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FORECASTING THE FUTURES OF BANKING INTEREST RATE IN INDONESIA WITH NEURAL NETWORK

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Abstract

This research was conducted by the author using Artificial Neural Network (ANN), which is considered by the authors is the information processing paradigm inspired by how biological neural systems, such as the brain, information process. The key elements of this paradigm is the structure of novel information processing system, consists of a large number of processing elements that are highly interconnected (neurons) are working together to solve a particular problem.

The purpose of this research is done by using the neural network is to get figures forecasting interest rate futures industry in Indonesia with the model of neural network. From the results of research that has been done can be concluded that there is a level of accuracy of forecasting interest rate futures industry approached nearly the range of 85% to 99%. Research conducted using the data of interest rate futures the banking industry started from January 2012 to March 2013 with the forecasting results for March 2013 to July 2013.

Keywords : artificial intelligence, neural network, forecasting, modeling and interest rate futures.

I INTRODUCTION

Since antiquity, the one thing that has made humans stand apart from the rest of the animal is, his brain. A set of the most intelligent on Earth, "human brain" is the driving force that has given us a progressive species dive into technology and development because every day it lasts. Due to the nature of the curious, someone tries to make amachine that could do the job intelligently process, and take a decision in accordance with the instructions of the analysis. The result is a machine that revolutionized the entire world, "Computer" (more technically Von Neumann computers).

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Although it could do millions of calculations per second, showing the incredible graphics and animations 3-dimensional,play audio and video but it makes the same error each time. The practice couldn't make it perfect. So the quest to create a more intelligent devices continuously performed. This research led to the birth of a more powerful processor with high-tech equipment attached to it, a super computer with the ability to handle more than one task at a time and finally network with resources can share facilities. But still the problem of designing an intelligent machine with independent study, a major problem in front of the human race. Then the ideas started the human brainstuck designers who started their research, one of the technologies that will change the way of working is Artificial Neural Networks.

Neural Network is a particular branch of Artificial Intelligence. In General, Neural Networks are only mathematical techniques which are designed to achieve various tasks. Neural Networks using a single set of processing elements (or node) is loosely Analogous to the neurons in the brain (hence, neural networks). This node is inter connected in a network can then identify patterns in data such as the affected data. In a sense, a network to learn from experiences such as people do. Neural networks can be configured in a variety of settings to perform a variety of tasks including pattern recognition, data mining, classification, and process modeling.

II LITERATUR REVIEW

A. The structure of the human brain

As stated previously, a Neural Networks is very similar to the biological structures of the human brain. The following is the structure of the biological brain is given. As shown in the picture, the left part of the brain consisting of the rules, concepts and calculations. This follows the ' Rule-based learning ' and thus solve the problem by passing them through the rules. Have pairs in sequence from Neurons. Therefore, this part of the brain similar to the expert system.
The right part of the brain, as shown below in the picture; consisting of functions,images, and controls. It follows a parallel ' learning ' and hence learn through experience. Have a pair of parallel Neurons. Therefore, the brain is similar to a Neural Network.

The conceptual construction of neural networks derived from our initial understanding of the human brain. The brain consists of billions and billions of neurons interconnected (up some experts estimate of 1011 neurons in the human brain). The fundamental building blocks of the cellular structure of massively parallel is really quite simple when studied in isolation. A neuron receives an electrochemical signalenters from the dendrite and accumulate at the core of signals of neurons. The core has a limited internal neurons that determine whether ban neuron it self in response to incoming information. If the incoming signal is a combined

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exceed this then fires the neurons and electrochemical signals sent to all the neurons that connect to neuronsfiring on the output connections or axons. If no incoming signal is ignored and the neurons remain active.

There are many types of neurons or cells. From the body of neurons (soma) finely branched, plenty of fiber called Dendrite, standout. Dendrite conducts signals to thecell body or soma. Extending from the soma of neurons is, at a point called axons Hill (initial segment), is a mockery of the so- called long axons, which are generally divided into branches that are smaller than aksonal arborization. The tip of the axon branches(also called nerve terminal, lamp end, telondria) violate both on Dendrite, somas oraxons of other neurons or effector.

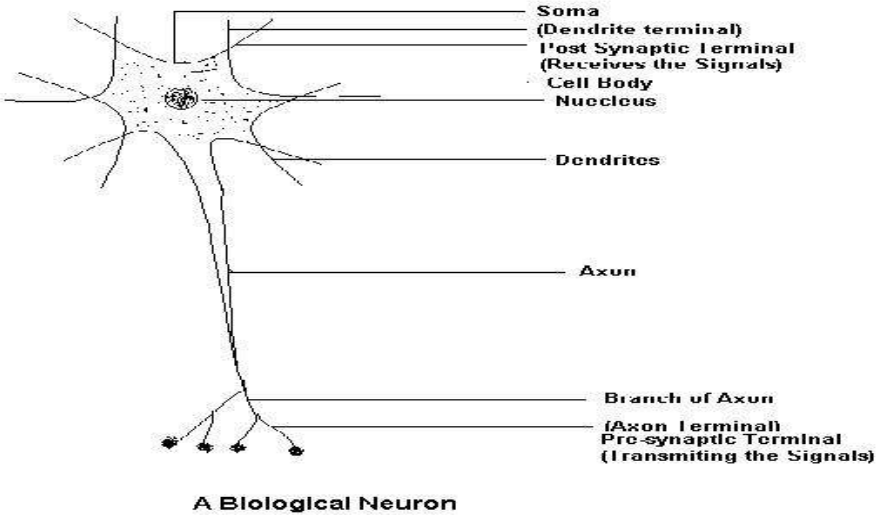

Figure. 1. Biological neuron

Axon-Dendrite (Axon-soma, Axon-Axon) contact between the end and the lightimpinges on the cells is called the synapse. The flow of signals in neurons is (with a few exceptions if the flow can be bi- directional) from the dendrite via soma convergein the axons and dendrites then descends the bulbs end. A neuron usually has many dendrites but only a single dendrite.

B. Fundamentals of Artificial Neural Model

The human brain consists of computing elements, called neurons, coupled with thesensory receptors (affecters) and effectors. The human brain is, on average, about three pounds in weight and 90 cubic inches in volume, estimated to contain about100 billion cells of different types. A special cell is the neuron that conducts electrical signals, and there were about 10 billion neurons in the human brain. The remaining 90billion glial

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cells called or glue the cells, and this serves as a support for the neuroncells. Each neuron is about one hundredth the size of the period at the end of this sentence. Neurons interact through a contact called synapses. Each Synapse gap covers about a millionth of an inch wide. Average every neuron receives signals through thousands of synapses.
The motivation for the neural network (ANN) research is the belief that human abilities, especially in real-time visual perception, comprehension of conversation, andsensory information processing and adaptive and intelligent decision-making in General, comes from the Organization and the principle of computing is exhibited in a very complex neural network of the human brain. Expectations of faster and better solution provides us with the challenge to build machines using the principles of computing and of the same organization, simplified and abstracted from neurobiological factors the brain.

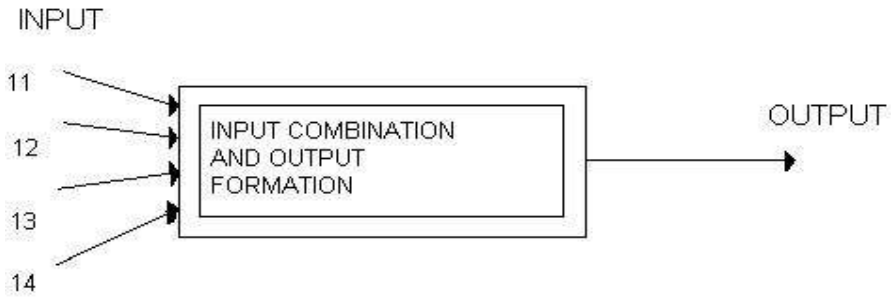

Figure 2 : system input and output

C. History Of Neural Network

The development of the science of the Neural Network has been around since 1943 when Warren McCulloch and Walter Pitts introduced the calculation model of neural network the first time. They do some simple processing unit combination together t hat is able to provide increased overall in the computing power.

The inventor of the first Neural Network
This continued on research carried out by Rosenblatt in 1950, where he managed to find a two-layer network, called the perceptron. Perceptron allows to work a particular learning classification with the addition of weights on any connections Interfaith network.

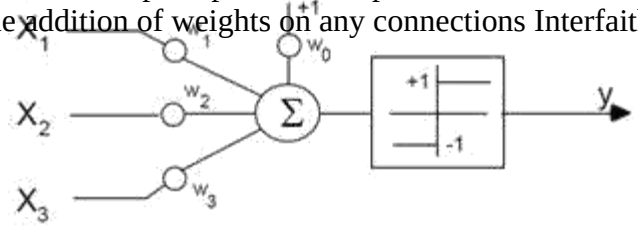

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Figure 3 : Perceptron

The success of the perceptron in which this particular pattern is not completely perfect, still found some of the limitations therein. Perceptron is unable to resolve the problems of the XOR (exclusive-OR). Assessment of the limitations of the neural network make this research in the field was dead for about 15 years. However, perceptron managed to become a basis for further studies in the field of neural network. Study of neural network against began to grow again in the early 1980s. The researchers found new fields of interest in science domain neural network. A recent study of them is Boltzmann machine, Hopfield networks, competitive learning models, multilayer network, and adaptive resonance theory model. For now, the Neural Network can already be applied to several tasks, including classification, recognition, approximation, prediction, clusterization, memory simulation and many different task-task, where the numbers are growing as time passes.

D. The Concept Of Neural Network

1. Neural Network on the work process of the human brain.

The idea of basic Neural Network, starting from the human brain,where the brain contains about 1011 neurons. These neurons function to process any incoming information. One neuron axons have a 1, and at least one dendrite. Each nerve cells connect with other nerves, the number reached approximately 104 synapses. Each cell was interacting with one another that generate certain ability on the working of the human brain.

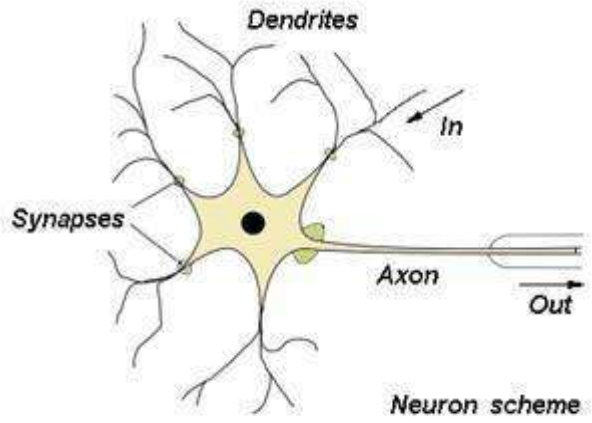

Figure 4 : The structure of Neurons in the human brain

From the picture above, we can see there is some part of the human brain, that is:

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1. Dendrite (Dendrites) serves to transmit the impulses it receives into the nerve cellbody.
2. the Axon (Axon) serves to transmit impulses from the body of the cell to another network functional unit serves as Synapses between two nerve cells.

The processes that occur in the human brain are:

A neurons receive impulses from other neurons through the dendrite and sends the signals generated by the cells via axons. The axons of nerve cells is divided into branches and connect with other nerve cells from the dendrite by sending impulses through synapses. Synapses are functional units between 2 pieces of nerve cell, for example A and B, where the one is the wire, the axons of the neurons A and the other is the dendrite of a neuron synaptic Strength b. can decrease / increase depending on how big the rate of propagation (broadcast) signal is received. Signal impulses (information) will be accepted by other neurons if it meets certain restrictions, commonly referred to by the value of the threshold (threshold).

2. Structure of the Neural Network

From the structure of neurons in the human brain, and the work process described above, the basic concept of the construction of the artificial neural network (Artificial Neural Network) was formed. The fundamental idea of the Artificial Neural Network (ANN) is adopting the mechanism of thinking a system or application that resembles a human brain, both for the processing of various elements of the signal received, tolerance of mistakes/errors, and also parallel processing.

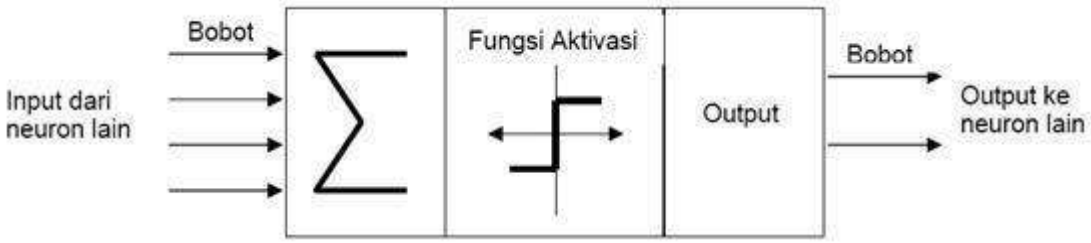

Figure 5 : Parallel processing neural network

The Structure Of ANN

Characteristics of ANN seen from the pattern of connections between neurons, the method of determining the weights of each connection, and activation functions. The image above describing the structure ANN fundamentally, which in reality is not justas simple as that.

1. Input, function like dendrite
2. Output, function like axons

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3. the activation Function, serves as synapses

Neural network built from many nodes/unit connected by a link directly. Links from one unit to another unit that is used to perform the activation of the first unit propagation to the next unit. Each link has a numerical weighting. These weights determine the strength as well as a

marker of a connectivity.

Process on ANN started from the input received by the neuron along with the value of the weighting of each input. After entry into the neuron, input values are aggregated by a function of propagation (summing function), which can be seen as on the image with the symbol of sigma (∑). The summation of results will be processed by the function activation every neuron, here the summation of results will be compared with a threshold (threshold value). If the value exceeds the threshold, then the activation of neurons will be cancelled, on the contrary, if it is still under nilai threshold, the Neuron will be activated. Once active, the neurons will send the output values through weighting-weighting output to all the neurons that are associated with it. This process will continue to repeat on input-input of the next. ANN consists of many neurons in it. These neurons will be grouped into several layers. Neurons contained in each layer is associated with other neurons in layer. This is certainly not valid at input and output layer, but only the layer that lies in between. Information received in the input layer to layer-layer in ANN singly until it reaches the last layer/layer output. The layer that lies between the input and output are known as hidden layer. However, not all ANN has a hidden layer, there are also the only input and output layer only.

III RESERACH METHOD

A. Research Time

This research was conducted by the author at the time of the June to September 2014. Starting from search research data uploaded from the website of some government agencies are there in Indonesia BI. GO.ID, BPS. Go.ID and MONETARY DEPARTMENT.GO.ID. For data analysis the author slightly change the shape of the model equations are beginning to get better results for forecasting.

B. Research Data

Research data used is the value of interest rate futures in the banking industry hoses monthly timed period 1 month, 3 months, 6 months and 12 months, starting January 2012 until February 2013. Forecasting model that will be done is for the period ahead, for a little over 6 months in the future. Data obtained by the author after the first processed.

C. Technique of Data analysis research

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The interest rate of the data obtained, will be analyzed according to interest rate futures each, such as 1 month, 3 months, 6 months and 12 months. The use of asigmoid function of using solver add in Excel as the display of the following:

Table 1 : solver add in

Input	**Weights**	**value**	**Start**
vector	w11	-2,69529	-2,695
	w12	1,308576	1,309
	w13	-0,48596	-0,486
	w21	0,002452	0,002
	w22	0,004188	0,004
Output	theta0	-101,559	-101,559
weights	theta1	25,33691	25,337
	theta2	188,8572	188,8572

Sources : Proceed by author

By using sigmoid help above, then the savings interest rate futures industry, forecasting can be done based on the specified time span.

IV RESULT AND DISCUSSION

The following authors attach research results by using a neural network, which the forecasting results grouped against interest rate futures with monthly interest rate forecasting results 1 month, 3 months, 6 months, 12 months.

The results of the forecasting interest rate futures 1 month using AFN/ANN

Table 2. Result ANN 1 month

Data	Bank PERSERO	Bank BPD	Non national Bank	Foreigh Bank	General Bank	Average	Hidden	Layer	Output Layer	Error	Norm
	Y	x1	x2	x3	x4	x5	at1	a2t			
01/01/2012	5,90	6,95	6,54	4,78	6,26	6,09	0,00	0,51	5,20	0,70	0,49
02/01/2012	5,71	6,73	6,24	4,76	5,97	5,88	0,00	0,51	5,28	0,43	0,19
03/01/2012	5,36	6,46	5,92	4,65	5,66	5,61	0,00	0,51	5,37	-0,01	0,00
04/01/2012	5,16	6,06	5,67	4,45	5,42	5,35	0,00	0,51	5,44	-0,28	0,08
05/01/2012	5,06	5,92	5,65	4,25	5,35	5,25	0,00	0,51	5,47	-0,41	0,17

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06/01/2012	5,03	5,83	5,71	4,37	5,39	5,27	0,00	0,51	5,46	-0,43	0,19
07/01/2012	5,08	5,85	5,62	4,54	5,39	5,30	0,00	0,51	5,46	-0,38	0,14
08/01/2012	5,07	5,77	5,71	4,73	5,42	5,34	0,00	0,51	5,45	-0,38	0,14
09/01/2012	5,09	5,71	5,65	4,82	5,40	5,33	0,00	0,51	5,45	-0,36	0,13
10/01/2012	5,13	5,80	5,81	4,85	5,49	5,42	0,00	0,51	5,42	-0,29	0,09
11/01/2012	5,14	5,79	5,65	4,85	5,42	5,37	0,00	0,51	5,44	-0,30	0,09
12/01/2012	5,22	5,92	5,96	4,61	5,58	5,46	0,00	0,51	5,40	-0,18	0,03
01/01/2013	5,16	5,84	5,77	4,80	5,49	5,41	0,00	0,51	5,42	-0,26	0,07
02/01/2013	5,07	5,69	5,67	4,87	5,43	5,35	0,00	0,51	5,44	-0,37	0,14
Actual	Actual	Predi ctions	Actual	Actual	Actual	Actual	Average				Sum 1,95
03/01/2013	5,05	5,74	5,05	5,66	5,87	4,71	4,26	0,00	0,51	5,74	
04/01/2013	4,99	5,73	4,99	5,74	5,70	4,79	4,24	0,00	0,51	5,73	
05/01/2013	4,97	5,73	4,97	5,76	5,91	4,77	4,28	0,00	0,51	5,73	
06/01/2013	5,21	5,67	5,21	5,76	5,97	5,05	4,40	0,00	0,51	5,67	
07/01/2013	5,33	5,61	5,33	5,84	6,32	5,33	4,56	0,00	0,51	5,61	
08/01/2013	5,70	5,48	5,70	6,06	6,61	5,96	4,87	0,00	0,51	5,48	

The results of the forecasting interest rate futures 3 month using AFN/ANN

Table 3 : Result ANN 3month

Data	Bank PERSE RO	Bank BPD	Non national Bank	Foreigh Bank	General Bank	Average	Hidden	Layer	Output Layer	Error	Norm
	Y	x1	x2	x3	x4	x5	at1	a2t			
01/01/2012	6,34	7,69	6,80	5,62	6,68	6,63	0,00	0,51	5,05	1,29	1,67
02/01/2012	6,18	7,31	6,67	5,45	6,52	6,43	0,00	0,51	5,11	1,07	1,16
03/01/2012	5,98	6,92	6,44	5,53	6,31	6,24	0,00	0,51	5,17	0,81	0,66

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04/01/2012	5,71	6,54	6,11	5,33	6,00	5,94	0,00	0,51	5,26	0,45	0,20
05/01/2012	5,56	6,42	6,00	5,30	5,89	5,83	0,00	0,51	5,29	0,27	0,07
06/01/2012	5,44	6,33	5,88	5,16	5,76	5,71	0,00	0,51	5,33	0,11	0,01
07/01/2012	5,44	6,09	5,77	5,22	5,67	5,64	0,00	0,51	5,36	0,08	0,01
08/01/2012	5,43	6,35	5,63	5,34	5,61	5,67	0,00	0,51	5,36	0,07	0,01
09/01/2012	5,45	6,17	5,76	5,39	5,69	5,69	0,00	0,51	5,35	0,10	0,01
10/01/2012	5,49	6,37	5,66	5,55	5,66	5,75	0,00	0,51	5,34	0,15	0,02
11/01/2012	5,48	6,45	5,88	5,55	5,81	5,83	0,00	0,51	5,30	0,18	0,03
12/01/2012	5,54	6,69	5,81	5,54	5,76	5,87	0,00	0,51	5,30	0,24	0,06
01/01/2013	5,53	6,38	6,04	5,42	5,89	5,85	0,00	0,51	5,29	0,24	0,06
02/01/2013	5,47	6,44	6,06	5,30	5,92	5,84	0,00	0,51	5,29	0,18	0,03
Actual	Actual	Predictions	Actual	Actual	Actual	Actual	Average				Sum 3,99
03/01/2013	5,51	5,57	6,27	5,61	5,54	5,64	4,61	0,00	0,51	5,57	
04/01/2013	5,48	5,55	6,14	5,76	5,54	5,73	4,63	0,00	0,51	5,55	
05/01/2013	5,50	5,56	6,18	5,68	5,54	5,68	4,62	0,00	0,51	5,56	
06/01/2013	5,61	5,55	6,20	5,71	5,59	5,72	4,64	0,00	0,51	5,55	
07/01/2013	5,85	5,47	6,34	5,98	6,04	5,99	4,87	0,00	0,51	5,47	
08/01/2013	6,05	5,43	6,58	6,15	6,16	6,16	5,01	0,00	0,51	5,43	

Sources : Proceed by author

The results of the forecasting interest rate futures 6 month using AFN/ANN

Table 4 : Result ANN 6 month

Data	Bank PERSERO	Bank BPD	Non national Bank	Foreigh Bank	General Bank	Average	Hidden	Layer	Output Layer	Error	Norm

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	Y	x1	x2	x3	x4	x5	at1	a2t			
01/01/2012	6,43	8,00	7,24	6,42	7,15	7,05	0,00	0,51	4,91	1,52	2,31
02/01/2012	6,33	7,76	7,06	6,07	6,94	6,83	0,00	0,51	4,98	1,35	1,83
03/01/2012	6,10	7,42	6,85	5,72	6,69	6,56	0,00	0,51	5,06	1,04	1,08
04/01/2012	5,90	7,09	6,69	5,55	6,50	6,35	0,00	0,51	5,12	0,78	0,60
05/01/2012	5,76	6,58	6,51	5,48	6,29	6,12	0,00	0,51	5,19	0,57	0,32
06/01/2012	5,64	6,50	6,30	5,51	6,14	6,02	0,00	0,51	5,23	0,41	0,17
07/01/2012	5,53	6,50	6,02	5,56	5,95	5,91	0,00	0,51	5,27	0,26	0,07
08/01/2012	5,43	6,40	5,95	5,59	5,87	5,85	0,00	0,51	5,29	0,14	0,02
09/01/2012	5,39	6,42	6,00	5,94	5,91	5,93	0,00	0,51	5,27	0,12	0,01
10/01/2012	5,40	6,45	6,02	6,03	5,93	5,97	0,00	0,51	5,26	0,14	0,02
11/01/2012	5,51	6,47	6,10	5,98	5,98	6,01	0,00	0,51	5,25	0,26	0,07
12/01/2012	5,58	6,60	6,18	6,04	6,05	6,09	0,00	0,51	5,23	0,35	0,13
01/01/2013	5,58	6,50	6,20	6,08	6,07	6,09	0,00	0,51	5,22	0,36	0,13
02/01/2013	5,54	6,43	6,22	6,07	6,10	6,07	0,00	0,51	5,22	0,32	0,10
Actua	Actual	Predi ctions	Actual	Actual	Actual	Actual	Average				Sum 6,86
03/01/2013	5,53	5,47	6,35	6,09	5,93	6,00	4,87	0,00	0,51	5,47	
04/01/2013	5,52	5,48	6,28	6,14	5,67	6,01	4,82	0,00	0,51	5,48	
05/01/2013	5,51	5,50	6,30	6,06	5,61	5,95	4,78	0,00	0,51	5,50	
06/01/2013	5,58	5,50	6,24	6,06	5,59	5,93	4,76	0,00	0,51	5,50	
07/01/2013	5,65	5,46	6,26	6,21	5,76	6,08	4,86	0,00	0,51	5,46	
08/01/2013	5,78	5,43	6,46	6,34	5,95	6,20	4,99	0,00	0,51	5,43	

Sources : Proceed by author

The results of the forecasting interest rate futures 12 month using AFN/ANN

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Table 5 : Result ANN 12 month

Data	Bank PERSERO	Bank BPD	Non national Bank	Foreigh Bank	General Bank	Average	Hidden	Layer	Output Layer	Error	Norm
	Y	x1	x2	x3	x4	x5	at1	a2t			
01/01/2012	6,60	8,31	7,02	5,98	6,96	6,97	0,00	0,51	4,95	1,65	2,74
02/01/2012	6,67	7,81	6,67	5,95	6,79	6,78	0,00	0,51	5,00	1,67	2,77
03/01/2012	6,58	7,69	6,56	5,98	6,71	6,70	0,00	0,51	5,03	1,55	2,41
04/01/2012	6,52	7,46	6,42	5,85	6,58	6,57	0,00	0,51	5,07	1,45	2,10
05/01/2012	6,43	7,40	6,32	5,83	6,51	6,50	0,00	0,51	5,09	1,34	1,79
06/01/2012	6,31	7,37	6,20	5,80	6,42	6,42	0,00	0,51	5,12	1,19	1,42
07/01/2012	6,22	7,07	6,06	5,85	6,30	6,30	0,00	0,51	5,16	1,06	1,13
08/01/2012	6,12	6,82	5,97	6,11	6,20	6,24	0,00	0,51	5,18	0,94	0,89
09/01/2012	5,97	6,91	5,93	6,19	6,16	6,23	0,00	0,51	5,19	0,78	0,62
10/01/2012	5,98	6,87	5,83	6,23	6,12	6,21	0,00	0,51	5,19	0,79	0,62
11/01/2012	5,92	6,91	5,83	6,25	6,11	6,20	0,00	0,51	5,20	0,72	0,52
12/01/2012	5,91	7,08	5,82	6,19	6,09	6,22	0,00	0,51	5,20	0,71	0,51
01/01/2013	5,86	6,91	5,78	6,34	6,03	6,18	0,00	0,51	5,21	0,65	0,42
02/01/2013	5,47	6,82	5,74	6,31	5,92	6,05	0,00	0,51	5,25	0,22	0,05
Actua	Actual	Predictions	Actual	Actual	Actual	Actual	Average				Sum 17,99
03/01/2013	5,45	5,48	6,69	5,71	6,29	5,86	4,91	0,00	0,51	5,48	
04/01/2013	5,45	5,49	6,62	5,71	6,27	5,83	4,89	0,00	0,51	5,49	
05/01/2013	5,45	5,50	6,52	5,76	6,10	5,81	4,84	0,00	0,51	5,50	
06/01/2013	5,81	5,48	6,54	5,79	6,22	5,91	4,89	0,00	0,51	5,48	
07/01/2013	5,67	5,45	6,62	5,95	6,26	6,00	4,97	0,00	0,51	5,45	

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08/01/2013	6,18	5,42	6,65	5,97	6,30	6,17	5,02	0,00	0,51	5,42	

Sources : Proceed by author

We can see from the results of the forecasting of the how is produced, which is attached to the table above, look how the results predicted in the columns, while the actual prediction is a futures interest rate columns of the banking industry. All tables are the same, the difference is only the columns interest rate futures time whether 1 month, 3 months, 6 months and 12 months on the results of the prediction and the actual column. Look at the last column of the table for the 12-month futures interest rate obtained results for the prediction on a start date of 3/1/2013 to 8/1/2013 each of {5.48 5.49,, 5.50, 5.48.5.45 5.42,} and the actual interest rate columns for each of {5.45,5.45, 5.45, 5.81, 5.67, 6.18}. The level of accuracy of each of the predictions with the actual interest rate is almost 87% above 99%.

The Forecast Level Of Accuracy

Following the results of the forecasting level accuracy obtained by using a neural network. Starting from the results of the forecast date of 3/1/2013 up to 8/1/2013 and Futures interest rate for a period of 1, 3, 6 and 12 months. Visible results the accuracy of forecasts in the table below:

Table 6 : Result ANN conclusion

The Accuracy Of The Prediction Forecast Approaching Actual Interest Rates

	1 Month	*3 Month*	*6 Month*	*12 Month*
03/01/2013	88,0%	99,0%	98,9%	99,4%
04/01/2013	87,0%	98,7%	99,3%	99,3%
05/01/2013	86,8%	98,9%	99,7%	99,1%
06/01/2013	91,8%	98,9%	98,6%	94,3%
07/01/2013	95,0%	93,6%	96,7%	96,2%
08/01/2013	96,1%	89,7%	93,9%	87,8%

Sources : Proceed by author

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Look the equation prediction accuracy rate is nearly approaching the value of each interest rate futures, which time average above 85%. There are also futures interest rate forecast results approaching close to 100%.

V CONCLUSION

From this research it can be concluded that the neural network can be used as a means of forecasting interest rates banking industry in Indonesia. A neural networks (neural network) interact with their environment through an interactive process of adjustment applied to the synaptic weight and level of bias. The network becomes more different about its environment after each iteration of a learning process. Look how the results the accuracy of predictions forecasting interest rates banking industry in Indonesia when using neural network, as presented in the table above.

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