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Backpropagation for Predicting the Share of Share Index Industry in Asean

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***Abstract* - This study aims to predict the index of stock exchanges in several ASEAN countries represented by Indonesia, Malaysia, Singapore, Thailand, the Philippines for the period of 2014. This research uses a Backpropagation Neural Network method. Data used for Input in this research is the daily data from the index of the stock exchange, and the data used is the stock closing price. The amount of data used is 213, this data is divided into 2 (two) parts, which are the training data as much as 200 data and the data testing as much as 13 data. The data training itself is divided into 2 (two) groups, the first group uses 1 hidden layer, epoch = 300, learning rate = 0.5, momenteum = 0.6, the function used is tansig and purelin, the neurons used are 1 2 3 5 7 10 12 15. The second group uses 1 hidden layer, epoch = 500, learning rate = 0.3, momenteum = 0.5, the functions used are tansig and purelin, the neurons used for the two groups are 1, 3, 5, 7, 10, 12, 15. At the end of the research, the smallest RMSE (Root Mean Square Error) value from the second group traning is 0.079388, while the smallest RMSE value for testing from the first group is 0.392098.**

***Keywords* - Stock exchange index, Backpropagation Neural Network, RMSE**

I. INTRODUCTION

Shares are identical to the Capital Market, the capital market is one of the drivers of a country's economy. As the capital market is a means of capital formation and the accumulation of long-term funds directed to increase public participation in the mobilization of funds to support the financing of national development. In addition, the capital market is also a representation to assess the condition of companies in a country since almost all the industries in a country are represented by the capital market. A bullish or bearish stock market is seen from the ups and downs of listed stock prices reflected through a stock index movement.

Usually, stock exchanges adjacent to the location, have often the same investors. These causes of changes in one exchange will also be transmitted to other countries' exchanges. In this case, a larger exchange will usually affect smaller exchanges [6] as with Indonesia which is included in Southeast Asia.

Index data is a periodical data, ie the data presented in a certain time. The periodical data is closely related to the depth or prediction. One attempt before taking the decision of the market participants is to forecast the value in the future. Before making an investment decision, an investor needs historical data about the movement of shares circulated in the stock. The behavior of investment decision of an investor in a capital market will be reflected from the movement of the Composite Stock Price Index (IHSG). Forecasting models determines the accuracy of the forecasting results so that the selection of the right model becomes very important. Due to the dynamic nature of forecasting model, it makes the development of data forecasting model of time series is becoming faster and faster.

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Backpropagation (BP) is a popular Neural Network (NN) model used to solve problems both in forecasting and others [1]. This type of network is a multi-layer perceptron architecture, often called Multi Layer Perceptron (MLP). Because of its popularity, some researchers have used Backpropagation to forecast the stock price index [3][7].

Choosing the right model is needed to predict the movement of stock index in ASEAN, so that it can be done for an action or making decisions. In this research the Backpropogation Neural Network will be used to predict the movement of exchanges in ASEAN.

II. MATERIALS AND METHODS

Understanding a general capital market according to Law Number 8 of 1995 concerning Capital Market is an activity related to public offering and securities trading, public company related to its issuing securities, as well as securities-related institutions and professions. Whereas in a narrow sense the capital market is the market (place, in the form of buildings) prepared to trade stocks, bonds and other types of securities using the services of intermediaries of securities traders [12].

Furthermore, the capital market is an abstract market, because it sells long-term funds, ie funds related to investment over one year [5].

Based on the above definition, the capital market can be interpreted as a place to reconcile the selling and buying of securities of other parties with the aim of trading the securities between them.

There are several ways to exploit the excess of funds, one of them is through investment in the form of shares. The main factor that affects stock prices is different perceptions of each investor in accordance with the information obtained. In the business world, respectively every time we invest, the investment will always contain profit or profit and risk [8].

Artificial Neural Network (ANN) is defined as an information processing system that has characteristics resembling a human neural network. The Artificial Neural Networks are created as a generalization of the mathematical model of human cognition based on the following assumptions [2]:

1. Information processing occurs in a simple element called a neuron.
2. Cues flow between nerve cells/neurons through a connecting link
3. Each connecting connection has corresponding weights. This weight will be used to double/multiply the gestures sent through it.
4. Each nerve cell will apply an activation function to the weighted signal summation that enters it to determine its output signal.

The activation function in this study is to determine the output of a neuron, so different activation functions will produce different results on a neural network. The activation functions used in artificial neural networks, among others, are [10]:

1. Linear, a straight line of binary and bipolar
2. Logarithmic, consisting of binary and bipolar logarithmic

The closest to the nervous system is the logarithmic function. In Matlab programming language, linear and logarithmic activation functions (binary and bipolar) are consecutive with purelin, logsig, and tansig functions.

Based on the artificial neural definition above, then the knowledge stored in the system must be given through learning. Learning is a process in which free parameters in artificial neural networks adapt to the environment in which neural networks are installed. The type of learning is determined based on the means used to change the artificial neural network parameters [10]

Broadly speaking, there are two types of learning process based on an output approach method, which are the supervised learning and unsupervised learning. In the supervised learning, the target class is determined earlier, whereas, in the unsupervised learning it is not specified. Most applications of artificial neural networks for classification use the supervised learning

Back propagation is the most commonly used method of learning ANN network. This method works through the process iteratively by using a set of data samples (data training), comparing the predicted value of the network with each instance. In each process, the relational weights in the network are modified to minimize Mean Square Error (MSE) values between the predicted values of the network and the real values. The modification of the ANN relation is done backwards, from the output layer to the first layer of the hidden layer so that this method is called back propagation [4].

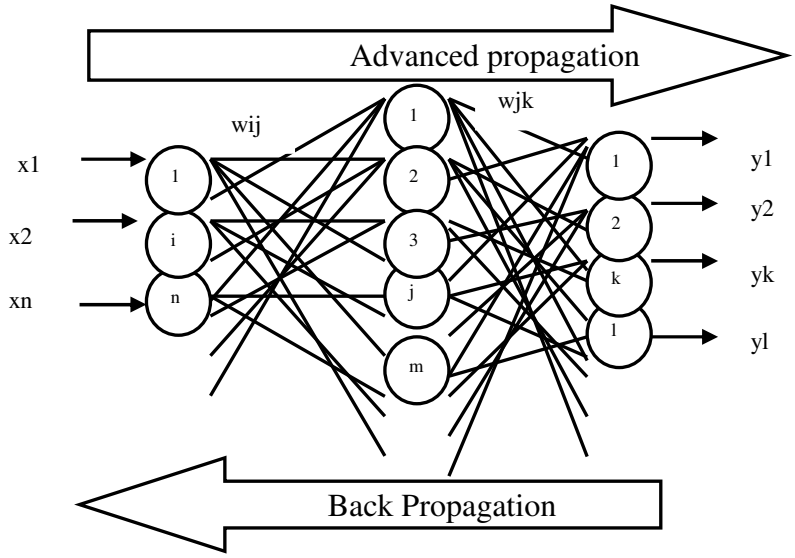

Figure 2.2 ANN Backpropagation Architecture [9]

The steps in the learning process using the back-propagation algorithm are as follows:

1. Initializing network weights at random (typically, between -1.0 to 1.0).
2. For each sample data (data training), calculating the output based on the network weight at that time.
3. Performing the process of calculating the error value for each output (output) and hidden node (neuron) in the network. Network relation weights are modified.
4. Repeat step 2 until the desired condition is reached

This research is the applied research that aims to find solutions about the problem in predicting stock prices. This stock price prediction research is complemented by the research stages, as well as the research design chart. The steps taken by the author for the formation of the MLP model are [2], starting from data collection, separating data for training and testing, determining a network structure, choosing learning algorithm, initializing network parameters, inputting training data, weight, testing and final implementation of artificial neural networks.

This study uses secondary data that is data collected by researchers themselves through the web.

Initially, the data used in the study is the daily data of the closing price of the stock index in ASEAN from 2009 to 2014 from the States in ASEAN which are represented by Indonesia, Malaysia, Thailand, Singapore, the Philippines, Vietnam, but due to incomplete data obtained then the data disconnected used is the index data of the stock exchange in 2014 alone, and the stock index used is from Indonesia, Malaysia, Thailand, Singapore, the Philippines.

III. Result Analysis And Discussion

3.1 Data Analysis

This study uses the daily data of the closing price of the stock index in some ASEAN countries.

Table 3.1 net data used in the research

No	Date	closejkse	closeklse	closeftse	closepsei	closeset
1	1/2/2014	4327.265	1.852,95	3.174,65	5.984,26	1.230,77
2	1/3/2014	4257.663	1.834,74	3.131,47	5.947,93	1.224,62
3	1/6/2014	4202.809	1.829,18	3.123,82	5.985,81	1.230,84

4	1/7/2014	4175.806	1.825,11	3.120,88	5.947,44	1.262,36
5	1/8/2014	4200.593	1.831,30	3.150,65	5.986,48	1.257,73
6	1/9/2014	4201.218	1.828,21	3.145,41	5.937,51	1.258,26
7	1/10/2014	4254.971	1.826,61	3.143,87	5.842,88	1.255,45
8	1/13/2014	4390.771	1.834,97	3.135,49	5.940,67	1.283,56
9	1/15/2014	4441.594	1.824,03	3.143,25	5.958,12	1.277,03
10	1/16/2014	4412.489	1.813,01	3.140,44	5.982,24	1.301,48
.	.	.	.	.	.	.
.	12/18/2014	5113.345	1.699,95	3.243,65	7.029,28	1.516,79
.	12/19/2014	5144.621	1.715,99	3.279,53	7.125,63	1.514,35
.	12/22/2014	5125.772	1.744,05	3.330,96	7.139,27	1.536,83
etc	12/23/2014	5139.068	1.749,05	3.332,51	7.186,32	1.531,17

Data training and data testing

All the data used from January to December 2014 is 213 data. The data is divided into 2 (two) parts, which is the data training and data testing. The data for training is 200 (data from 1 up to 200 data) and 13 data (data from 201 up to 213 data) for testing. The training data used for 200 data is intended for the results of the training which can be bette**r.**

Table 3.2 Data on the closing trade of the index training in ASEAN

NO	closejkse	closeklse	closeftse	closepsei	closeset	targetjkse
1	4327.265	1852.95	3174.65	5984.26	1230.77	4257.663
2	4257.663	1834.74	3131.47	5947.93	1224.62	4202.809
3	4202.809	1829.18	3123.82	5985.81	1230.84	4175.806
4	4175.806	1825.11	3120.88	5947.44	1262.36	4200.593
5	4200.593	1831.3	3150.65	5986.48	1257.73	4201.218
6	4201.218	1828.21	3145.41	5937.51	1258.26	4254.971
7	4254.971	1826.61	3143.87	5842.88	1255.45	4390.771
8	4390.771	1834.97	3135.49	5940.67	1283.56	4441.594
9	4441.594	1824.03	3143.25	5958.12	1277.03	4412.489
10	4412.489	1813.01	3140.44	5982.24	1301.48	4412.228
11	4412.228	1813.01	3147.33	5987.09	1295.41	4431.572
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
197	5133.036	1842.17	3349.66	7356.59	1591	5145.315
198	5145.315	1829.91	3340.96	7265.34	1599.82	5149.888
199	5149.888	1820.89	3350.5	7294.38	1593.91	5164.288
200	5164.288	1778.27	3305.64	7331.73	1593.82	5175.793

Table 3.3 Data testing of the closing price of the stock index in ASEAN

NO	closejkse	closeklse	closeftse	closepsei	closeset	targetjkse
201	5175.793	1785.97	3322.32	7344.23	1594	5166.044
202	5166.044	1758.15	3303.39	7360.75	1594.58	5177.16
203	5177.16	1745.69	3304.82	7299.85	1597.76	5122.312
204	5122.312	1738.1	3319.84	7183.87	1559.56	5152.695
205	5152.695	1744.57	3318.7	7072.1	1526.81	5160.433
206	5160.433	1732.99	3324.13	7224.21	1514.95	5108.432
207	5108.432	1697.31	3294.14	7275.62	1478.49	5026.028
208	5026.028	1673.94	3215.09	7160.38	1461.74	5035.649
209	5035.649	1681.9	3227.23	6966.21	1480.2	5113.345
210	5113.345	1699.95	3243.65	7029.28	1516.79	5144.621
211	5144.621	1715.99	3279.53	7125.63	1514.35	5125.772
212	5125.772	1744.05	3330.96	7139.27	1536.83	5139.068
213	5139.068	1749.05	3332.51	7186.32	1531.17	5178.373

3.2 Training and Testing

The training data in this research consists of 2 groups of data.

- The data in the 1st group will use 1 hidden layer, epoch = 300, learning rate = 0.5, momenteum = 0.6, the functions used are tansig and purelin, the neurons used are: [1 1], [3 1], [5 1], [7 1], [10 1], [12 1], [15 1]
- The data in the 2nd group will use 1 hidden layer, epoch = 500, learning rate = 0.3, momenteum = 0.5, the functions used are tansig and purelin, the neurons used are: [1 1], [3 1], [5 1], [7 1], [10 1], [12 1], [15 1]

In this research, Pre-processing data is used to change the data so that the data lies between -1 and 1. After the training and simulation, then the resulting output must be returned to the original scale. Returning data to its original scale is called Post-processing [11].

The first group

The training data to predict the closing price of the Jakarta Stock Exchange (JKSE) Index in the 1st group will use 1 hidden layer, with epoch = 30 0, and learning rate 0.5, MC = 06 and the functions used are Tansig and Purelin.

Table 3.4 The RMSE value of the first group training, to predict the closing price of the JKSE Index

NO	Neuron	RMSE	Information
1	1	0.085543	**Smallest Rmse value**
2	3	0.086281	
3	5	0.119261	
4	7	0.101441	
5	10	0.092543	
6	12	2.520769	
7	15	0.091684	

From the above training results, it is known that the smallest value is no.1, with RMSE value of 0.085543. Based on this training, the result of comparison of the actual data and predicted result of the closing price of the JKSE index is as shown below.

Figure 3.1 Comparison of the actual data and JKSE index prediction result based on the first group training data

The second group

The training data to predict the closing price of the Jakarta Stock Exchange (JKSE) Index in the 1st group will use 1 hidden layer, with epoch = 50 0, and learning rate 0.3, MC = 05 and the functions used are Tansig and Purelin.

Table 3.5 The RMSE value of the 2nd group training, to predict the closing price of the JKSE Index

NO	Neuron	RMSE	Information
1	1	0.090427	
2	3	0.089726	
3	5	0.094735	
4	7	0.081719	
5	10	0.082789	
6	12	0.084047	
7	15	0.079388	**Smallest Rmse value**

From the above training results, it is known that the smallest RMSE value is no.1, with RMSE value of 0.079388. Based on this training, the result of comparison of the actual data and predicted result of closing price of the JKSE index is as shown below.

Figure 3.2 Comparison of the actual data and the JKSE index prediction result based on the second group training data

3.4 Results of the RMSE Value Testing Data of a Closing Exchange Index in ASEAN

The First group

Data testing to predict the closing price of the Jakarta Stock Exchange (JKSE) index in the 1st group will use 1 hidden layer, with epoch = 300, and learning rate 0.5, MC = 0.6 and the functions used are Tansig and Purelin.

Table 3.6 RMSE value of the first group testing, to predict the closing price of the JKSE

NO	Neuron	RMSE	Information
1	1	0.52906	
2	3	0.457471	
3	5	0.392098	**Smallest Rmse value**
4	7	0.427392	
5	10	0.594835	
6	12	2.360658	
7	15	0.571192	

From the above test results, it is known that the smallest RMSE value is no.3, with RMSE value of 0.392098. Based on this testing, the resulting comparison of the actual data and predicted closing results of the JKSE index based on the first group testing data is as shown below.

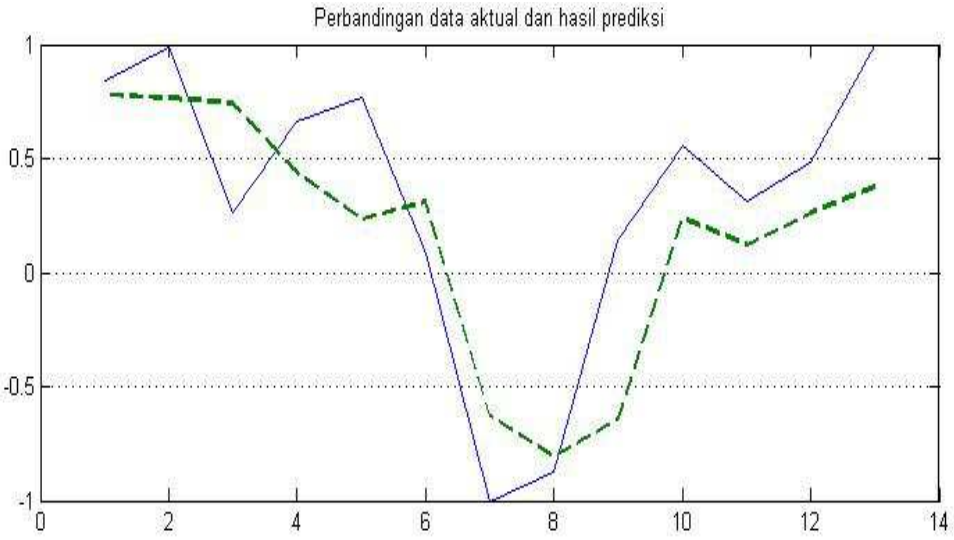

Figure 3.3 Comparison of the actual data and the JKSE Exchange index prediction results based on the first group testing data

The second group

Data testing to predict the closing result of the Jakarta Stock Exchange (JKSE) Index in the 2nd group will use 1 hidden layer, with epoch = 500, and learning rate 0.3, MC = 0.5 and the functions used are Tansig and Purelin.

Table 3.7 The RMSE value of the 2nd group testing, to predict the closing price of the JKSE

NO	Neuron	RMSE	Information
1	1	0.525935	
2	3	0.445812	**Smallest Rmse value**
3	5	0.489623	
4	7	0.532781	
5	10	0.618568	
6	12	0.528217	
7	15	0.548099	

From the above test results, it is known that the smallest RMSE value is no.2, with RMSE value of 0.445812. Based on this testing, the resulting comparison of the actual data and predicted closing results of the JKSE exchanges index based on the second group testing data is as shown below.

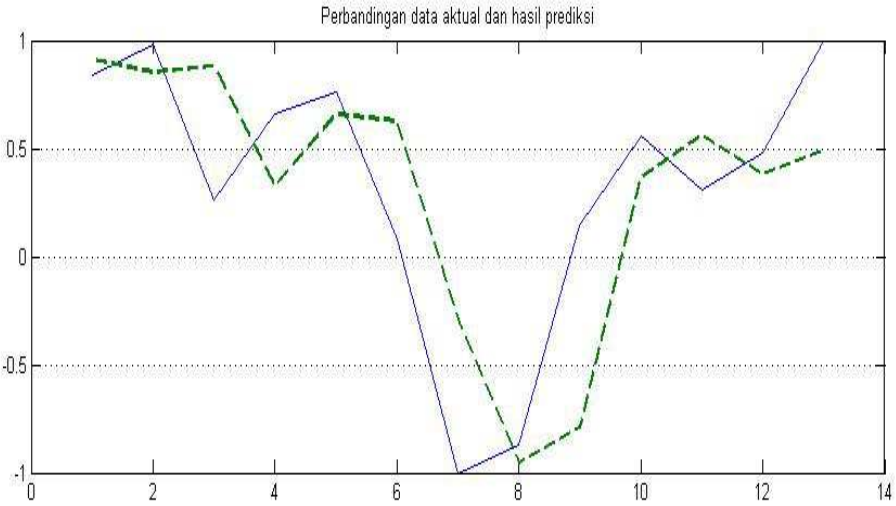

Figure 3.4 Comparison of the actual data and the JKSE Stock index prediction result based on the 2nd group testing data

IV. CONCLUSION

Based on the results that can be obtained from this study, it can be drawn some conclusions as follows:

At the end of the research, the smallest RMSE (Root Mean Square Error) value from the second group traning is 0.079388. While the smallest RMSE value for testing from the first group is 0.392098. This could be due to:

a. Stock index price movement on the training data is not the same as the movement that occurs in the stock index during testing.

b. The existence of data cleansing that there is a missing history that causes the smallest RMSE value in the training does not lead to better training results than the RMSE is of greater value, and it can be seen from the test results.

V. RECOMMENDATION

The research above is not perfect due to the limited time of the researcher in this research, therefore, for the next research a development can be done by comparing this research with other method such as Adaptive Neural Fuzzy Inference System (ANFIS) to get a better reliability and accuracy level.

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REFERENCES

[1] Daehyon Kim. (2001).Performance comparison of neural network models: backpropagation *vs.* fuzzy artmap. Journal International Journal of Computer Mathematics Volume 78, Issue 3, 2001.

[2] Hermawan, Arief. (2006). Jaringan Saraf Tiruan Teori dan aplikasi. Yogyakarta. Andi. Offset.

[3] Jian-ZhouWang[a]Ju-JieWang[a]Zhe-GeorgeZhang[bc]Shu-PoGuo[a]. (2011). Forecasting stock indices with back propagation neural network, Expert Systems with Applications Volume 38, Issue 11, October 2011, Pages 14346-14355

[4] Kusrini & Luthfi, Emha Taufiq. 2009. Algoritma Data Mining. Andi, Yogyakarta.

[5] Lubis, Ade Fatima. 2008. Pasar Modal. Jakarta: Lembaga Penerbit FE UI

[6] Mansur, Moh. (2005). Pengaruh Indeks Bursa Global terhadap Indeks Harga Saham Gabungan (IHSG) pada Bursa Efek Jakarta (BEJ) Periode Tahun 2000-2002. Sosiohumaniora, Vol. 7, No. 3, 2005. Hal. 203 - 219 . Bandung. Jurnal.unpad.ac.id/sosiohumaniora/article/view/5352/2714

[7] Mingyue Qiu ,Yu Song. 2016. Predicting the Direction of Stock Market Index Movement Using an Optimized Artificial Neural Network Model. PLOS ONE | DOI:10.1371/journal.pone.0155133 May 19, 2016

[8] Mudjiyono. (2012). Investasi Dalam Saham & Obligasi Dan Meminimalisasi Risiko Sekuritas Pada Pasar Modal Indonesia. Jurnal Stie Semarang, 2012 Vol 4, No 2, Edisi Juni(ISSN : 2252-7826)

[9] Prasetyo, Eko. (2012). Data mining. Konsep dan Aplikasi menggunakan matlab. Yogyakarta: Andi offset.
[10] Pudjo Widodo, Prabowo, Trias Handayanto, Rahmadya. (2012). Penerapan Soft Computering dengan Matlab . Bandung: Rekayasa Sains.
[11] Santosa, Budi. 2007. Data mining. Teknik Pemanfaatan Data untuk Keperluan Bisnis. Graha Ilmu,Yogyakarta
[12] Sunariyah, 2003. Pengantar Pengetahuan Pasar Modal. Yogyakarta: UPP AMP YKPN– Yogyakarta.