

CHAPTER I

INTRODUCTION

1.1. Background

Potatoes are one of the largest vegetable commodities in Indonesia, where Indonesia is an agrarian country, of course, has good and large yields, especially for potato crops. The provinces that produce the most potatoes in Indonesia in 2020 are East Java, Central Java, West Java, North Sumatra, North Sulawesi, and South Sulawesi which reached a production figure of 1.28 million tons. Vegetable farmers are the spearhead in providing good results for vegetable agricultural products. If you get a good harvest, it is an extraordinary pride, because in addition to getting a good selling price, of course it can also save the country in terms of not importing potatoes from countries outside Indonesia. So that the Indonesian people consume plants from their own country's products and buy them at low prices. [1]

Getting a good potato harvest is the most important thing in the planting period, therefore potato plants should not be attacked by pests, in order to get a good harvest. The most common disease in potato plants is late blight, and there is also early blight. Diseases in potato leaves, if left unchecked, will spread to parts of the stalk and will reduce crop yields and can even cause crop failure. By looking at the symptoms that occur in potato plants, farmers can immediately deal with the problem of rotten leaf disease. However, in the process of seeing the existing symptoms, there are several obstacles because not all farmers have knowledge about how to recognize the symptoms of this disease thoroughly. The process of identifying the type of disease in potato leaves can be done with the five senses of human vision by observing the pattern of damage to potato leaves. However, humans have a lack of subjective judgment so that the results of identification between individuals can differ due to lack of concentration and fatigue or fatigue and also require a lot of experience. Since computers cannot distinguish textures like human vision, texture analysis is used to determine the pattern of a digital image based on mathematically obtained characteristics. In the future, this image processing is expected to be one of the options in the identification of potato leaf diseases. [2][3]

Local Binary Pattern Histograms (LBPH) is a combination of the LBP (Local Binary Pattern) method with Histograms of Oriented Gradients (HOG). LBP is a simple but highly efficient texture operator that labels the pixels of an image by distinguishing the environment from each pixel and treating the result as a binary number. This method is commonly used to solve facial recognition problems because of its simple use and easy calculation. However, in addition to being used for facial recognition, LBPH is also used in the classification of plant disease images. Compared to the Convolutional Neural Network (CNN) method, which requires a long training time. The CNN method will also be more difficult if the number of objects trained is increasing. [4]

The k-nearest neighbor method is a classification method that determines the label (class) of a new object based on the majority of the class from the nearest distance k in the training data group. The k-values used are 3 and 5 are used in using the k-nearest neighbor method. Meanwhile, the distance calculation uses the Euclidean Distance method. K-nearest neighbor will classify the test image into the class with the most members. The working principle of k-nn is to find the shortest distance between the data to be evaluated and the nearest neighbor on the training data.[5]

The Local Binary Pattern Histogram (LBPH) method is a feature extraction technique used to recognize texture in images. In this process, the cropped image is first divided into several parts or regions. Next, feature extraction is carried out by converting the value of each pixel into a binary representation based on the comparison of the center pixel value to its neighboring pixels in a 3x3 window. The center pixel is used as a reference value, while each neighboring pixel is compared with that value. If the neighboring pixel value is greater than or equal to the center pixel value, it is given a binary value of 1; conversely, if it is smaller, it is given a value of 0. The resulting series of binary values is then converted into decimal values, thus forming a new value at the center pixel. This collection of binary codes is known as the Local Binary Pattern (LBP), which is then used to form a histogram as a representation of image texture features. This method has a simple calculation but is also good for classification, so in this final project, it is investigated whether

the *Local Binary Pattern Histogram* and the *k-nearest neighbor* method have high accuracy in classifying images even though they have simple calculations.

1.2. Problem Formulation

The following is a formulation of the problems raised in this study based on the previous background:

- 1 How to classify leaf disease in potatoes using the LBPH method and the *k-nearest neighbor* method?
- 2 How is the application of the LBPH method and the *k-nearest neighbor* method for the classification of potato plant leaf images?
- 3 What are the results and analysis of the accuracy of leaf disease classification in potatoes using the LBPH method and the *k-nearest neighbor* method ?

1.3. Purpose

In this study, the objectives to be achieved based on the formulation of the problem are:

- 1 Knowing how to classify leaf disease in potatoes using the LBPH method and the *k-nearest neighbor method*.
- 2 Knowing how to apply the LBPH method and the *k-nearest neighbor* method for the classification of potato plant leaf images.
- 3 To find out the results and accuracy level of the LBPH method and the *k-nearest neighbor* method for the classification of potato leaves affected by disease.

1.4. Benefits

The benefits of this research are as follows:

1 Theoretical Benefits

This research is expected to be a reference for the next authors in the classification of potato leaf disease using the LBPH method and the *k-nearest neighbor* method.

2 Practical Benefits

a. For the Author

Adding new insights for the author in applying the LBPH method and the *k-nearest neighbor* method for the classification of potato leaf

disease.

b. For Farmers

Assisting farmers in diagnosing potato leaf diseases more easily and with maximum accuracy.

c. For the general public

Knowing the diseases experienced by potato plants, especially in the leaves so that they can take preventive steps against the spread of diseases in potato plants that are still healthy.

1.5. Problem Limitations

The following are the limitations of the problems discussed in this study:

- 1 The dataset used is secondary data (data that is not taken directly) taken from the Kaggle website.
- 2 The method used is *the Local Binary Pattern Histogram* method *k-nearest neighbor*.
- 3 The types of images identified are Early Blight, Late Blight, and Healthy leaf images.
- 4 The image data uses an image file in JPEG/JPG format.
- 5 This research focuses on the classification of diseases seen from the symptoms found in plant leaves. The amount of data used is 2,150 images.