



Forecasting The Stock Market Movements Of Unilever Companies Jakarta During The Covid-19 Pandemic Using Artificial Neural Network

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Abstract: The coronavirus (Covid-19) pandemic that has hit Indonesia since March 2020 and has been spreading for a year has led to twists and turns to stock price movements in the capital market. This study aims to determine the accuracy of predictions and movements in the stock price of UNVR companies. JKT in the face of the Covid 19 pandemic. Daily stock data samples from January 01, 2019 to May 15, 2021 taken from <https://finance.yahoo.com/quote/UNVR.JK> p=UNVR.JK sources. The data information in this study includes closure as a class or label. Medium attributes the opening, high, low, and volume of the company's stock as an atribut or predictor. As many as 90% datasets as data training to build models and as much as 10% datasets as data testing. Data analysis is done with Artificial Neural Network algorithm to predict the value of the company's share price. The right stock price prediction will provide knowledge information about the current status and future stock price movements. The results showed that the ANN model obtained from the experiment results was with 95% training data and 5% testing data. The ANN model has 5 input notes with one bias note, one hidden layer with 5 notes including one bias and produces one output that is stock closing. The validation result of RMSE value model is 62,741 and SE value is 3936.43. The accuracy of the model with a correlation coefficient value of 0.998 means there is a very strong positive correlation between the actual data and the prediction data.

Keywords: Prediction, Stock Price, Artificial Neural Network

INTRODUCTION

The Covid 19 pandemic disaster that entered Indonesia in March 2020 has brought changes in economic conditions, especially impacting the development of the company's stock price. The coronavirus pandemic in the past year has not only caused highs and downs in stock indices, but spawned a new generation of stock investors (Tari, 2021). Decline in UNVR's share price. JKT

this year due to the coronavirus pandemic showed a trend that followed the Composite Stock Price Index (JCI) which is until the third week of March 2020, reaching more than 30%. Unlike the conditions in 2008 where unvr shares. JKT tends to be defensive and when during 2008 JCI fell -50% but unvr shares. JKT is still able to grow by about 8%.

With the announcement of the Covid-19 pandemic health disaster in Indonesia on March 2, 2020, it has a direct impact on stock trading, especially the share price of UNVR. JKT which closed 6,900 and the next day immediately tended to fall to 5,650 on March 19, 2020. To anticipate such a situation, a fundamental analysis of stocks is required based on the performance and business prospects of a company (Budiman, 2020).

This process is very important to do before making an investment decision. This condition that makes all companies surprised by the spread of the Covid-19 pandemic began to change the management system so that a month later the stock prices began to move positively again, namely on April 23, 2020 unvr shares. JKT closed at 7,500. However, this pandemic that has not been clear the end has displaced business systems and mechanisms. Government policies limiting large-scale mobility of sedentary people and a homecoming ban have had implications for falling stock prices in UNVR companies. JKT again dropped to reach 5,550 on May 7, 2021 (<https://finance.yahoo.com/quote/UNVR.JK/chart?p=UNVR.JK>).

The pattern of price movements that are very variable as mentioned above is certainly a thought for entrepreneurs and a good analysis is needed to predict the movement of the company's stock price. Prediction and analysis of stock market data plays an important role in today's economy. In various activities all investments are needed an analysis so that investment can be maximized and develop (Wijaya, 2012). Stock price prediction is done by the application of the Artificial Neural Network (ANN) method, where the algorithm has the ability to extract useful information from large datasets so that ANN is considered able to predict the stock market and is very useful for predicting stock prices in general (Thangaraj et al., 2015). Thus, an investor will get the benefit of the results of this prediction has become the right model to predict stock prices and volatility affected by macroeconomic factors and other factors (Gao et al., 2020).

This research aims to find out the predictive value and movement of the stock price value of UNVR companies. JKT in the face of the Covid 19 pandemic. By knowing the pattern of movement of the company's stock price data in the future, the company's leadership will be able to take strategic steps in making business policies or decisions so that the company can run well in accordance with the targets that have been set in accordance with the planning.

RESEARCH METHODS

The study's stock data uses secondary data. Parameters or data attributes include closing, opening, high, low, volume of company shares. Data samples were taken before and during the Covid 19 pandemic from January 1, 2019 to May 15, 2021. This research data is further divided into two datasets, namely 95% as training data to train models and by 5% as data testing. Before the analysis was previously done pre-processing data that is to find out the existence of missing values, outliers and data inconsistencies. Conceptually the frame of mind in this study in the image below:

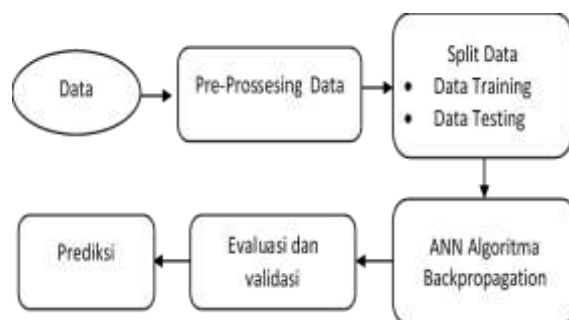


Figure 1. Research Framework

The research data was analyzed with the Artificial Neural Network (ANN) method. Artificial Neural Networks (JST), often called neural networks, are a collection of interconnected links that have weights associated with them. In general, JST consists of three layers that form it, namely input layer, hidden layer, and output layer. The workings of the three layers is the input layer is the initial value input that will be passed to the hidden layer in the form of a weight value to be processed and will later come out through the output layer. *Artificial Neural Network architecture model as in the image below.*

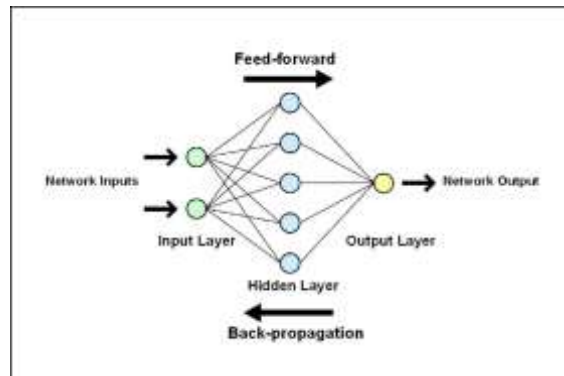


Figure 2. Artificial Neural Network Backpropagation Model Architecture (Source: (Gullu et al., n.d.)

Each pattern of input and output information provided into ann is processed in neurons. These neurons collect in layers called neuron layers consisting of input layers, hidden layers and output layers:

1. Input Layer, the units within the input layer are called input units. These input units receive an outside input pattern that further describes the input data of a problem.
2. Hidden layers, units within hidden layers are called hidden units. This hidden layer rhymes inputs where inputs to the output cannot be directly observed.
3. Output Layer, The units within the output layer are called output units. The output of this layer is an ANN solution to a problem.

The idea of this neural network model was first inspired by a nervous system consisting of a number of processing units called neurons. Each neuron receives some signal from outside or from another neuron and then by processing it in the activation function produces an output and sends it to another neuron. Each input impact is different from other inputs. Neural networks have the ability to extract information from large data sets (Patel & Yalamalle, 2014).

The accuracy of model validation uses criteria on correlation coefficient values, Root Mean Square Error (RMSE), and Mean Square Error (MSE). ANN performance is evaluated using the quadratic error coefficient of the modeled output (Hedayati et al., 2016). Correlation shows the relationship between observational data and prediction data. The greater the value of the correlation coefficient, the better the pattern of relationship between observation data and prediction data. While validating a model with an RMSE parameter, MSE is an error rate or measuring error in a model. The smaller the value of these parameters, the interpretive the model developed the better.

Root Mean Square Error (RMSE), is the sum of the square errors or the difference between the actual value and the predetermined predictive value. The formula of the RMSE formula is as follows:

$$RMSE = \sqrt{\sum_{i=1}^n \frac{(\hat{y}_i - y_i)^2}{n}}$$

RMSE = root mean square error value

y = observation value

\hat{y} = predicted result value
 i = sequence of data on the database
 n = amount of data

MAE (Mean Absolute Error) indicates the average error value that is the error of the actual value with the prediction value. MSE is the average value of error kwadrat. The model is said to have good accuracy or is considered valid if the MSE value $\leq 5\%$ (Suryani, 2006). Mathematically the formulas of MSE are:

$$MSE = \sum \frac{(Y' - Y)^2}{n}$$

Where:

MSE = Mean Square Error Value

\hat{Y} = Predicted Result Value

Y = Observation/actual result value

n = Amount of Data

The accuracy of the forecasting model will be higher if the values of RMSE and MSE are getting smaller.

RESULTS AND DISCUSSIONS

Data Description

Stock closing data patterns have a tendency to continue to decline lately. It is seen in the chart that this decline in the value of this stock as long as the pandemic has the smallest value on March 23, 2020. During the observation period the average value of the stock closing amounted to 8,272 with a maximum value of 9,890 and a minimum value of 6,500 Dynamics of fluctuations in UNVR stock closing data. JKT can be shown in figure 1 below.

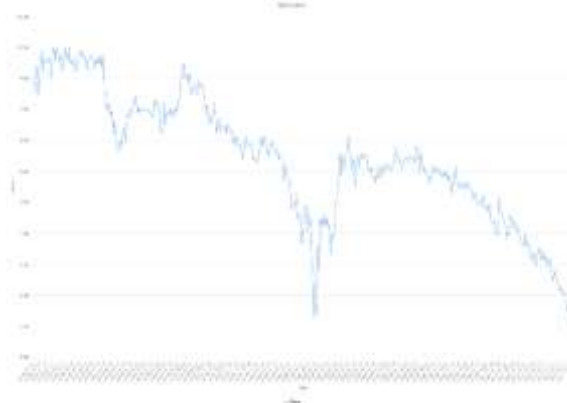


Figure 3. UNVR stock closing chart. JKT (January 2, 2019 – May 11, 2021)

Experiment

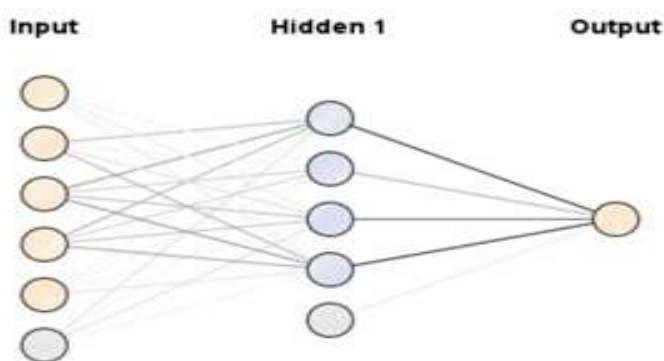
In choosing a suitable model or optimal model with a neural network model has been treated several times the experimental scenario by changing the percentage of training data and data testing. The first scenario with split data 90% data training and 10% data testing, the second scenario split data with 95% data training and 5% data testing, and the third skenario split data 99% data training and 1% data testing. The results of the model are further compared by considering the error values in RMSE (Root Mean Square Error) and SE (Square Error) in each scenario:

Table 1. Scenario Outcome Comparison

Skenario	RMSE	SE
Data 90% Training dan 10% testing	70.142	4919.882
Data 95% Training dan 5% testing	62.741	3936.433
Data 99% Training dan 1% testing	120.594	14542.825

Source: Research Data Processing Results

From the results of the modeling obtained the best model is a model where 95% as training data and 5% data testing because it has the smallest error value. Thus, the model can be continued to be able to predict the stock price. From ANN modeling obtained results there are 3 layers, namely input layer, hidden and results. The input layer consists of 5 inputs, including input bias 1, there is one hidden layer consisting of 5 inputs, namely close, open, high, low and volume and note bias 1. At output there is only one that is closure.



Picture 4. Ann network image Of the trial results.

Stock Predictions

The most important stage of research is the conformity of actual data patterns with predictive data. A prediction will have a good fit if it has the same pattern as the actual.

Table 2. Comparison of Predictive Value with Actual

Date	Share Closing Value	
	Actual	Prediction
09-Jan-19	9,470	9,396
16-Jan-19	9,585	9,646
12-Mar-19	9,800	9,728
.	.	.
.	.	.
.	.	.
24-Feb-21	6,850	6,893
04-Mar-21	6,725	6,731
30-Mar-21	6,550	6,556

Source: Research Data Processing Results

Visually the graph of the pattern of comparison of prediction data with actual can be seen in figure 5 as follows:

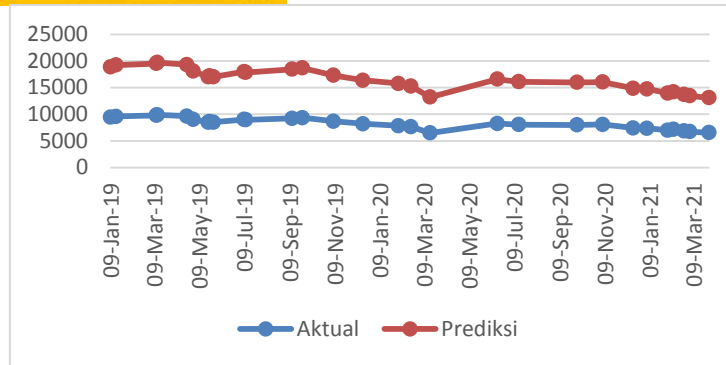


Figure 5. Actual Data Patterns and Stock Closing Predictions.

From the results of observations on the data patterns above between actual data with predictions of rhythmic patterns. It can be explained that the ANN model is quite good and can predict the closing value of the stock in the future. To test whether the prediction pattern of actual data with prediction data can be done with correlation analysis. The correlation value of actual data with predictions of 0.998 means that there is a very strong positive correlation between actual data and prediction data. By testing the regression coefficient value with pearson corellation sig value (2-tailed) of 0.000 para level $\alpha = 1\%$ this result concluded that there is a very strong correlation that is very significant.

Table 3. Correlation Coefficient Test Results

Description		Actual Data	Prediction Data
Data Aktual	Pearson Correlation	1	0.998**
	Sig. (2-tailed)		.000
	N	29	29
Data Prediksi	Pearson Correlation	0.998**	1
	Sig. (2-tailed)	.000	
	N	29	29

** . Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Data Processing Results

CONCLUSION

From the results of this study the algorithm method with ANN using datasets 95% data trainingd and 5% data testing produced the best modeling with a validation rate of RMSE of 76,741 and SE of 3936.43. This value is the best value of the various alternative datasets scenarios that have been piloted in the ANN modeling. Thus, this neural network model can be used to predict the closing value of the stock for the next day.

From the results of this modeling, then to further improve the accuracy of the data can then be recommended to do with other algorithm models or by adding the number of layers on hidden notes that can provide improved accuracy levels.

REFERENSI

- Budiman, R. (2020). *Rahasia Analisis Fundamental Saham: Analisis Perusahaan*. Jakarta: PT. Elex Media Komputindo.
- Gao, P., Zhang, R., & Yang, X. (2020). *The Application of Stock Index Price Prediction with Neural Network*. <https://doi.org/10.3390/mca25030053>
- Gullu, M., Yilmaz, M., & Yilmaz, I. (n.d.). *Application of Back Propagation Artificial Neural Network for Modelling Local GPS / Levelling Geoid Undulations : A Comparative Study Application of Back Propagation Artificial Neural Network for Modelling Local GPS / Levelling Geoid Undulations : A Comparative Study*. May 2011, 18–22.
- Hedayati, A., Hedayati, M., & Esfandyari, M. (2016). Stock market index prediction using artificial neural network. *Journal of Economics, Finance and Administrative Science*, 21(41), 89–93. <https://doi.org/10.1016/j.jefas.2016.07.002>
- Romadhina, A. P. (2020). Pengantar Ilmu Ekonomi Mikro Dan Makro.
- Lesmana, R., Sutarman, A., & Sunardi, N. Building A Customer Loyalty Through Service Quality Mediated by Customer Satisfaction. *American Journal of Humanities and Social Sciences Research (AJHSSR)*, 5(3), 38-45
- Lesmana, R., Sunardi, N., & Kartono. The Effect of Financing and Online Marketing on MSMEs Income Increasing at Intermoda Modern Market BSD City Tangerang Selatan. *American Journal of Humanities and Social Sciences Research (AJHSSR)*, 5(7), 25-34
- Sugiyanto, S. (2019). The Liquidity, Profitability, Good Corporate Governance, Corporate Value Committee. *Proceedings Universitas Pamulang*, 1(1).
- Sugiyanto, S., & Fitria, J. R. (2019). The Effect Karakter Eksekutif, Intensitas Modal, Dan Good Corporate Governance Terhadap Penghindaran Pajak (Studi Empiris pada Perusahaan Manufaktur Sektor Food & Beverages Idx Tahun 2014-2018). *Proceedings Universitas Pamulang*, 1(1).
- Romadhina, A. P. (2020). Pengantar Ilmu Ekonomi Mikro dan Makro.
- Sugiyanto, L. N., & Wanten, I. K. (2020). Studi Kelayakan Bisnis Penerbit Yayasan Pendidikan dan Sosial Indonesia Maju (YPSIM) Banten 2020. *Cetak Perdana*.
- Sunardi, N., & Lesmana, R. (2020). Konsep Icepower (Wiramadu) sebagai Solusi Wirausaha menuju Desa Sejahtera Mandiri (DMS) pada Masa Pandemi Covid-19. *JIMF (Jurnal Ilmiah Manajemen Forkamma)*, 4(1).
- Sugiyanto, E. M. (2018). Earning Management. *Risk Profile And Efficient Operation In The Prediction Model Of Banking: Eviden From Indonesia*.
- Patel, M. B., & Yalamalle, S. R. (2014). *Stock Price Prediction Using Artificial*. 3(6), 13755–13762.
- Tari, D. N. (2021). *Setahun Corona di Indonesia, Pasang Surut IHSG dan Generasi Baru*. <https://market.bisnis.com/read/20210302/7/1362610/setahun-corona-di-indonesia-pasang-surut-ihsg-dan-generasi-baru-investor-saham>
- Thangaraj, E., Subinson, G., & Shibi, S. R. (2015). *A Survey of Artificial Neural Networks machine learning methods and Applications in Bio-Neuron System*. 4(7), 697–702.
- Wijaya, R. F. (2012). *Investasi Saham Ala Swing Trader Dunia*. Jakarta: Elex Media Komputindo.