



Image Processing for Freshness Identification Tilapia Using Backpropagation Algorithm (Case Study: Binjai City Food Security and Agriculture Office)

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Abstract

Tilapia (*Oreochromis niloticus*) is a type of fish that comes from rivers and lakes that connect the river. Tilapia was imported to Indonesia officially by the Freshwater Fisheries Research Institute in 1969, Tilapia fish breeds in Indonesia come from Taiwan as for the dark color with vertical stripes as many as 6-8 pieces and the Philippines which is red. The problems faced today related to testing the level of freshness still use conventional methods, namely by only seeing and sorting fish by sight or sight only. This can certainly cause errors in choosing fish for ordinary people or who do not have expertise in choosing fresh fish. For this reason, a system is needed that can identify the freshness of tilapia using digital image management. Many methods are used in identifying an image, one of which is used by using the *Backpropagation method*.

Keywords: *Image Processing, Freshness of tilapia, Backpropagation*

1. Introduction

This tilapia fish (*Oreochromis niloticus*) is a type of fish that comes from rivers and lakes that connect the river. Tilapia was imported to Indonesia officially by the Freshwater Fisheries Research Institute in 1969, Tilapia fish breeds in Indonesia came from Taiwan as for dark characteristics with vertical stripes as many as 6-8 pieces and the Philippines which was red. In general, tilapia is traded in a dead state and often still alive. The decline in fish quality can be seen from changes in fish skin color, eyes, gills, and fish meat texture. These changes are caused by the activity of enzymes, chemicals, and bacteria in it so that the fish is not suitable for trade let alone consumed by humans, Good fish is fish that is still fresh. Fresh fish is fish that still has the same properties as living fish, both in appearance, smell, taste and texture. Based on its freshness, fish can be classified into four quality classes, namely fish with a very good level of freshness (prime), fish with good freshness (*advanced*), fish whose freshness is backward (medium), and fish that are no longer fresh or rotten [1]. The problems faced today related to testing the level of freshness still use conventional methods, namely by only seeing and sorting fish by sight or sight only [2]. This can certainly cause errors in choosing fish for ordinary people or who do not have expertise in choosing fresh fish. For this reason, a system is needed that can identify the freshness of tilapia using digital image management. Many methods are used in identifying an image, one of which is used by using the *Backpropagation method*. In addition to the above problems, this study was also made to test the application of the Backpropagation method in identifying the freshness of tilapia. How much is the level of accuracy based on predetermined training data, namely tilapia images in identifying tilapia freshness using the Backpropagation method [3].

2. Researd Methods

2.1. Previous Methods

A study is conducted to find bright spots or get a conclusion that can be accepted by many people. The use of methods in a study is very important to use with the aim of getting the desired results in solving a problem. Problem solving is a series of procedures and steps in research that aims to obtain stages that are structured systematically, so that research can be carried out effectively and efficiently.

2.2. Backprogogation

JST backpropagation is one of the information or data processing systems designed by mimicking the workings of the human brain in solving a problem by carrying out the learning process through changes in the weight of its synapses. JST in the form of an arrangement of artificial nerve cells (neurons) is built based on the principles of human brain organization. One of the methods used in JST is

Backpropagation. Backpropagation is a systematic method of neural networks using supervised learning algorithms and is usually used by perceptrons with multiple layer screens to change the weights in their hidden layers [6], [7], [8]. Backpropagation is a gradient descent method to minimize the squared of output error. There are three stages that must be carried out in network training, namely the forward propagation stage, the backpropagation stage, and the weight and bias change stage. Backpropagation is a gradient descent method to minimize the squared of output error. There are 3 (three) stages that must be carried out in network training, namely the forward propagation stage, the back-propagation stage, and the weight and bias change stage. This network architecture consists of input layers, hidden services, and output layers. The reverse propagation method is an excellent method of dealing with complex pattern recognition problems [9], [10], [11].

In Backpropagation, the activation function used must meet several conditions, namely continuous, easily differentiated and is a function that does not go down. One of the functions that meets these three conditions so that it is often used. Here are the activation functions that are often used, namely [12]:

In detail, the backpropagation network training algorithm is:

1. Initialize weights (take the initial weight with a fairly small random value).
2. Set the maximum Epoch, Targer error, and learning rate.
3. Initialization epoch = 0.
4. Do the following steps during the condition is false with the following steps:
5. Stages of Forward propagation (Forward propagation)

Each input unit ($i = 1, 2, 3, \dots, n$) receive the signal and forward the signal to the layer above it (hidden layer). x_i, x_i

1. Each unit in a hidden layer ($z_j, j=1, 2, 3, \dots, p$) sums the weighted signals:

$$z_in_j = v_0_j + \sum_{i=1}^n x_i v_{ij} \quad (1)$$

2. Use the activation function to calculate the output signal:

$$z_j = f(Z_in_j) \quad (2)$$

And send the signal to all units in the upper layer (output units).

3. Each unit of output (sums weighted input signals). ($y_k, k = 1, 2, 3, \dots, m$)

$$y_in_k = w_0_k + \sum_{j=1}^p z_j v_{jk} \quad (3)$$

4. Use the activation function to calculate its output signal

$$y_k = f(y_in_k)$$

And send the signal to all units in the upper layer (Output units).

2.3. Parrot Fish

Tilapia is one of the freshwater fish that was officially imported to Bogor in 1969 by the Freshwater Fisheries Research Institute. Furthermore, the fish was disseminated to various provinces throughout Indonesia around 1971. Tilapia is resistant to environmental changes, omnivorous, able to digest feed efficiently, fast growth and resistance to disease attacks. Classification of tilapia according to [1] The advantages possessed by tilapia include being tolerant of the environment both in fresh and brackish water in the range of pH 5 - 11, the growth is quite fast, namely within 6 months the fry are 30 g in size. Can grow to a size of 300 - 500 g, can be spawned after 5 - 6 months old and can be spawned again after 1 - 1.5 months later, and can withstand lack of oxygen in water. Tilapia lives in rivers, lakes, reservoirs and rice fields. In the tropics, tilapia can live and grow well throughout the year at locations up to an altitude of 500 meters above sea level. This fish is kept with a higher density compared to fish from other Cyprinidae groups such as goldfish, but tilapia meat is less preferred by the community [1].

2.4. Fish freshness

Good fish is fish that is still fresh. Fresh fish is fish that still has the same properties as living fish, both in appearance, smell, taste and texture. Based on freshness, fish can be classified into four quality classes, namely fish with a very good level of freshness (prime), fish with good freshness (advanced), fish whose freshness is backward (medium), and fish that are no longer fresh (rotten). As soon as the fish dies, it will undergo changes that lead to decay caused by bacterial activity, chemical changes caused by enzymes and the process of oxidation of fish fat by air [8].

2.5. Identification

Identification is a way done by a person to take over the characteristics of others, Identification is a tendency or desire in a person to be equal to other individuals or make it an integrated part of his own personality. Then the other person to whom the target is identified is called an idol (from the word idol meaning "revered figure"). The lifestyle, attitude, behavior and even beliefs of the idol will institutionalize and animate the identified actors so that their personalities are affected by the idol and form similar characters. At first glance, this identification is similar to imitation, but basically the two things are different. The basic difference is the identification process, imitation is carried out thoroughly, so that the identification process is more in-depth, while in the imitation process imitation tends to be not thorough [5].

2.6. Matlab

Matlab was developed as a programming language as well as a visualization tool, which offers many capabilities to solve various cases that are directly related to mathematical disciplines, such as engineering, physics, statistics, computing and modeling, matlab is a

programming language as a form of media to interact between humans and computers, today made to be easier and faster. Matlab is a high-level programming language (the higher the language level, the easier it is to use) devoted to technical computing. It integrates computing, visualization and programming capabilities in a single, easy-to-use environment. Matlab provides an interactive system that uses the concept of *arrays* / matrices as standard variable elements without the need for array declarations as in other programming languages [4].

3. Results And Discussion

3.1 Research Methods

This research method uses scientific methods to solve a problem in research, of course, researchers must have a way or a method applied in solving problems so that the research carried out can be resolved properly and in accordance with the expected results. Research methods are carried out to search for something systematically using scientific methods and applicable sources. In this research process, it is intended for the Binjai City Fisheries Office, especially in identifying the freshness of tilapia that is suitable for consumption by the community.

The results of the conceptualization will be poured into a research method complete with a literature study pattern, collecting the data needed to analyze the identification system to be made, namely for the identification of tilapia freshness using the *backpropagation method*.

3.2 Research Supporting Data

In identifying a data, of course, previous data is needed which will be a support for the analysis of the calculation of a method so that later the best alternative can be obtained based on predetermined data. In the identification system to identify the freshness of tilapia. The data used are picture pattern data / photos of tilapia. Based on these data, the data obtained in this study are as in the table below.

Table 1: Tilapia Data




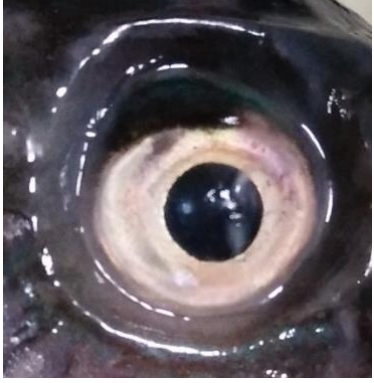
No	Pattern	Picture	Information
1	Image 1		Fresh
2	Image 13		Not Fresh

Table 2: Fisheye Pattern Value Data

No	Pattern	Picture	Information
1	Image 1		Fresh
2	Image 13		Not Fresh

3.3 Application of the Method

The application of methods is needed in solving a problem in a research and assessment process. In identifying a data, of course, accurate data analysis must be carried out in the process of identifying a data. Many methods used in the data identification process have been widely carried out by researchers. In research with image management to identify the freshness of tilapia using a backpropagation algorithm.

3.3.1 Define Train Data and Target Data

The data used in the identification analysis process using the backpropagation method are fresh and non-fresh tilapia pattern data. Then the data is extracted characteristics to be used as subterfuge data. The characteristic ecstasy process is carried out by finding RGB (Red Green Blue) values, entropy mean and variants. The extraction process of tilapia image patterns was obtained using matlab software. Target data is data determined by the user to achieve the desired target. In this study, users code target data that is 1 (one) as a fresh category and 0 (zero) for a non-fresh category. The results of extracting fish pattern data that will be used as training data are as in the table below.

Table 3: Training Data and Training Target for Tilapia Pattern

No	Pattern	Train Data						Target Latih
		Red	Green	Blue	Mean	Entropy	Varians	
1	Image 1	0,5995	0,5730	0,5704	0,1700	0,6251	0,0258	1
2	Image 2	0,5745	0,5272	0,5275	0,2099	0,6676	0,0393	1
3	Image 3	0,6069	0,5783	0,5748	0,1894	0,6468	0,0327	1
4	Image 4	0,5975	0,5725	0,5666	0,1897	0,6457	0,0333	1
5	Image 5	0,4205	0,3931	0,3954	0,1717	0,6410	0,0329	1

Table 4 : Training Data and Training Targets for Tilapia Eye Pattern

No	Pattern	Train Data						Target Train
		Red	Green	Blue	Mean	Entropy	Varians	
1	Image 1	0,3851	0,3363	0,3600	0,0844	0,5585	0,0039	1
2	Image 2	0,3828	0,3684	0,3701	0,1241	0,6166	0,0083	1
3	Image 3	0,3940	0,3792	0,3936	0,0931	0,5695	0,0058	1
4	Image 4	0,4480	0,4180	0,4377	0,1355	0,6281	0,0124	1
5	Image 5	0,3805	0,3319	0,3535	0,1419	0,6404	0,0152	1

3.3.2 Backpropagation Method Calculation

The process manually uses tilapia pattern 1 image data which will later be analyzed using the *backpropagation* method. The input pattern data pattern 1 is as follows as follows.



Fig. 1: Pattern 1

With the extraction results as shown in the table below.

Table 5: Train Data and Train Target

Pola	Data Latih						Target
	Red	Green	Blu	Mean	Entropy	Varians	
Pola – 1	0,61636	0,58332	0,58712	0,21209	0,65576	0,03971	1

Furthermore, it determines the initial weight connecting neurons in the input layer and hidden layer (V_{11} , V_{1-n} , V_{21} , V_{2-n}) and the bias weight V_{01} , and V_{0n} is randomly selected in the system, in manual calculations then in this analysis is made freely by the researcher. Similarly the initial weights connecting *neurons* in the hidden layer and output layers (W_{11} , W_{12} , ..., W_{1n}) and the biased weights W_{01} were also randomly selected.

The following is a training calculation using the *backpropagation* method.

Inisialisasi ditetapkan sebagai berikut :

1. Learning rate (α) = 0.2
2. Target error = 0,01
3. MaximumEpoch = 10000
4. Target (T) = 1

Initialization of weights randomly is as follows:

1. Initial weight of *input to hidden layer* (V_{ij}):

$V_{11} = -0,2$	$V_{21} = -0,5$	$V_{31} = 0,1$	$V_{41} = 0,3$	$V_{51} = -0,3$	$V_{61} = 0,5$
$V_{12} = 0,2$	$V_{22} = 0,1$	$V_{32} = -0,3$	$V_{42} = 0,4$	$V_{52} = -0,1$	$V_{62} = 0,2$
$V_{13} = 0,3$	$V_{23} = 0,4$	$V_{33} = 0,2$	$V_{43} = 0,1$	$V_{53} = 0,5$	$V_{63} = 0,1$
$V_{14} = 0,4$	$V_{24} = 0,2$	$V_{34} = -0,5$	$V_{44} = 0,1$	$V_{54} = 0,2$	$V_{64} = -0,3$
$V_{15} = 0,1$	$V_{25} = 0,3$	$V_{35} = -0,2$	$V_{45} = 0,4$	$V_{55} = 0,2$	$V_{65} = 0,1$
2. Initial weight biased to *hidden layer* (V_{0j}) :

$V_{01} = 0,3$
$V_{02} = 0,7$
$V_{03} = 0,5$
$V_{04} = 0,1$
$V_{05} = 0,8$
3. Initial weight of *hidden layer to output layer* (W_{jk})

$W_{11} = 0,1$
$W_{12} = 0,3$
$W_{31} = 0,2$
$W_{41} = 0,4$
$W_{51} = 0,2$
4. Initial weight biased to *layer output* (W_{0j}):

$W_{01} = 0,1$

3.3.3 Forward propagation stage

Operation on the *hidden layer* with the equation:

$$\begin{aligned} Z_{in1} &= V_{01} + \sum_{i=1}^5 x_1 V_{i1} \\ Z_{in1} &= 0,3 + (0,61636 * -0,2) + (0,58332 * -0,5) + (0,58712 * 0,1) + (0,21209 * 0,3) + (0,65576 * -0,3) + (0,03971 * 0,5) = -0,169468395 \\ Z_{in2} &= V_{02} + \sum_{i=1}^5 x_1 V_{i2} \\ Z_{in2} &= 0,7 + (0,61636 * 0,2) + (0,58332 * 0,1) + (0,58712 * -0,3) + (0,21209 * 0,4) + (0,65576 * 0,2) + (0,03971 * 0,5) = 0,732672226 \\ Z_{in3} &= V_{03} + \sum_{i=1}^5 x_1 V_{i3} \\ Z_{in3} &= 0,5 + (0,61636 * 0,3) + (0,58332 * 0,4) + (0,58712 * 0,2) + (0,21209 * 0,1) + (0,65576 * 0,1) + (0,20084 * -0,2) = 1,388719342 \\ Z_{in4} &= V_{04} + \sum_{i=1}^5 x_1 V_{i4} \\ Z_{in4} &= 0,1 + (0,61636 * 0,4) + (0,58332 * 0,2) + (0,58712 * -0,5) + (0,21209 * 0,1) + (0,65576 * -0,3) + (0,03971 * 0,3) = 0,310099174 \\ Z_{in5} &= V_{05} + \sum_{i=1}^5 x_1 V_{i5} \\ Z_{in5} &= 0,8 + (0,61636 * -0,2) + (0,58332 * 0,5) + (0,58712 * 0,1) + (0,21209 * 0,3) + (0,65576 * 0,5) + (0,03971 * -0,4) = 1,139169991 \end{aligned}$$

Binary sigmoid activation function in the *hidden layer* with the equation:

$$\begin{aligned} Z_1 &= \frac{1}{1+e^{-z.in_1}} = \frac{1}{1+e^{-0,17299}} = 0,457734 \\ Z_2 &= \frac{1}{1+e^{-z.in_2}} = \frac{1}{1+e^{-0,732672226}} = 0,675391 \\ Z_3 &= \frac{1}{1+e^{-z.in_3}} = \frac{1}{1+e^{-1,388719342}} = 0,800388 \\ Z_4 &= \frac{1}{1+e^{-z.in_4}} = \frac{1}{1+e^{-0,310099174}} = 0,576909 \\ Z_5 &= \frac{1}{1+e^{-z.in_5}} = \frac{1}{1+e^{-1,139169991}} = 0,757527 \end{aligned}$$

Operations on the *output layer* with the equation:

$$\begin{aligned} Y_{in1} &= W_{k1} + \sum_{j=1}^3 Z_j W_{kj} \\ Y_{in1} &= 0,1 + (0,457734 * 0,1) + (0,675391 * 0,3) + (0,800388 * 0,2) + (0,576909 * 0,4) + (0,757527 * 0,5) = 0,890737594 \end{aligned}$$

The function of sigmoid binner activity in the *output layer* with the equation:

$$Y_1 = \frac{1}{1+e^{-y.in_1}} = \frac{1}{1+e^{-0,890737594}} = 0,709042363$$

Cek error (iterasi berhenti bila $error < 0,01$)

Error lapisan $Y_1 = 1 - 0,709042363 = 0,2909576$

Jumlah kuadrat error = $(0,2909576)^2 = 0,084656347$

3.3.4 Backpropagation stage

$$\begin{aligned} \delta_1 &= (T_1 - y) * \left(\frac{1}{1+e^{-y.in_1}} \right) * \left[1 - \left(\frac{1}{1+e^{-y.in_1}} \right) \right] \\ \delta_1 &= (1 - 0,709042363) * \left(\frac{1}{1+e^{-0,890737594}} \right) * \left[1 - \left(\frac{1}{1+e^{-0,890737594}} \right) \right] \\ &= 0,060024936 \end{aligned}$$

Wkj weight change rate (with $\alpha = 0,2$):

Calculating weight correction with equations :

$$\begin{aligned} \Delta W_{11} &= \alpha \delta_1 Z_1 = 0,2 * (0,060024936) * 0,457734 = 0,005495 \\ \Delta W_{21} &= \alpha \delta_1 Z_2 = 0,2 * (0,060024936) * 0,675391 = 0,008108 \\ \Delta W_{31} &= \alpha \delta_1 Z_3 = 0,2 * (0,060024936) * 0,800388 = 0,009609 \\ \Delta W_{41} &= \alpha \delta_1 Z_4 = 0,2 * (0,060024936) * 0,576909 = 0,006926 \\ \Delta W_{51} &= \alpha \delta_1 Z_5 = 0,2 * (0,060024936) * 0,757527 = 0,009094 \end{aligned}$$

Calculate the refractive correction with the following equation:

$$\Delta W_{01} = \alpha \delta_1 = 0,2 * (0,060024936) = 0,012005$$

The hidden unit sums the input delta :

$$\begin{aligned} \delta_{in1} &= \sum_{k=1}^m \delta_1 W_{1k} = (0,060024936) * 0,1 = 0,006002 \\ \delta_{in2} &= \sum_{k=1}^m \delta_1 W_{2k} = (0,060024936) * 0,3 = 0,018007 \\ \delta_{in3} &= \sum_{k=1}^m \delta_1 W_{3k} = (0,060024936) * 0,2 = 0,012005 \\ \delta_{in4} &= \sum_{k=1}^m \delta_1 W_{4k} = (0,060024936) * 0,4 = 0,024010 \\ \delta_{in5} &= \sum_{k=1}^m \delta_1 W_{5k} = (0,060024936) * 0,2 = 0,012005 \end{aligned}$$

Hitung informasi *output* dengan persamaan :

$$\begin{aligned} \delta_1 &= \delta_{in1} * \left(\frac{1}{1+e^{-z.in_1}} \right) * \left[1 - \left(\frac{1}{1+e^{-z.in_1}} \right) \right] \\ \delta_1 &= (0,0060024936) * \left(\frac{1}{1+e^{-0,17299}} \right) * \left[1 - \left(\frac{1}{1+e^{-0,17299}} \right) \right] = 0,001490 \\ \delta_2 &= \delta_{in2} * \left(\frac{1}{1+e^{-z.in_2}} \right) * \left[1 - \left(\frac{1}{1+e^{-z.in_2}} \right) \right] \\ \delta_2 &= 0,018007 * \left(\frac{1}{1+e^{-0,732672226}} \right) * \left[1 - \left(\frac{1}{1+e^{-0,732672226}} \right) \right] = 0,003948 \\ \delta_3 &= \delta_{in3} * \left(\frac{1}{1+e^{-z.in_3}} \right) * \left[1 - \left(\frac{1}{1+e^{-z.in_3}} \right) \right] \\ \delta_3 &= 0,012005 * \left(\frac{1}{1+e^{-1,388719342}} \right) * \left[1 - \left(\frac{1}{1+e^{-1,388719342}} \right) \right] = 0,001918 \end{aligned}$$

$$\delta_4 = \delta_{in_4} * \left(\frac{1}{1+e^{-z.in_4}} \right) * \left[1 - \left(\frac{1}{1+e^{-z.in_4}} \right) \right]$$

$$\delta_4 = 0,024010 * \left(\frac{1}{1+e^{-0,310099174}} \right) * \left[1 - \left(\frac{1}{1+e^{-0,310099174}} \right) \right] = 0,005860$$

$$\delta_5 = \delta_{in_5} * \left(\frac{1}{1+e^{-z.in_5}} \right) * \left[1 - \left(\frac{1}{1+e^{-z.in_5}} \right) \right]$$

$$\delta_5 = 0,012005 * \left(\frac{1}{1+e^{-1,139169991}} \right) * \left[1 - \left(\frac{1}{1+e^{-1,139169991}} \right) \right] = 0,002205$$

Calculate weight correction with equation :

$$\begin{aligned} \Delta V_{11} &= \alpha \delta_{1X1} = 0,2 * 0,001490 * 0,61636 = 0,000184 \\ \Delta V_{12} &= \alpha \delta_{2X1} = 0,2 * 0,003948 * 0,61636 = 0,000487 \\ \Delta V_{13} &= \alpha \delta_{3X1} = 0,2 * 0,001918 * 0,61636 = 0,000236 \\ \Delta V_{14} &= \alpha \delta_{4X1} = 0,2 * 0,005860 * 0,61636 = 0,000722 \\ \Delta V_{15} &= \alpha \delta_{5X1} = 0,2 * 0,002205 * 0,61636 = 0,000272 \end{aligned}$$

$$W_{01(Baru)} = W_{01(Lama)} + \Delta W_{01} = 0,1 + 0,012005 = 0,112005$$

$$Y_1 = \frac{1}{1+e^{-y.in_1}} = \frac{1}{1+e^{-0,890737594}} = 0,709042363$$

Error check (iteration stops when error < 0,01)
 Layer errors $Y_1 = 1 - 0,709042363 = 0,2909576$
 Number of squares error = $(-0,126091489)^2 = 0,084656347$

For one iteration using the backpropagation method the result is 0.709042363 with the sum of squared errors = 0.084656347, then the results achieved are not in accordance with the target. Because it has a difference of 0.2909576, it must iterate again until it converges or until the maximum epoch or square of the error < the error target (0.01).

Re-iterate the same way and update the input until iteration to 42 and the error target (0.01) is reached as below.

$$Y_1 = \frac{1}{1+e^{-y.in_1}} = 0,858904064 = \frac{1}{1+e^{-1,806217174}}$$

Error check (iteration stops when error < 0.01)
 lapisan error $Y_1 = 1 - 0,858904064 = 0,1410868$
 Total squared error = $(0,1410868)^2 = 0,019908063$

From the calculation example above, the result of tilapia identification image pattern 1 is 0.858904064 or equal to 1. Provided that if the identification result is more < 0.5 then the result is 0, if the identification result is > 0.5 then the identification result is 1. Thus, the results of the identification of the tilapia pattern image 1 are in accordance with the target, namely fresh tilapia.

Table 6 : Identification Results

Pattern	Train Data						Target	Identification Results
	0,61636	0,58332	0,58712	0,21209	0,65576	0,03971		
Pattern 1	0,61636	0,58332	0,58712	0,21209	0,65576	0,03971	1	1

4. Implementation

At this implementation stage, the results of system trials will be explained regarding algorithms for digital image management, identification of tilapia freshness levels by backpropagation method. Testing is carried out to determine the extent of system performance in processing and recognizing tilapia image pattern data so that it is able to produce the desired information. Apart from the results of the trials that have been carried out, it will be analyzed whether the design can meet the wishes to be achieved. The results of the training are carried out in 2 stages, namely the data training stage to be trained and testing new data. The training data consisted of 144 X 6 patterns of extraction of tilapia image pattern characteristics, while the target data used was 1 X 144 data. Then the data will be trained until the training process is complete. After the data is trained, the data will be tested by inputting test data. The test data used is tilapia image pattern data then the data is tested to see the results of Identify whether it is as desired. The data is then processed into the system to be trained and tested whether the expected results have been achieved and how accurate the digital image processing system is to identify the level of freshness of tilapia by training and recognizing these data. The process of this system is as follows:

To identify the freshness of tilapia, the first thing to do is process the data by inputting training data and training targets, then carry out the training process as shown below.

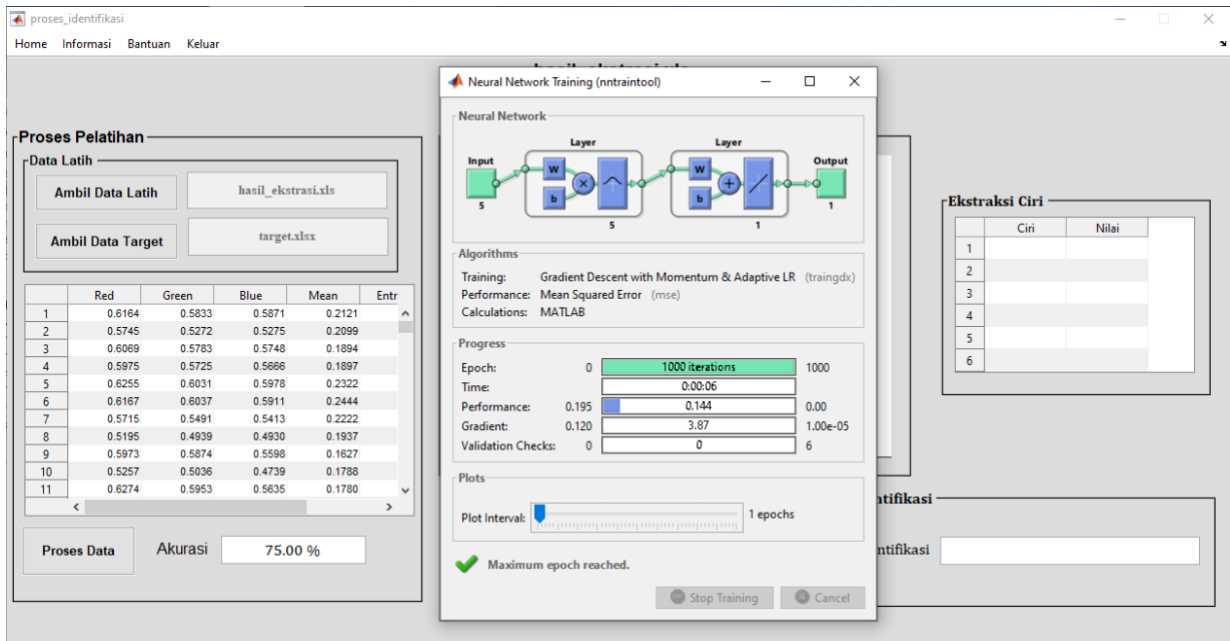


Fig. 2: Training on Tilapia Freshness Identification Data

From the above process, a training process was obtained with an epoch of 1000 target error or performance of 0.144 and with a training process accuracy value of 75%. Next is to test new data, tilapia image pattern data that has never been trained and recognized by the system. This test data is carried out to test whether the system built is as expected.

To test the tilapia image pattern data, the first step is to click the open image button then select the tilapia image to be tested. After appearing, the next step is to extract the characteristics of the image pattern. After the extraction process is complete, then click the Identify button then the results of tilapia identification will appear whether the fish is fresh or not. The process is as shown below.

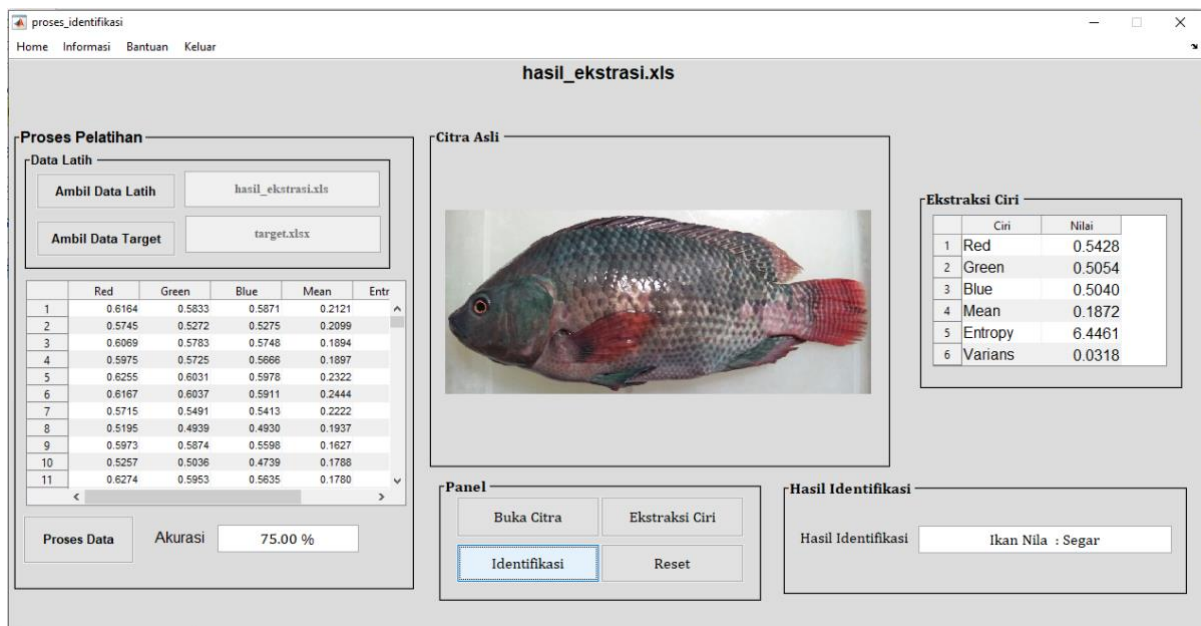


Fig. 3: Identification of Fresh Tilapia

From the results of the test pattern, the tilapia eye image is not fresh above according to the pattern inputted, namely tilapia is not fresh. Based on the analysis that has been done, it can be concluded that fresh tilapia has bright color characteristics both in terms of scales, eyes and insang. While fish that are not fresh have a characteristic shape that has changed or the color of the body, eyes, scales and insang that have faded from the original color of the fish value.

5. Conclusion

From the results of the research conducted, it can be concluded that the backpropagation method can be used for digital image management to identify the freshness of tilapia. Based on the results of the analysis at the training and testing stage on the application that has been built, it can draw conclusions that are as follows:

1. The backpropagation method can be applied to digital image management systems to identify the freshness of fish values using matlab software.

2. The results of training with the input of tilapia image patterns can be trained using the backpropagation method, the results of the training conducted show that the training process with an epoch of 1000 target error or performance of 0.144 and with a training process accuracy value of 75%. With the test results carried out that the test data with pla images of fresh tilapia can identify the tilapia is fresh and not fresh. While the tests carried out with image input based on tilapia eye patterns show what is desired.

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