CHAPTER 4
ANALYSIS AND DESIGN

4.1. Analysis

The problem in this project is the classifications of ripeness of banana. The dataset used is 3 level ripeness that is green banana, ripe, and over ripe banana. The first step it does is dividing datasets to 3 classes that are Green, Ripe, and Overripe. After the datasets divided by 3 classes, the next step is convolution process, in this process all of the datasets will be put inside the convolution layer with the intention to tell the system that this is an image with the level of ripeness that already determined.

Next step is training process which where the result of the last process will be train with 75 repetition to find the highest accuracy it can get from 3 different optimizer and add brightness adjustment to allow the system to predict over-brightness image.

The last process is prediction process, and this will be the last step on this project. At this last step it will predict what level of ripeness will be detected from the tested image. This project takes 80 datatest images of bananas with different levels of ripeness to test and at the last results will be compare with the result obtained from 3 different optimizer and calculate the precision, recall, and accuracy.

4.2. Design

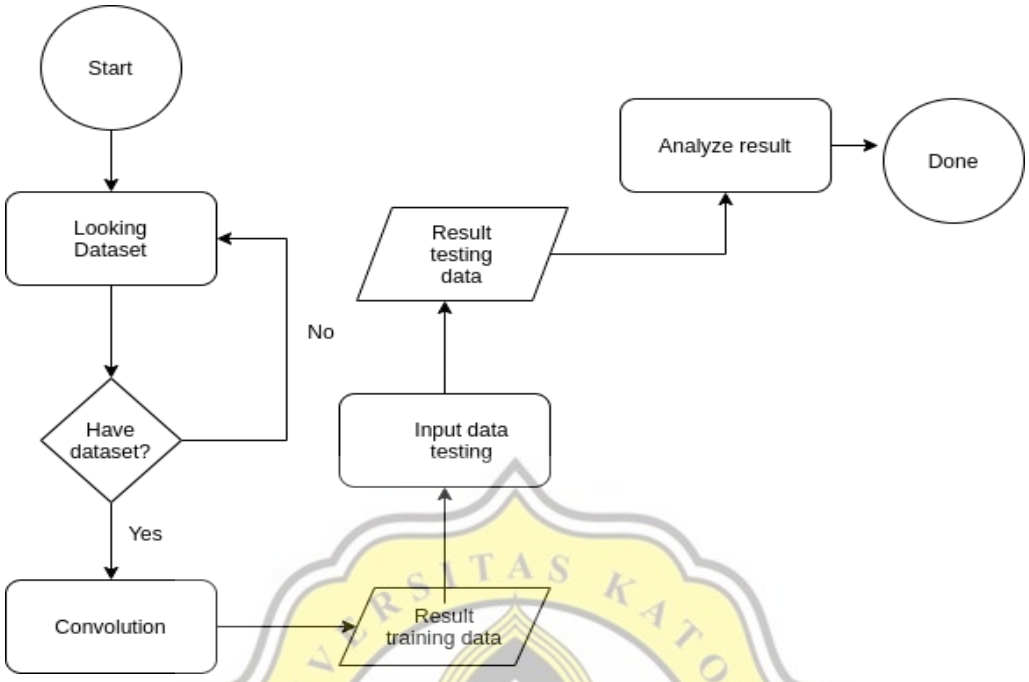

Figure 4.1 *Flowchart of the research*

This is the design step that use for writing this research. First step is looking for dataset the more the better because this images very useful for this research to clasify the ripeness of banana . After all dataset collected, continue to the next step which is Convolution layer. This sections is used to train the sampel data for tell the program that this is the banana witha certain level of martuity.On this part too, it will be done the test to 3 optimizer and every optimizer will be test untill it finished to look for the accuracy value, which later that accuracy value will be used to compare all of the three optimizer.

4.3 Function

Confusion matrix is one method that can be used to measure the performance of a classification method. The confusion matrix has information that compares the results of the classification performed by the system with the results of the supposed classification. The confusion matrix contains actual and predicted information on the classification system. Performance measurement using a confusion matrix contains four terms to represent the classification results, including True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN). Based on the classification results, precision, recall, and accuracy values can be obtained. The precision value is the comparison of the amount of relevant information obtained by the system with the total amount of information retrieved by the system. The precision value can be obtained using the equation. The recall value is a comparison of the amount of relevant information obtained by the system with the total amount of relevant information contained in the information, either taken or not taken by the system. The recall value can be obtained using the equation. The value of accuracy is the effectiveness of the test based on the effectiveness between the predicted value and the actual value. Accuracy values can be obtained from the equation.

Actual	Positive Prediction	Negative Prediction
Positive Class	True Positive (TP)	False Negative (FN)
Negative Class	False Positive (FP)	True Negative (TN)

Table 4.1 *Confusion Matrix*

TP = Positive predictable positive data

TN= Negative predictable Negative data

FP= Negative predictable Positive

FN= Positive predictable Negative

$$Precision = \frac{\sum_{i=1}^{l} TP_i}{\sum_{i=1}^{l} FP_i + TP_i} \times 100\%$$

$$Recall = \frac{\sum_{i=1}^{l} TP_i}{\sum_{i=1}^{l} TP_i + FN_i} \times 100\%$$

$$Accuracy = \frac{\sum_{i=1}^{l} \frac{TP_i + TN_i}{TP_i + TN_i + FP_i + FN_i}}{l} \times 100\%$$

Figure 4.2 Formula For Calculation