CHAPTER 3
RESEARCH METHODOLOGY

3.1 Literature Study

This is the first step in this project. At this stage, several journals are collected in order to obtain further information on the classification of fruit maturity using various methods. All these journals become my reference.

3.2 Collecting Sample Images

This project uses 50 guava fruit image data which is divided into 25 ripe and 25 raw images which will be stored in the form of a datalatih.txt dataset. The image is taken with the help of the Vivo Y91c type cellphone camera with a resolution of 13megapixel with the help of a stable light to produce good images.

3.3 Application of Classification Methods

The classification method used in this study is Learning Vector Quantization (LVQ). LVQ is a pattern classification method where each output represents a certain class or category. In this method there are several possible outputs for every class. The weight vector for a unit of output is usually a reference to the class where the unit is located. LVQ is a learning method at a competitive layer supervised. A competitive layer will automatically learn to classify the input vectors.

The classes obtained as a result of this competitive stratum depend only at the distance between the input vectors. If 2 input vectors are the same, then the layers are competitive will put the second vector input into the same class shows an LVQ network with 6 units in the input layer, and 2 units (neurons) at the output layer. The processing that occurs in each neuron is finding the distance between a input vector to the corresponding weight (w1 and w 2). w1 is the associated weight vector each neuron in the input layer to the first neuron in the output layer. To calculate distance used Euclidian Distance. that is

$$= \sqrt{(x_1 - w_1)^2 + (x_2 - w_2)^2 + \ldots + (x_n - w_n)^2}$$

Activation function F 1 will map y_in1 to y1 = 1 if w1 x <w2 x , and y1 = 0 if otherwise. Likewise, the activation function F2 will map y_in2 to y 2 = 1 if w2 x < w1 x , and y 2 = 0 otherwise.

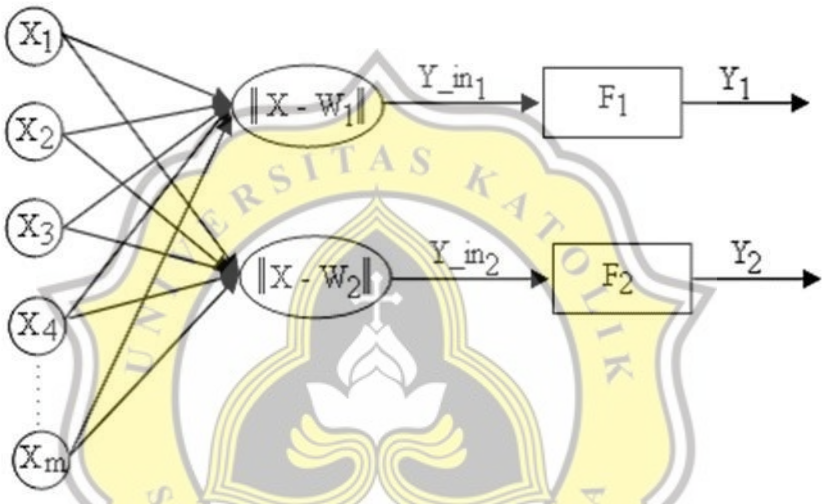

Illustration 3.1 LVQ Network Architecture

Information :

X1 ..... X6 = Enter / Input data

X-W1 = Weights that connect each neuron in the first keneuron input layer on the output layer.

X-W2 = Weights that connect each neuron in the layer to the second neuron in the layer the output.

F1, F2 = Purelin activation function as a linear transfer function used for networks neural trained using the LVQ method, this function has value in the range 0 to 1.

Y = Output / output.

3.4 Testing

This project uses 30 guava images that will be processed one by one such as cropping, then RGB color extraction, after which HSV color conversion and the last classification using the LVQ algorithm and then stored as training data. Then it was repeated with 100 images of guava as test data to know what the classification accuracy was like during the training as a comparison. if the amount of training data can affect the test results.

3.5 Analysis

The initial stage makes training data as guideline data and test data can be used to find accuracy values. Then do the classification by looking for the smallest value that is closest to the actual result class, then the conclusion can be made the classification value. According to the actual assessment which means determining the exact and accurate results expected in the design of this project. the more training data the program will be getting used to learning to classify guava fruit images.

3.6 Desain

The flowchart above tells you that the first thing to do is to input a guava fruit image.After the fruit image is successful, it will arrive at the cropping process where the process will cut the side of the image to take the middle side of the guava fruit image. Next, it will look for the average RGB value of the cropped image. After the RGB value is obtained, proceed to convert to obtain the HSV value which is useful for processing with the LVQ algorithm so that it can be classified into which class. after processing the smallest value of processing can be classified into ripe or raw classs

Illustration 3.2 Flowchart of program steps

3.7 Data Collection

The collection data below contains a collection of guava fruit images that have been divided into 2 raw and ripe classes. Getting a guava image is done by shooting independently and manually so that the results obtained are as desired. the level of lighting and background greatly affects the result.

Illustration 3.3 picture of ripe guava fruit

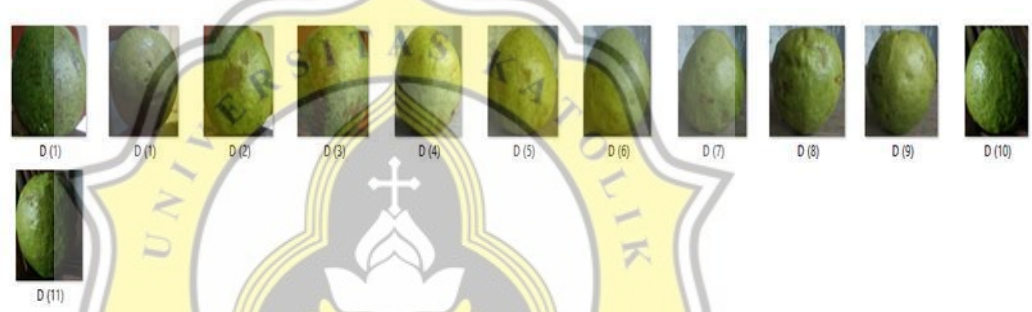

Illustration 3.4 picture of raw guava fruit

3.8 Data Training

The data contains the HSV value that has been converted from RGB and the storage format is as shown below. training data will later be used as initiation during testing and will be loaded. the more training data, the higher the accuracy when testing with test data. training data storage format in the form of txt. The Hue component of the HSV image (Hue, Saturation, Value) is a component that represents the color of visible light wavelengths (red, orange, yellow, green, blue, purple). Therefore, this component can be used as a reference for identifying the color of an object in a digital image.

3.9 Guava Classification

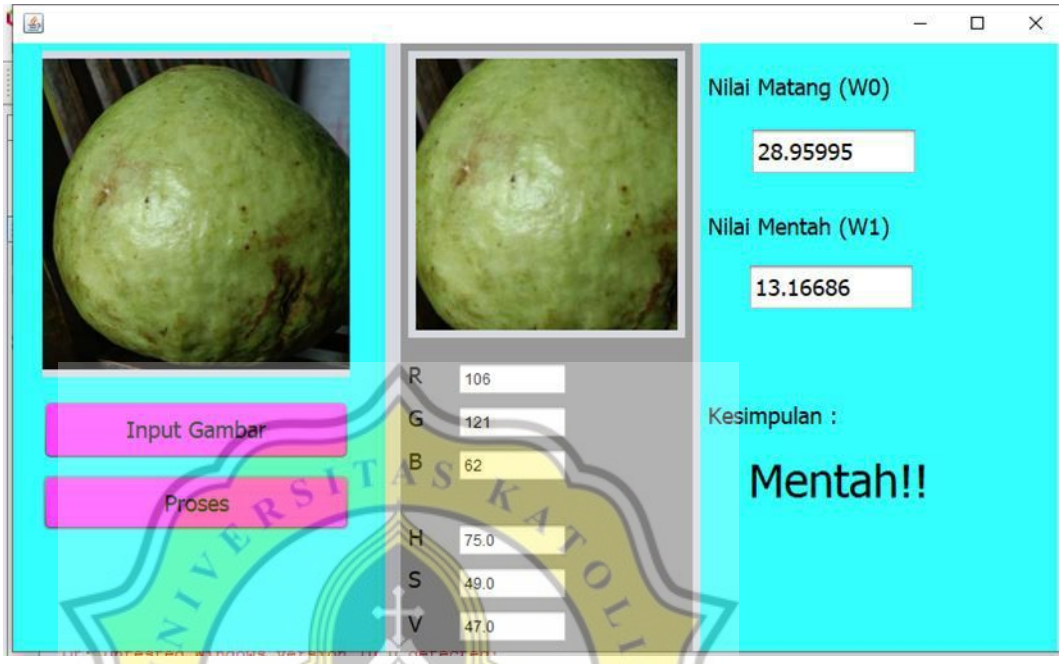

Illustration 3.5 GUI display of the program

In the image above, I first input the guava fruit image, then after we successfully process the RGB extraction results and convert to HSV, the value is obtained then the HSV value will be processed directly by the LVQ method which will look for the value that is closest to the ripe or raw class. and can be seen below from the image above the image is included in the raw class with value 13,16686 and decided with the conclusion included in the raw class.