

Application of Artificial Neural Networks using the Matlab Application for Predicting the Rate of Development of Rainfall Intensity (Case Study in Rangkasbitung District)

Luthfy Budhy Adzy*

* Program Study of Informatics Engineering, Faculty of Science and Technology, Muhammadiyah University of Sukabumi

Correspondence Author: luthfybudhy28@ummi.ac.id

Article Info :	ABSTRACT
<p>Article History :</p> <p>Received :</p> <p>17 Oct 2022</p> <p>Revised :</p> <p>13 Nov 2022</p> <p>Accepted :</p> <p>14 Nov 2022</p> <p>Available Online :</p> <p>16 Jan 2023</p> <p>Keyword :</p> <p>Artificial Neural Network, Backpropagation, MatLab.</p>	<p><i>With the development of increasingly advanced information technology at this time, the MatLab application program created by applying an Artificial Neural Network can be used to predict the rate of development of rainfall intensity. Information technology can now be used to assist in processing, obtaining, compiling, storing, and managing data to produce information for researchers in compiling research so that research becomes very easy. Food crop production is influenced by rainfall during the development and growth of food crops; this causes rainfall prediction to be essential in agricultural planning. Prediction is the most crucial tool in determining everything effectively and efficiently. Therefore, several methodologies are used in compiling this research, namely collecting rainfall intensity data from each year, checking each problem, and then matching it with the required data. Samples were taken to determine the criteria for rainfall intensity based on BPS (Central Statistics Agency) data, namely data on rainfall intensity in Rangkasbitung sub-district from 2010 to 2020. The data is presented in tabular form. The following is a table of rainfall intensity data. 1) The backpropagation algorithm can be used in the prediction process; whether it is good or not is influenced by a learning material and the number of neurons in the hidden layer. 2) If the data is getting more significant on the unit in the hidden layer, the prediction results will be closer to the targeted value. 3) Using an artificial neural network in the MatLab software is proven to predict rainfall intensity development rate.</i></p>

1. INTRODUCTION

With the development of increasingly advanced information technology at this time, the MatLab application program created by applying an Artificial Neural Network can be used to predict the rate of development of rainfall intensity. Current information technology can assist in processing, obtaining, compiling, storing, and managing data to produce accurate quality information for use in personal or business needs and government needs, increasing or decreasing.

Prasetyawan (2018) wrote a journal that uses the Artificial Neural Network (ANN) method with a backpropagation training algorithm to predict horse racing in Jamaica, ANN with the feed-forward network or backpropagation used in research has been proven to give the best results for a prediction. In addition, there is a journal written by Al Cripps (1996) which uses the Artificial Neural Network (ANN) method, which has succeeded in predicting academic performance in the

form of graduation achievement, study period, and GPA. Then finally, the journal written by Meinanda (2009) using the Artificial Neural Network (ANN) method has succeeded in predicting the level of success of MBA students with the GPA predictor for the undergraduate program.

Based on the comparison of the two journals above, the researcher can conclude that using an artificial neural network is a model using an artificial neural network a data model that is capable of providing complex input or output in Artificial Neural Network (ANN), which is a data processing technique that has the same characteristics as in biological neural networks or called JSB, as a mathematical generalization model of human understanding (Wuryandari & Afrianto, 2012) or. Therefore, solving a problem is relatively easy, one of which is the data input process. Speed in execution and initialization on a system that is so complex (Hamid et al., 2011). Backpropagation is one of the training methods from ANN, which uses a multilayer architecture with supervised training methods (Pakaja & Naba, 2015). The backpropagation network consists of three layers or more processing units: the input layer (input variable of nerve cell units), the hidden layer, and the output layer (Anwar, 2011). Backpropagation neural networks have advantages, including repeatedly learning to create a system resistant to damage and consistently working well sent to neurons and weights (Sudarsono, 2016). Using the training or learning rate variable functions to speed up backpropagation training, a combination of the understanding rate or learning rate and momentum parameters, to obtain relatively more accurate results (Putra & Ulfa Walmi, 2020).

2. METHOD

Research methodology is a collection of work steps by researchers in compiling research so that research becomes very easy. Several methodologies are used in compiling this research, including collecting rainfall intensity data from each year, checking each problem and then matching it with the required data.

The framework in this study describes the process of work steps carried out by researchers in conducting this research so that each work step can be well structured to get the expected data results later. The following is a picture of the research framework, including:

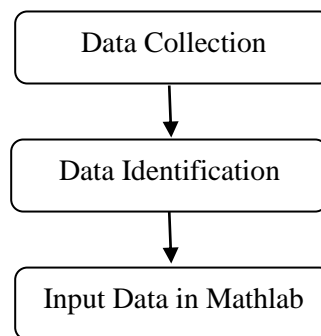


Figure 1. Researcher Framework

3. RESULTS AND ANALYSIS

The samples taken in determining the criteria for rainfall intensity are based on BPS (Central Statistics Agency) data, namely rainfall intensity data for the Rangkasbitung sub-district from 2010 to 2020; the data is presented in tabular form. The following is a table of rainfall intensity data, including:

In this section, the research results are explained and at the same time, a comprehensive discussion is provided. Results can be presented in numbers, graphs, tables, and others which make the reader understand easily. The discussion can be divided into several sub-chapters.

Table 1. Rainfall Intensity Data (mm3) January - February

Year	January	February
2010	436	230
2011	436	230
2012	513	280
2013	35	16
2014	584	283
2015	584	283
2016	584	283
2017	584	283
2018	307	328
2019	307	328
2020	307	328

Table 2. Rainfall Intensity Data (mm3) March - May

March	April	May
393	66	426
393	66	426
258	233	252
60	29	34
118	78	183
118	78	183
118	78	183
118	78	183
75	278	224
75	278	224
75	278	224

Table 3. Rainfall Intensity Data (mm3) June - August

June	July	August
304	351	183
304	351	183
51	19	58
10	21	22
163	265	35
163	265	35
163	265	35
163	265	35
10	10	14
10	10	14
10	10	14

Table 4. Rainfall Intensity Data (mm3) September - November

September	October	November
200	509	299
200	509	299
74	79	42
18	51	56
10	175	332
10	175	332
10	175	332
10	175	332
201	74	157
201	74	157
201	74	157

Table 5. December Rainfall Intensity Data (mm3).

December
247
247
28
36
202
202
202
202
239
239
239

3.1. Initialization Stage

Initialization defines the initial mindset on the values of the required variables, input values, outputs, and weights that produce learning rates.

3.2. Activation Stage

At this stage, two activities are carried out, and the first is to calculate the output on the hidden layer. Then for the second, the calculation of the actual output layer is carried out.

3.3. Weight Training Stage

At this stage, it is almost the same as the previous stage. Two activities are carried out; the first is to calculate the gradient error on the output layer and the gradient error hidden layer.

3.4. Iteration Stage

A repetition process is carried out to get the minimum error value at this stage.

3.5. MatLab

MatLab is a software made by MathWorks inc, which has a function to solve problems such as numeric, easy, and simple in solving problems such as vectors and matrices. Generate matrix inversion values and solve linear equations.

3.6. Program and Output Results

For the first step, training data is carried out then the regression is carried out, and then the output is obtained; the following results include:

1) Process Training Data

The process of this training data includes rainfall intensity data that form an artificial neural pattern, and the following results are obtained:

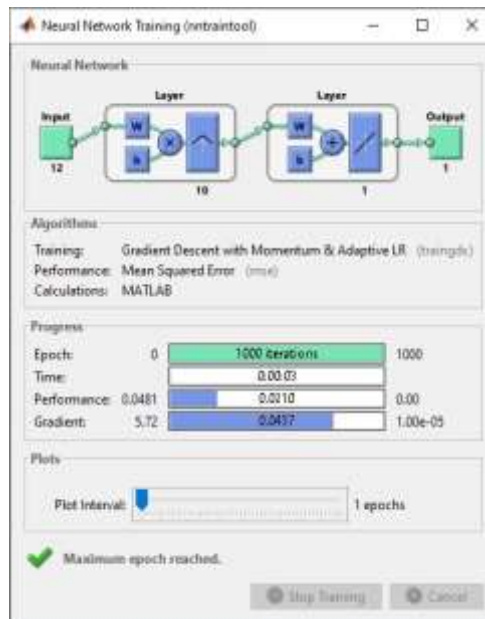


Figure 2. Results of Training Data

In Figure 2, the training data results show that the best performance is 0.0481 with a gradient value of 5.72, which forms the brain's nerves to solve problems. This figure is a predictive performance evaluation for easy understanding and analysis. Then the accuracy results are made in graphical form; the process of analysis is by observing the ANN parameters used at the level of prediction accuracy.

2) Regression Process / Data Testing

The results obtained from this regression data include changes in rainfall intensity in Rangkasbitung District, Lebak Regency, Banten. The following are the regression results obtained in Figure 3:

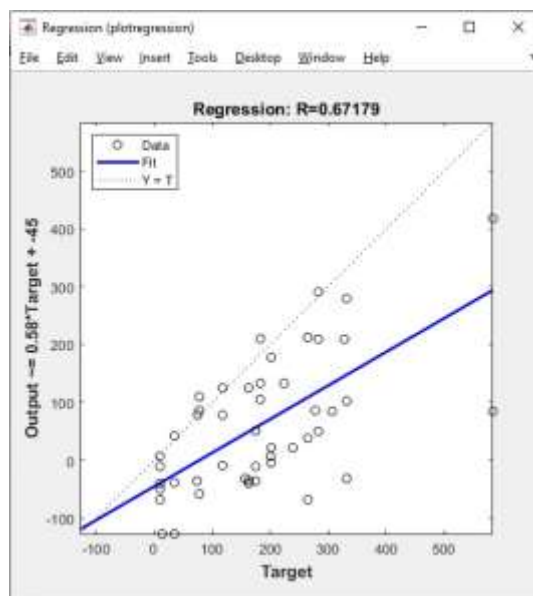


Figure 3. Regression Data Results

Looking at the regression results obtained by 0.67179 in predicting rainfall intensity for five years experienced a significant change in rainfall intensity.

3) Prediction / Figure Process

In the process of predicting or testing this figure, it describes two lines that coincide with each other by forming an irregular pattern; the following results are shown in Figure 4:

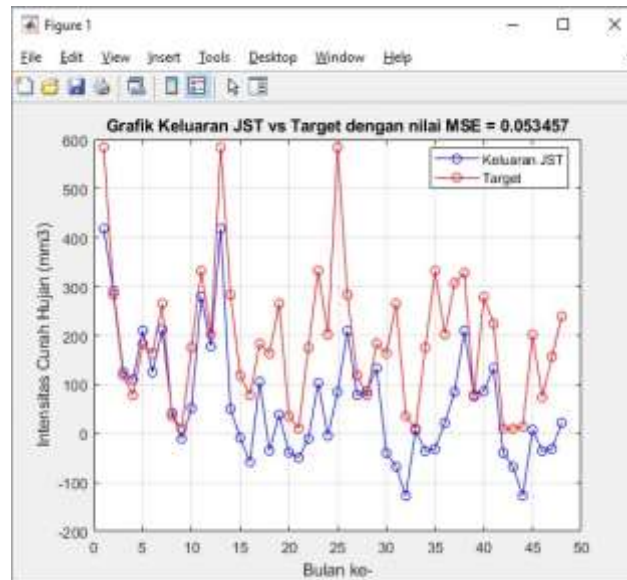


Figure 4. Prediction data results

Looking at the results above, the ANN (Artificial Neural Network) output graph vs the target by obtaining an MSE value of 0.053457, that the predicted data is 85% valid.

4. CONCLUSION

From the results of the discussion and testing using the MatLab software, we can conclude that:

- 1) The network consists of three layers: the input layer, the hidden layer, and the output layer. The backpropagation algorithm can be used in the prediction process; whether it is good or not is influenced by a learning rate and the number of neurons in the hidden layer.
- 2) If the data is getting bigger on the unit in the hidden layer, the prediction results will be closer to the targeted value. Several factors affect the accuracy of a prediction on artificial neural network backpropagation, namely learning rate, target error, amount of data and weight values assigned randomly to each neuron.
- 3) By using an artificial neural network in the MatLab software, it is proven that it can predict the rate of development of rainfall intensity and has succeeded in carrying out a series of steps needed to predict the rate of development of rainfall intensity in Rangkasbitung sub-district, Lebak Regency, Banten.

5. DECLARATION OF COMPETING INTEREST

We declare that we have no conflict of interest.

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