5thICITB

Prediction Of Coffee Prices With Backpropagation Neural Networks

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ABSTRACT
Robusta coffee is a type of coffee plant in Indonesian, sepcialy at west lampung.lampung province have much spices of herbs plant.one of that spices is Robusta Coffe. Robusta coffee is the fourth most reliable source of Robusta coffee in the world. Robusta coffee prices in Lampung are influenced by the price of coffee from Vietnam and Brazil. This research was conducted to determine the predication of coffee prices. the price of this coffee can be used for government reference. This prediction is used for farmers to get more leverage. The training data is data for 2010-2014. Testing data used in 2015-2017. 2018 is used as an output target the algorithm used is backpropagationof neural network. the study uses five architectural models. They are 3-9-1,3-12-1,3-15-1 dan 3-19-1. the best model is3-15-1 with mse value is 0.00904753.therefor, this model is good for predicting prices, especially this result is good for the Lampung

Keywords :*Robusta, coffe, prices, prediction, neural network, backpropagation*

1. INTRODUCTION

Coffee is one of the mainstay commodities in the plantation sector in Indonesia.(1)Coffee is an important commodity in West Lampung Regency.Coffee is one of the coffee production centers. (2) The period 1976-1982, the selling price of coffee at the farm level, was always above 2 US dollars / kg. Selling prices below 1.00 US dollars began to occur since 1983.(3), The price of coffee in the area of are climate and amount of coffee production at the area. Previous research using data in March until December 2003,, Research shows that retail prices in Japan are always higher than prices in the US, Germany, Italy and the Netherlands. As a result, prices have the same pattern and trend.[4].

The price of coffee in Indonesia is controlled by world coffee prices, especially the price of coffee in Vietnam and Brazil[5]. Price prediction is done to find out the price level in the

future. Prediction results can be used for government and farmer reference. Then,the government and farmers can get more leverage in increasing the price of coffee.Predictions are used to anticipate the occurrence of very significant price changes. Prediction requires needs a research algorithm. The algorithm used is the backpropagation algorithm. this algorithm can be used to predict the price of coffe the next year, expecially in lampung. The following are price data from 2015 to 2018

Table 1. Coffee price data

No	2015	2016	2017	2018
1	0,413703	0,569668	0,204849	0,329741
2	0,515261	0,574983	0,071208	0,224224
3	0,509947	0,287535	0,059075	0,217629
4	0,488692	0,232414	0,180402	0,197845
5	0,494005	0,26248	0,186468	0,204439
6	0,537883	0,192326	0	0,342931
7	0,570295	0,334911	0,275458	0,252202
8	0,543285	0,441053	0,383246	0,17806
9	0,548687	0,385455	0,232213	0,173407
10	0,575697	0,267491	0,244241	0,147142
11	0,575697	0,157249	0,190113	0,186539
12	0,554089	0,304911	0,29837	0,160274
13	0	0	0,520506	0,401113
14	0,092793	0,110198	0,140593	0,35475
15	0,043954	0,095751	0,146529	0,426779
16	0,078141	0,045511	0,33055	0,466234
17	0,053722	0,116099	0,301728	0,534808
18	0,180702	0,087855	0,253198	0,548312
19	0,004884	0,092562	0,399753	0,474042
20	0,20016	0,097269	0,387438	0,487545
21	0,087578	0,143908	0,239659	0,639183
22	0,221988	0,045359	0,492114	0,45293
23	0,097677	0,23762	0,32076	0,499493
24	0	0,331332	0,236717	0,271487
25	0,627335	0,591036	0,632799	0,58671
26	0,646562	0,663098	0,652091	0,641753
27	0,570317	0,724987	0,529905	0,607351
28	0,642383	0,548952	0,787138	0,593591
29	0,676151	0,8	0,780708	0,75809
30	0,630224	0,6339	0,523474	0,602955
31	0,711915	0,746419	0,587783	0,5818

32	0,701023	0,730345	0,523474	0,449047
33	0,75652	0,639258	0,652091	0,703676
34	0,8	0,521381	0,523448	0,729884
35	0,78913	0,596394	0,652091	0,708729
36	0,755483	0,564245	0,613506	0,701677
37	0,729344	0,548171	0,793569	0
38	0,728253	0,548171	0,787138	0,56607
39	0,602993	0,708913	0,8	0,224224
40	0,613885	0,612468	0,5681	0,8
41	0,641116	0,77321	0,536206	0,623339
42	0,728253	0,60711	0,632799	0,378303
43	0,63567	0,66069	0,514935	0,371537
44	0,717361	0,499948	0,56849	0,657598
45	0,717361	0,553529	0,729261	0,303876
46	0,695576	0,596394	0,571406	0,303876
47	0,711915	0,601752	0,496111	0,416473
48	0,760929	0,580319	0,671383	0,239812

Backpropagation algorithm is used for prediction of stock price indexes. The study uses 8 architectural models. this research resulted in 92% accuracy
(6) Backpropagation algorithm is used for stock price prediction(7) Therefore, in this study using the backpropagation algorithm. This research is for coffee price prediction

2. MANUSCRIPT PREPARATION

2.1 Prediction

Forecasting efforts to predict what will happen in the future(8) This prediction uses previous relevant information data. Prediction is also used to obtain information that will come with the probability of scattered events(9) predictions can also be done with time series(10) Predictions can also be done by using qualitative and quantitative data. This calculation also uses mathematical theory(11)

2.2 Algoritma Backpropagation

Backpropagation is a supervised learning algorithm usually used by perceptron with multiple layers to change the weights on the hidden layer(11)(12)

2.3 Coffe

Coffee is one of the mainstay commodities in the plantation sector in Indonesia(1)

2.4 Data Normalization

Data normalization is performed by sigmoid function sigmoid function with a value not reaching 0 or 1(13)here is the normalized data

Normalisasi data training tahun 2015-2018

No	2015	2016	2017	2018
1	0,413703	0,569668	0,204849	0,329741
2	0,515261	0,574983	0,071208	0,224224
3	0,509947	0,287535	0,059075	0,217629
4	0,488692	0,232414	0,180402	0,197845
5	0,494005	0,26248	0,186468	0,204439
6	0,537883	0,192326	0	0,342931
7	0,570295	0,334911	0,275458	0,252202
8	0,543285	0,441053	0,383246	0,17806
9	0,548687	0,385455	0,232213	0,173407
10	0,575697	0,267491	0,244241	0,147142
11	0,575697	0,157249	0,190113	0,186539
12	0,554089	0,304911	0,29837	0,160274
13	0	0	0,520506	0,401113
14	0,092793	0,110198	0,140593	0,35475
15	0,043954	0,095751	0,146529	0,426779
16	0,078141	0,045511	0,33055	0,466234
17	0,053722	0,116099	0,301728	0,534808
18	0,180702	0,087855	0,253198	0,548312
19	0,004884	0,092562	0,399753	0,474042
20	0,20016	0,097269	0,387438	0,487545
21	0,087578	0,143908	0,239659	0,639183
22	0,221988	0,045359	0,492114	0,45293
23	0,097677	0,23762	0,32076	0,499493
24	0	0,331332	0,236717	0,271487
25	0,627335	0,591036	0,632799	0,58671
26	0,646562	0,663098	0,652091	0,641753
27	0,570317	0,724987	0,529905	0,607351
28	0,642383	0,548952	0,787138	0,593591
29	0,676151	0,8	0,780708	0,75809

30	0,630224	0,6339	0,523474	0,602955
31	0,711915	0,746419	0,587783	0,5818
32	0,701023	0,730345	0,523474	0,449047
33	0,75652	0,639258	0,652091	0,703676
34	0,8	0,521381	0,523448	0,729884
35	0,78913	0,596394	0,652091	0,708729
36	0,755483	0,564245	0,613506	0,701677
37	0,729344	0,548171	0,793569	0
38	0,728253	0,548171	0,787138	0,56607
39	0,602993	0,708913	0,8	0,224224
40	0,613885	0,612468	0,5681	0,8
41	0,641116	0,77321	0,536206	0,623339
42	0,728253	0,60711	0,632799	0,378303
43	0,63567	0,66069	0,514935	0,371537
44	0,717361	0,499948	0,56849	0,657598
45	0,717361	0,553529	0,729261	0,303876
46	0,695576	0,596394	0,571406	0,303876
47	0,711915	0,601752	0,496111	0,416473
48	0,760929	0,580319	0,671383	0,239812

the price of 2018 is the target, 2015 to 2017 prices are input data

3. RESULT DAN CONCLUSION

This study uses a bacpropagation model. his study uses four architectural models. including 3-9-1 (neuron input layer, 9 hidden layer neurons and 1 output layer) , 3-12-1 ((neuron input layer, 12 hidden layer neurons and 1 output layer) 3-15-1 (neuron input layer, 15 hidden layer neurons and 1 output layer) 3-21-1 (neuron input layer, 21 neurons hidden layer and 1 output layer). 3-9-1 is the best model.

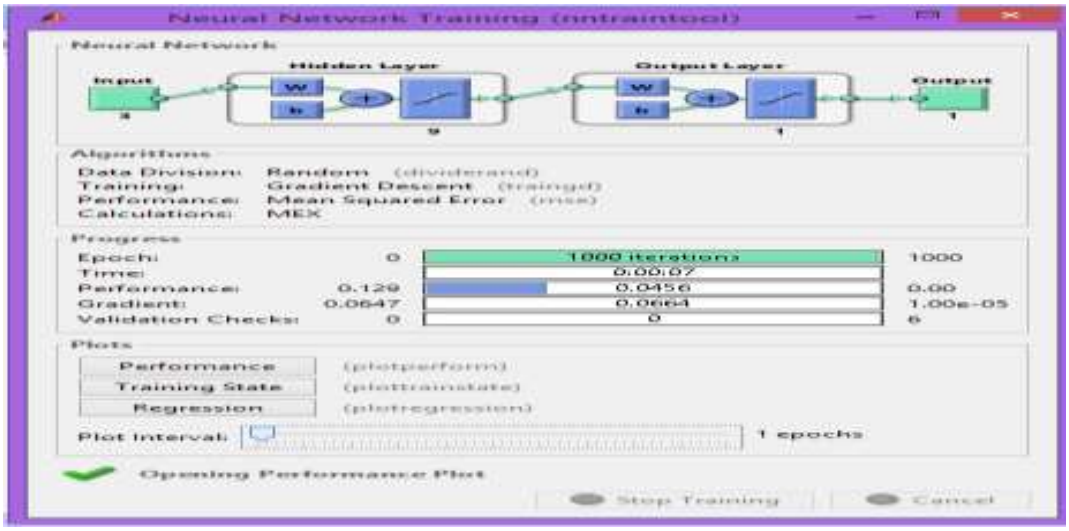

Figure 1. Training models 3-9-1

The figure below is a training data model 3-12-1

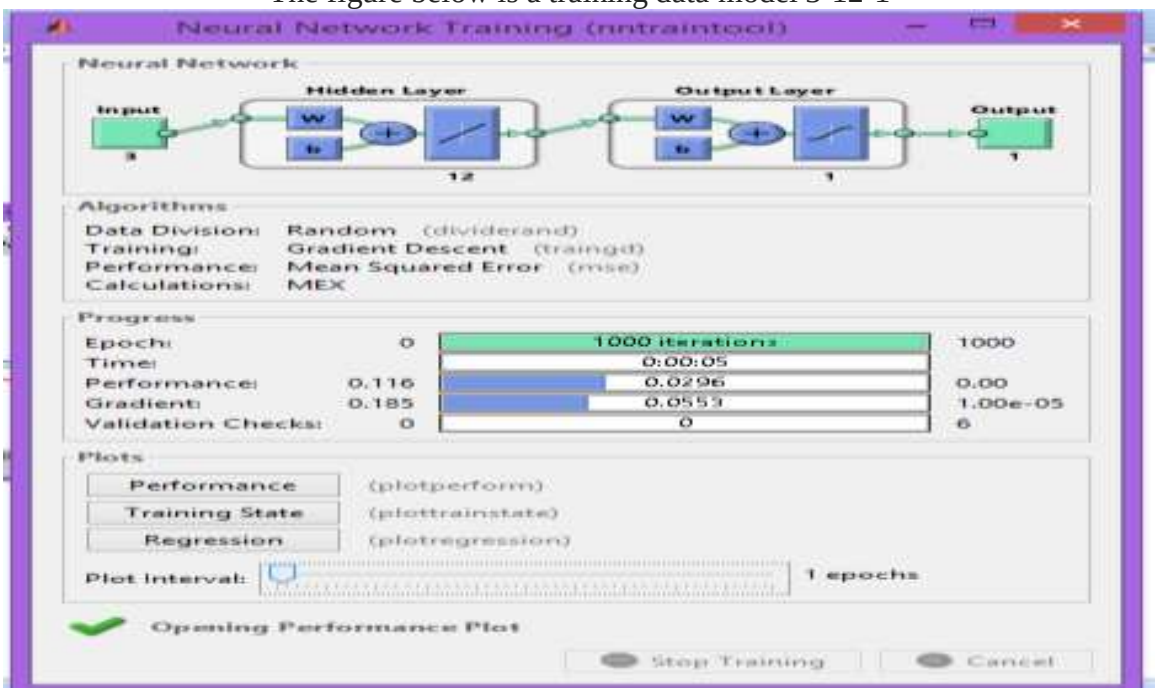

Figure 2. Training models 3-12-1

The figure below is a training data model 3-18-1

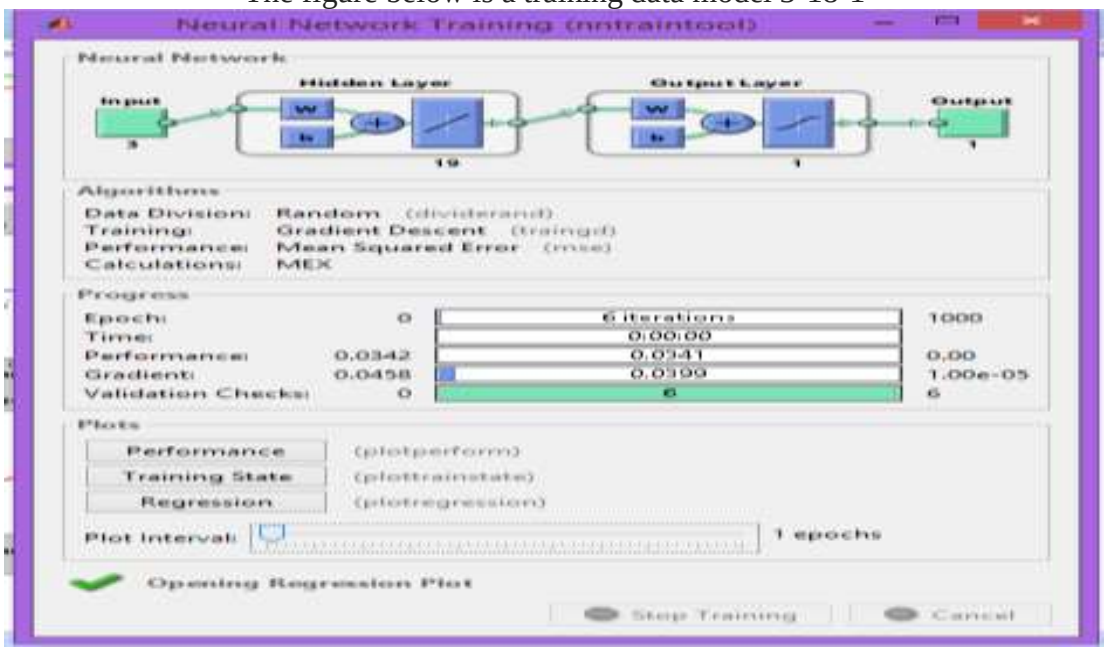

Figure 3. Training models 3-18-1

The figure below is a training data model 3-21-1

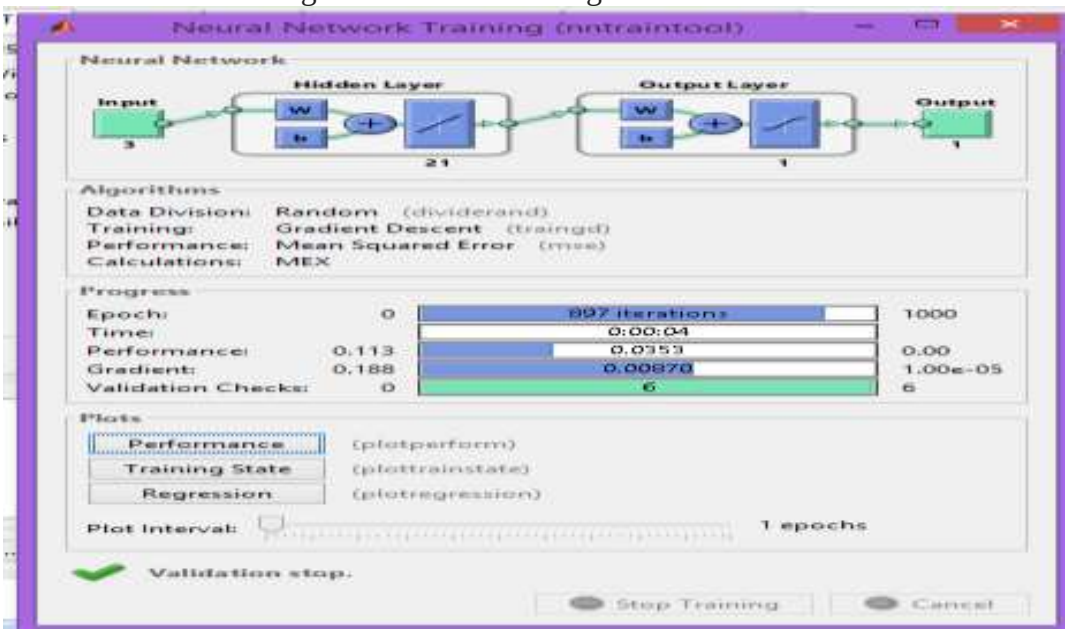

Figure 4. Training models 3-21-1

The following is table 3 the error value is obtained from the output value minus the target value. SSE value is obtained from error value 2. MSE values obtained from the number of SSE divided by the amount of data (48). accuracy is obtained by the number of correct results (1) divided by the amount of data (48). The result will be true (1) if the error value <= 0.05

Tabel 3. Arsitektur Model 3-9-1

NO	output9	error9	target	SSE	Hasil
1	0,784893	-0,45515	0,329741	0,207163	1
2	0,794422	-0,5702	0,224224	0,325126	1
3	0,794924	-0,5773	0,217629	0,33327	1
4	0,785426	-0,58758	0,197845	0,345252	1
5	0,784963	-0,58052	0,204439	0,337008	1
6	0,79671	-0,45378	0,342931	0,205916	1
7	0,769596	-0,51739	0,252202	0,267697	1
8	0,696422	-0,51836	0,17806	0,268699	1
9	0,778803	-0,6054	0,173407	0,366505	1
10	0,779683	-0,63254	0,147142	0,400109	1
11	0,7866	-0,60006	0,186539	0,360073	1
12	0,761121	-0,60085	0,160274	0,361017	1
13	0,197106	0,204008	0,401113	0,041619	0
14	0,621109	-0,26636	0,35475	0,070947	1
15	0,562169	-0,13539	0,426779	0,01833	1
16	0,470702	-0,00447	0,466234	2E-05	1
17	0,492656	0,042153	0,534808	0,001777	1
18	0,639849	-0,09154	0,548312	0,008379	1
19	0,364757	0,109284	0,474042	0,011943	0
20	0,567387	-0,07984	0,487545	0,006375	1
21	0,584061	0,055122	0,639183	0,003038	0
22	0,397561	0,055368	0,45293	0,003066	0
23	0,630616	-0,13112	0,499493	0,017193	1
24	0,677157	-0,40567	0,271487	0,164568	1
25	0,468983	0,117728	0,58671	0,01386	0
26	0,435054	0,206699	0,641753	0,042724	0
27	0,505317	0,102034	0,607351	0,010411	0
28	0,408349	0,185242	0,593591	0,034315	0
29	0,361805	0,396286	0,75809	0,157042	0
30	0,553383	0,049572	0,602955	0,002457	1
31	0,474426	0,107374	0,5818	0,011529	0
32	0,523773	-0,07473	0,449047	0,005584	1
33	0,512545	0,19113	0,703676	0,036531	0
34	0,645099	0,084785	0,729884	0,007188	0
35	0,555689	0,15304	0,708729	0,023421	0
36	0,570276	0,131401	0,701677	0,017266	0

37	0,459817	-0,45982	0	0,211432	1
38	0,462905	0,103165	0,56607	0,010643	0
39	0,320882	-0,09666	0,224224	0,009343	1
40	0,512438	0,287562	0,8	0,082692	0
41	0,485677	0,137662	0,623339	0,018951	0
42	0,522455	-0,14415	0,378303	0,02078	1
43	0,553629	-0,18209	0,371537	0,033158	1
44	0,599214	0,058384	0,657598	0,003409	0
45	0,48666	-0,18278	0,303876	0,03341	1
46	0,549132	-0,24526	0,303876	0,060151	1
47	0,598104	-0,18163	0,416473	0,03299	1
48	0,537329	-0,29752	0,239812	0,088517	1
			jumlah	5,092893	0,882353
			MSE	0,106102	

The following are the results of a comparison of the four architectures. MSE and accuracy are obtained using Microsoft Excel respectively

Table 4. compares the accuracy with the backpropagation algorithm

No	Arsitektur	Epoch	Waktu	MSE	Akurasi
1	3_9_1	1000	00.00.06	0,106101941	0,882353
2	3_12_1	1000	00.00.05	0,022853535	0,6875
3	3_15_1	1000	00.00.05	0,029505921	0,625
4	3_21	1000	00.00.12	0,07133032	0,8125

The above tebel shows the comparison .The best results are with architectural models 3-9-1.

4. CONCLUSIONS

this research resulted with models 3-9-1 producing 88.2% accuracy, models 3-12-1 have good grades in terms of speed. for the next research it is hoped that can be used other methods . for examples conjugate gradient , or another

ACKNOWLEDGEMENTS

I can say thank you very much for STMIK Dian Cipta Cendikia Kotabumi.

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