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Implementation Network Nerves Imitation Using the Backpropagation Method For Prediction Sale Groceries

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Abstract

The sale of groceries is one of the important things _ in the retail industry, Predicting the sale of groceries accurately can help the company in planning supplies, and making decisions for business. In implementing network nerves imitation backpropagation method as tool predictions For sale basic food.Method This can used To practice network nerve imitation to recognize patterns and relationships between influencing factors _ _ in the sale of groceries, like price, promotion, and economic factors. Data sale collected groceries _ from periods previously used as a training dataset For practice network nerves imitation. Aside from That For shows that implementation network nerves imitation with backpropagation method can give predictions of sales enough basic necessities accurate predictions This is also used by other companies for optimizing inventory, managing promotional strategies, and responding to change conditions company with more effectively. .

Keywords *- _ Backpropagation, Matlab, Sales*

1. INTRODUCTION

Sembako is an abbreviation of Nine Basic Ingredients which consists of various food ingredients that are generally needed by Indonesian people [1]. As one of the most common types of retail business, grocery stores provide various products such as rice, cooking oil, sugar, and many more. These products are basic necessities that are really needed by people in living their daily lives. Therefore, grocery stores have a very important role in ensuring an adequate supply of food for the community [2].

Problems at the shop groceries This sometimes supplies material principal to Lots so that products must stored in a warehouse causing inventory and quality material principal decrease. On the contrary, a lack of supply of groceries causes disappointment in customers Because material necessary groceries are No available, interesting customers look for shop groceries [1].

Therefore, the company requires a sales strategy To increase profit. One of the methods or techniques used is making good sales (forecast). Inactivity forecasting, This can make policy or possible decisions give information, and forecast sales in accordance with forecasting. Through the use and selection method right a successful company in marketing products can bring advantages [3].

The method used is the method of network nerve imitation. Ability copy function parts brain man that's what it means with network nerve imitation [4]. One artificial neural network method that is often used for forecasting is the backpropagation method. Backpropagation is an artificial neural network method that is quite reliable in solving problems [5]. Backpropagation is a reverse calculation of the feed-forward process. The goal is to determine the value of weight changes at each layer [6]. Characteristic from backpropagation covers three layers: the input layer, where data is carried to the network; layer hidden layer where the data is processed; and the layers output, which result from input provided by the layer input [7].

2. RESEARCH METHODS

Research methodology is a scientific process or method for obtaining information that will be used for research purposes. In conducting this research, the author followed the steps of this research methodology, which are as follows [8].

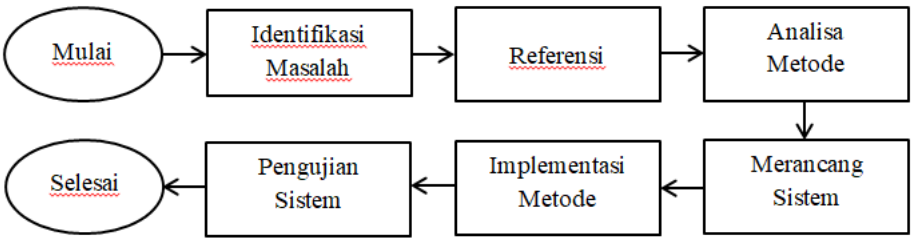

Figure 1 . Methodology Study

This research aims to predict grocery store sales using the backpropagation method. Achievement to results studies This is supported by material, data, and methods as follows:

1.1 Method of collecting data

1.1.1 Observation

Observation is something activity For data collection via meetings as well as observation in a way direct place study. With observation, researchers know in a way clearly the problems that exist in ko groceries mentioned [9].

1.1.2 Interview

Interviews are something method of collecting information by submitting questions in a way direct to an expert or responsible authority to answer on problem [10].

1.1.3 Literature review

A literature review is a method of data collection with the method of gathering journals, literature, papers, papers, books, and internet sites as source references For the study [11].

1.2 Network Nerves Imitation

Artificial Neural Network (ANN) or *Artificial Neural Network* (ANN) is part of an artificial intelligence system (*Artificial Intelligence*, AI), namely an artificial representation of the human brain and always tries to simulate the learning process in the human brain. The term "artificial" or "artificial" means that this neural network is implemented by a computer program capable of performing many calculations during the learning process. ANN plans to create a computer system model that can imitate the behavior of biological neural networks

[12]. An artificial neural network is a network that resembles the power of a human brain that tries to perform a certain task [13]. Artificial neural networks (ANN) are artificial representations of the human brain that always try to simulate the learning process in the human brain. One area where ANN can be put to good use is the field of forecasting [14]. Single-screen ANN has limitations in pattern recognition. This drawback can be overcome by adding one or more hidden screens between the input and output screens [15].

1.3 Matlab

Matlab (Matrix Laboratory) is a program for numerical analysis and calculations with a programming code that uses calculations based on interpretation based on the characteristics and shape of the matrix [16].

1.4 Sale

Sale is an activity performed by a company To maintain the growth of its business and to produce desired benefits. Activity distribution is part of purposeful marketing To move products from producer to consumers [17].

1.5 Prediction

Forecasting is very important for modern business enterprises. Necessary forecasts must be created, refined, and verified. If change occurs if it is not anticipated, the consequences can be devastating. A business prepares for change through planning, which in turn requires making forecasts, setting goals based on the forecasts, and deciding how to achieve the goal arc. In short, forecasting is an integral part of the planning process [18].

1.6 Backpropagation Method

Backpropagation is a learning algorithm used for networks with multilayer networks or networks of many layers to change the weights connected to neurons in the hidden layer [19] . Backpropagation trains a network to achieve a balance between the network's ability to recognize patterns used during training and the network's ability to correctly respond to input patterns that are similar (but not identical) to the patterns used during training, to achieve this [20] . In the backpropagation method, there are 2 calculation flows, namely forward propagation and backward propagation. Forward propagation in the backpropagation method uses the binary sigmoid activation function as follows:

$$f(x) = \frac{1}{1 + e^{(-x)}}$$

The following are the steps in the process of forward propagation and backward propagation in a backpropagation artificial neural network.

a. Forward Propagation is:
   1. Calculation of the signal sent from the input layer to the hidden layer (z_in_j) is done using the following equation:

$$z\_in_j = v_{0j} \sum_{i=0}^{n} x_i v_{ij}$$

   2. Calculation of the signal sent from the hidden layer to the output layer (y_in_k) is done using the following equation:

$$y\_in_k = w_{0k} \sum_{j=0}^{n} z_j w_{jk}$$

b. Backward Propagation is:
   1. To update the weight that connects the output layer and hidden layer ($w_{jk}(baru)$) is done using the following equation:

$$\delta_k = (t_k - y_k) y_k (1 - y_k)$$

$$\Delta w_{jk} = \alpha \delta_k z_j$$

$$w_{jk}(baru) = w_{jk}(lama) + \Delta w_{jk}$$

2. To update the weight that connects the hidden layer and input layer (v_{ij}($baru$)) is done using the following equation:

$$\delta\_in_k = \sum_{k=1}^{n} \delta_k w_{jk}$$

$$\delta_j = z\_in_j z_j(1 - z_j)$$

$$\Delta v_{ij} = \alpha \delta_j x_i$$

$$v_{ij}(baru) = v_{ij}(lama) + \Delta v_{ij}$$

3. RESULTS AND DISCUSSION

Prediction sales use a backpropagation algorithm that is performed by processing existing sales data. When using network nerves imitation For predicting sale product, yes a number of a must thing defined, namely the input to the network nerves imitation. Input the accepted by the system and enter to system form initialized number before input. The system does what data processing the result The same as what was expected or No.

Testing the backpropagation algorithm is performed with Matlab. Matlab (Matrix Laboratory) is Language programming developed by The Mathwork Inc. This includes different features and functions from Language and other programming for finish-related problems with operation mathematics on elements, matrices, optimization, data mining, prediction, etc.
Our data use is Sales Data :

Nama Toko	Beras	Daging	Tepung	Gula
TOKO HERUNIAWATI	9840000	8400000	1162000	1280000
TOKO HERUNIAWATI	62910000	9800000	1660000	960000
TOKO APRILIA SUKRISNI	8597700	166000	498000	114600000
TOKO APRILIA SUKRISNI	5412000	7700000	498000	5250000
TOKO APRILIA SUKRISNI	12372300	2800000	332000	22200000
TOKO MAJU TERUS	4920000	4200000	332000	5250000
TOKO MAJU TERUS	4920000	4200000	166000	8400000
TOKO MAJU TERUS	1968000	7700000	332000	889200
KOPERASI BRI MELAWI	2621250	10500000	1162000	15600000
KOPERASI BRI MELAWI	4920000	8400000	1120000	51600000
KOPERASI BRI MELAWI	2621250	5600000	1280000	16800000
TOKO DEB	4428000	1400000	960000	30600000
TOKO DEB	2097000	2800000	2640000	17400000
TOKO FATHULLAH ZIKRI	5904000	2450000	1920000	51600000
TOKO FATHULLAH ZIKRI	3145500	4200000	480000	25800000
TOKO FAHRI	6888000	2450000	3600000	13800000
TOKO FAHRI	31500000	3500000	640000	35400000
TOKO KEDAI YUDA	10500000	1920000	480000	89400000
TOKO KEDAI YUDA	10500000	480000	2400000	15400000
TOKO KEDAI YUDA	5250000	3600000	82800000	12600000
TOKO KOPERASI KONSUMEN SYARIAH B	5250000	5600000	2964000	82800000
TOKO KOPERASI KONSUMEN SYARIAH B	5250000	5250000	480000	2964000
TOKO KOPERASI KONSUMEN SYARIAH B	5250000	15400000	2400000	23600000

Figure 2. Sales Data

The picture above is sales data. Our sales data _ used is 200 data, and the data used for training data is 100 data.

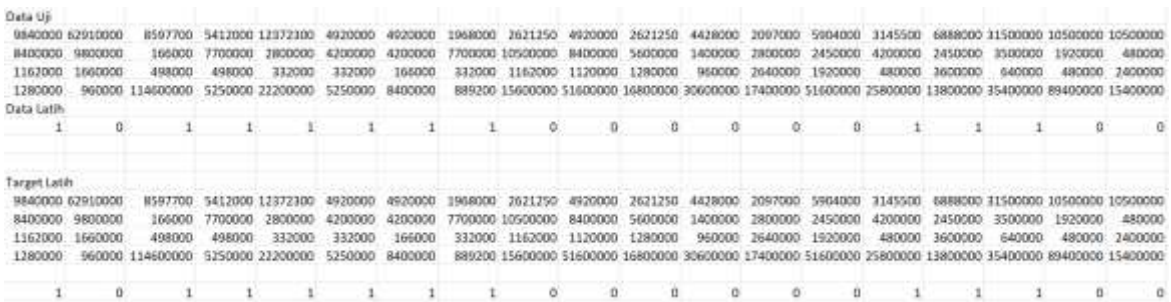

Figure 3 . Data Input

The picture above is sales data that has been transposed for the process carried out using the Backpropagation algorithm.

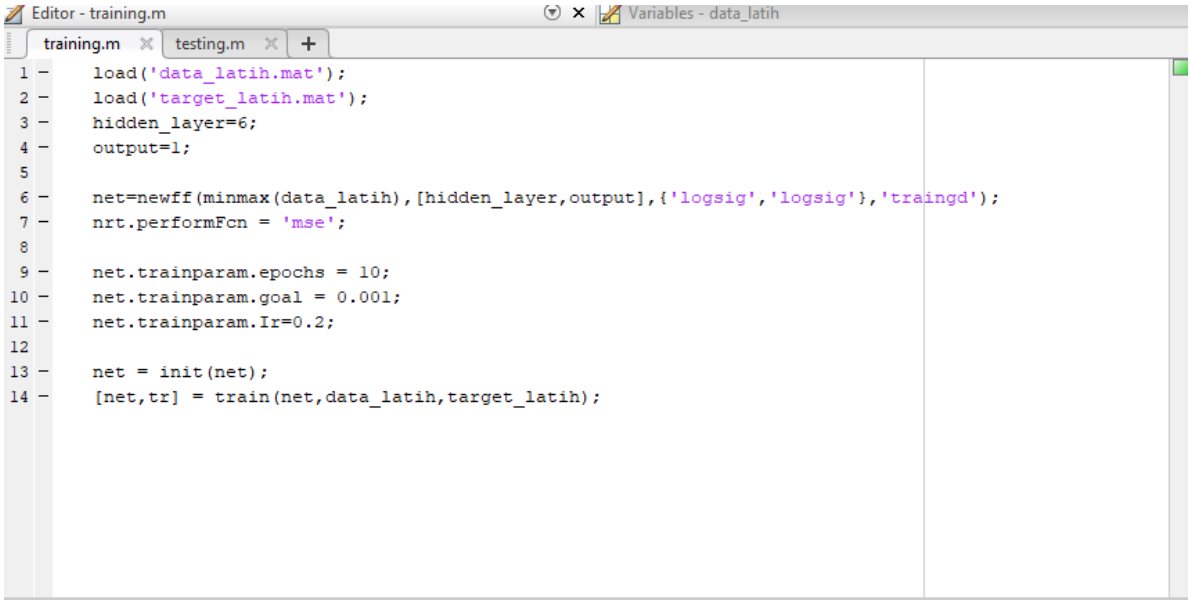

Figure 4. Training data testing process

The picture above is the process of testing training data using the application Matlab, with hidden layer=6, epoch=10, limit threshold =0.001, and output=1.

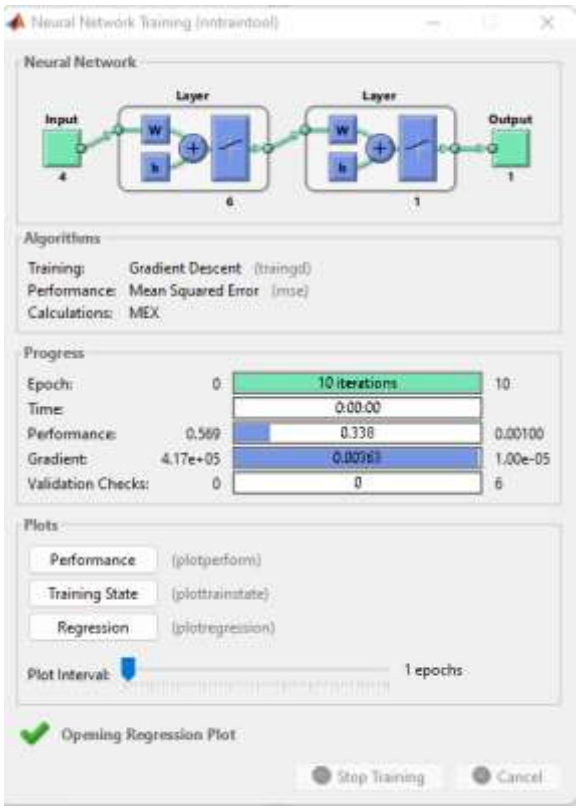

Figure 5. Results of training data processing

The picture above is the results from the training data process with input result =4, hidden layer=6, and output=1 with 10 iterations.

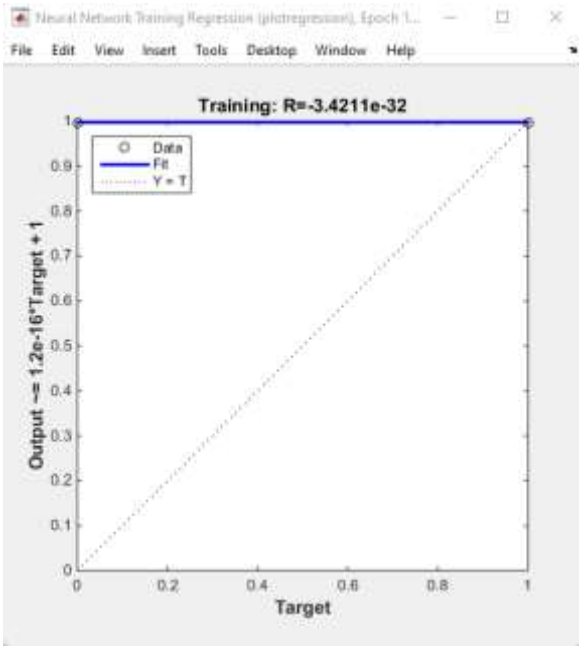

Figure 6. Linear Regression

The picture above is the result of linear regression of the calculation of the resulting training data in the backpropagation algorithm process in the application Matlab.

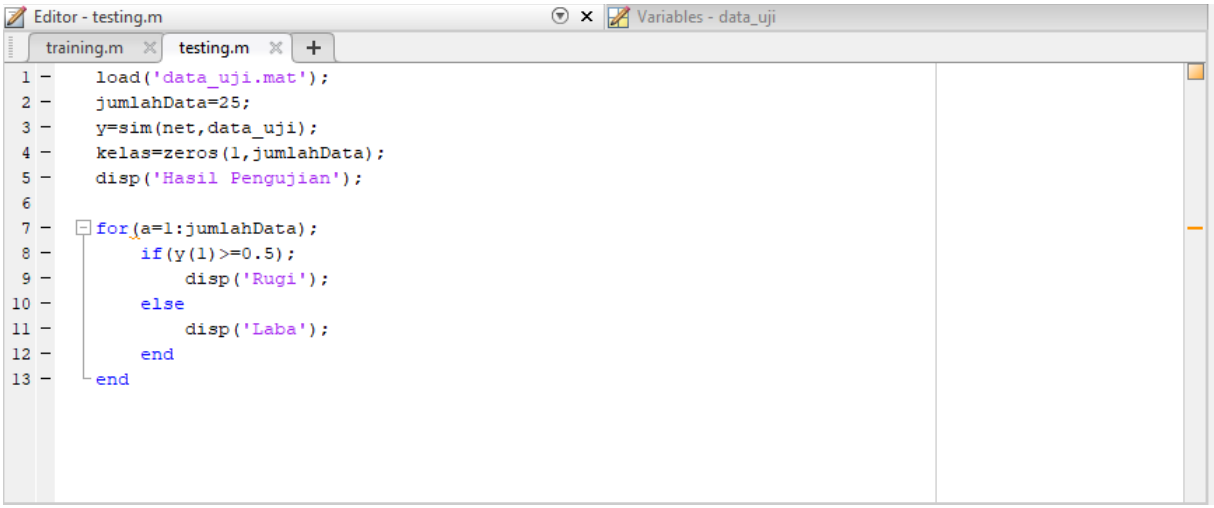

Figure 7 Test data calculation process

The picture above is the process of calculating test data using the application Matlab, with a number of data=25, and if the calculation more bigger than 0.5 then the result Makes a loss However If No the result is Profit/ Profit.

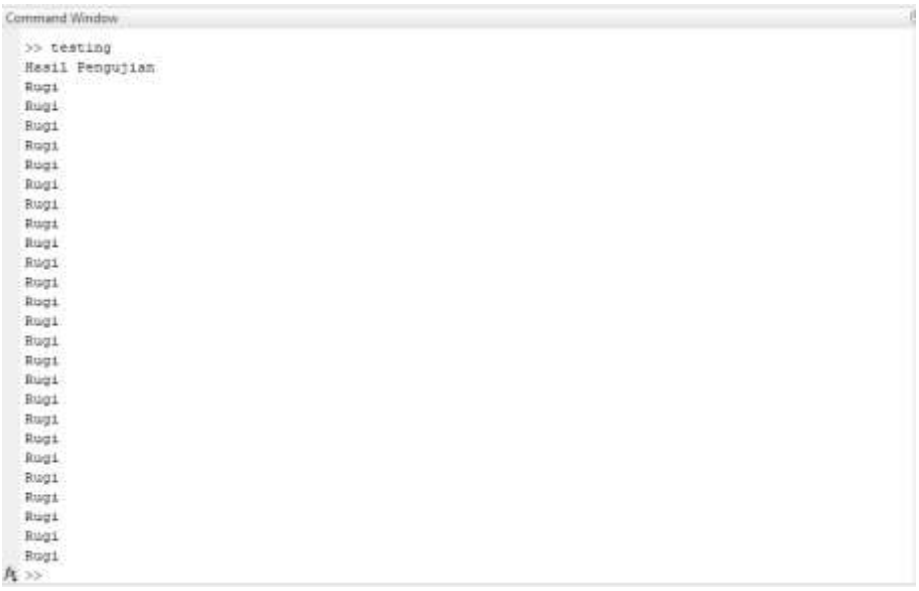

Figure 8. Test results

The picture above is the results testing of the 25 data tested using the application Matlab.

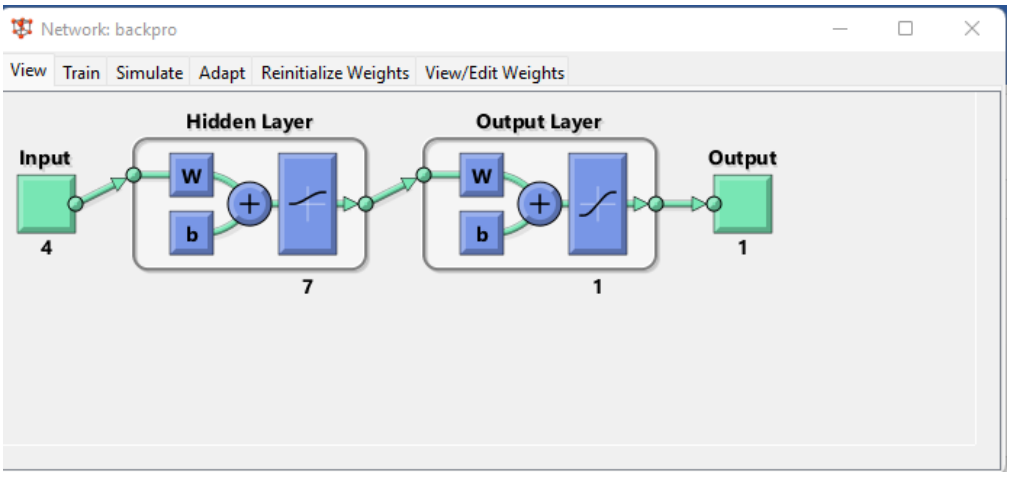

Figure 9. Backpropagation Algorithm Pattern Results

The picture above is the pattern of the results from the network Backpropagation Algorithm.

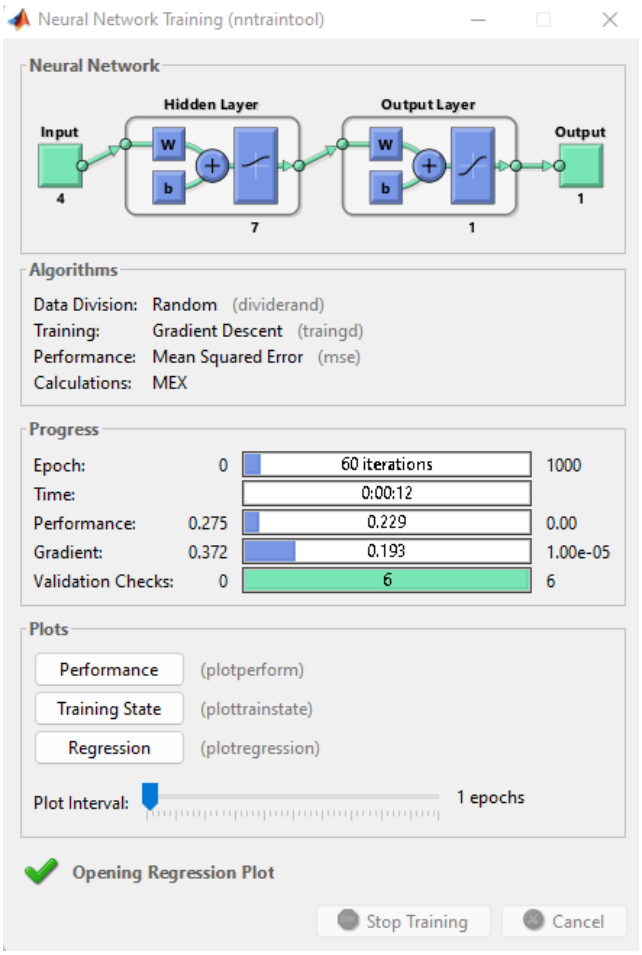

Figure 10. Neural Network Training

The picture above is a Neural Network Training network Backpropagation algorithm from test data calculation. With input =4, hidden layer=7, output=1, with 60 iterations and 12 seconds processing time.

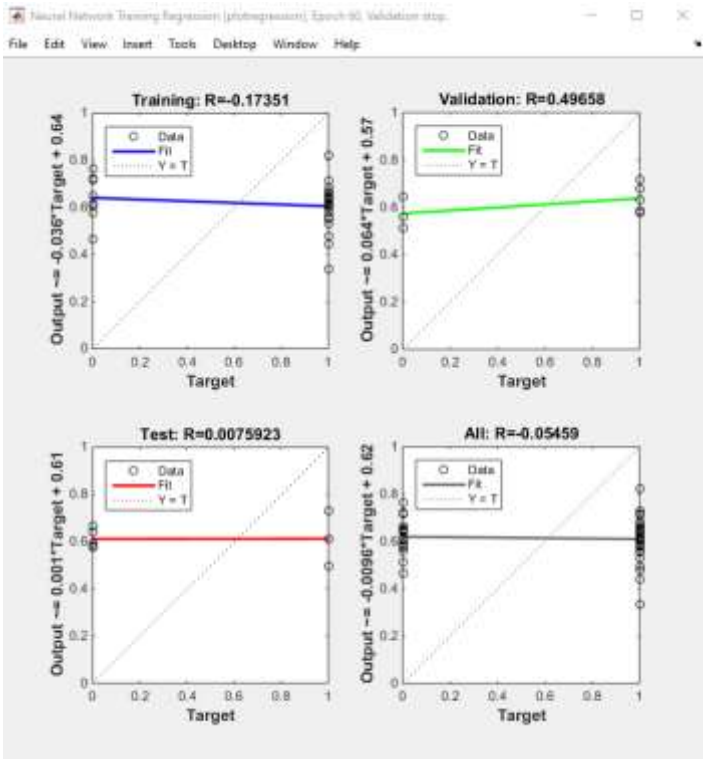

Figure 11. Regression Neural Network Training

The picture above is a neural network training graph from the calculation of the resulting test data in the backpropagation algorithm process in the application Matlab.

4. CONCLUSION

After doing implementation and testing using the programming language *Matlab*, then can conclude as follows:

1. Network nerve imitation can used To predict sales of groceries with sufficient results _ and is accurate and capable of becoming an effective tool _ in enlivening sales of groceries in the Century front.
2. For sales data groceries from period previously can used as input for practice nervous system tissue imitation.
3. Architecture more network _ complex used that is level possible accuracy _ improve, expand, and update sales datasets groceries.
4. Network nerves imitation with method backpropagation is possible For catching a non-linear relationship between influencing factors _ sale groceries, like factor seasonality, change price, and factor economy.

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