (n5a)x(n) & n5a & (n6a)x(n) & n6a \\ (n5a)x(n) & n5a & (n6a)x(n) & n6a \end{bmatrix} \dots(4)$$

**4<sup>th</sup> layer:**

Each node in this layer is an adaptive node, and it is at this layer that we obtain matrix A, which looks like the following: It is the same number of input data x that determines the number of rows in the matrix. The LSE method is used in this layer to search for the value of the following parameter in the data. The LSE method is represented by the following equation:

$$\theta = inv(A^T A) A^T .y \dots\dots\dots(5)$$

y = Target achieved

$$\theta = [p1 \quad q1 \quad p2 \quad q2] \dots\dots\dots (6)$$

Furthermore, the output of the fourth layer must be calculated, the following equation is used:

$$n7a = p1 * x + q1 \dots\dots\dots (7)$$

$$n8a = p2 * x + q2 \dots\dots\dots (8)$$

**5<sup>th</sup> layer:**

In this layer, there is only one node, denoted by the letter n9a, which counts all outputs as the sum of all incoming signals:

$$n9a = n7a+n8a \dots\dots\dots(9)$$

$$T_s (l,t) = T_g (l,t) \dots\dots\dots (10)$$

**Methodology**

*Data*

The data collected included 396 samples for training and testing.

### *Statistic Analysis*

In this study, four statistical criteria were used to assess the model's ability to predict the future. The coefficient of determination ( $R^2$ ), the root mean squared error (RMSE), the Standard Deviation (STD), and the mean absolute percentage error (MAPE) are the criteria to be considered.

### *Desirability Function*

The main purpose of the desirability function procedure is to transform a multi-response problem into a single problem using a transformation methodology. Some of these responses may be very similar to one another, while others may not follow a consistent pattern. As a result, both the individual and the overall desire functions are established. There is a difference between 0 and 1 in the value of the desire function.

### *ANFIS Modeling and Validation*

ANFIS is a neuro-fuzzy hybrid technique for automatic tuning of based on training data, Fuzzy Type Inference Systems take advantage of the advantages of fuzzy logic and neural networks to make inferences. This type of modeling approach is well suited to processes with non-linear behavior. The data has two parts: training (78%) and test (22%) after calculating the input parameters. The ANFIS model is part of the PREDICTOR software function. To build the ANFIS model, PREDICTOR uses with sharp C (C#).

## **Results And Discussion**

The most immediately apparent advantage of using ANFIS is that it opens up many possibilities for extending existing estimators to mixed data settings. A less advantage stems from an examination of the problem of estimating nonparametric functions in general. Asymptotic arguments are frequently more accessible and established in a continuous setting. For instance, the ANFIS argument makes it easy to obtain a minimal-optimal level of convergence in a mixed data model with nonparametric variables.

The critical issue in non-parametrics is the estimator's characteristics. The primary criterion is how the "local" estimator operates; more precisely, whether the estimator is affected only by data collected in a compact environment. This methodology applies only to nonparametric estimators. Usually, the form is functional.

The program display for parameter selection is as follows.

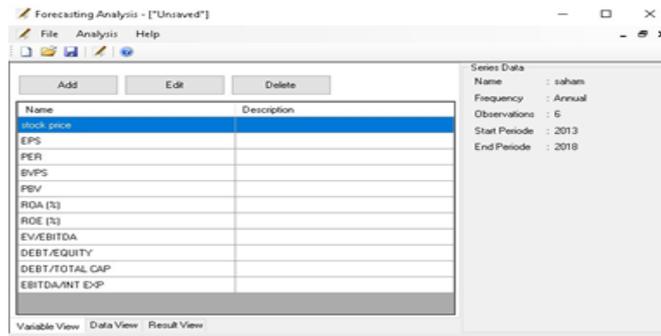


Figure 3. ANFIS Parameter  
 Source: data processing, Matlab 2017b

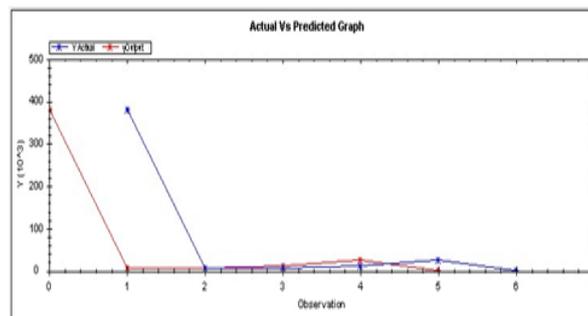


Figure 4. ANFIS Learning Process  
 Source: data processing, Matlab 2017b

Table 1 shows the description of the variables used for prediction

Table 1. Variable Description

Variable	Description
Stock price	Composite Stock Price Index
ROA	Return on Assets
ROE	Return on Equity
EPS	Earnings Per Share
PER	Price Earnings Ratio
BPVS	Book Value Per Share
PBV	Price to Book Value Ratio
EV	Enterprise Value
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
DEBT / EQUITY	Debt to Equity Ratio (DER)
DEBT/ TOTAL CAP	Debt to Capitalization Ratio
EBITDA / INT EXP	Earnings Before Interest, Taxes, Depreciation and Amortization / Interest Expense

Source: (G.Siegel, 2000)

Table 2. Results of Analysis with ANFIS

Dependent variable	Independent Variable	Mean Square Error(MSE)	Mean Percentage Error (MPE)
Stock price	ROA, ROE	0.000333	-0.000019
Stock price	ROA, ROE, BVPS	0	0
Stock price	ROA, ROE, EPS	0	0
Stock price	ROA, ROE, PER	0	0
Stock price	ROA, ROE, PBV	0	0
Stock price	ROE, EPS, PER	0	0
Stock price	ROE, EPS, PBV	0	0
Stock price	ROE, EPS, BVPS	40401988 0.01	-25.334
Stock price	ROA, ROE, BVPS, EPS	0	0
Stock price	ROA, ROE, BVPS, EPS, PER	0	0
Stock price	ROA, PBV, BVPS, PER, EPS	0	0
Stock price	ROE, PBV, BVPS, PER, EPS	0	0

Table 2 shows that ROA, ROE, EPS, PBV, BVPS, PER affect Stock Prices, both simultaneously, except DEBT / EQUITY, CAP DEBT / TOTAL, EBITDA / INT EXP

can not be predicted if only with one variable, this means profit for the year then / loss can not be a guideline for stock forecasting, need other variables to make forecasts. With the assumption of autocorrelation ignored.

## Conclusions and Suggestions

Precise timely forecasts are very valuable for companies to take profit. This paper uses the Composite Stock Price Index (ISHG) data. Even the historical stock data of large companies has been used. Financial analysis shows that R O A, R O E, E P S, P E R, B V P S, P B V, and low MSE and MAPE values show a strong correlation with output (stock price). So now we can say that, ANFIS can be used to predict the stock market closing price one day ahead providing historical data beforehand. To avoid autocorrelation, it is better if the entered variables are tested for autocorrelation first, or the analysis can be combined with Statistical Analysis.

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