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CONTENTS

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Cassava Leaf Disease Detection System using Support Vector Machine

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***Abstract*—Cassava (Manihot esculenta Crantz) has been used as a staple food of many nations. It is also known as manioc, and tapioca. In Malaysia also cassava is used as a daily food source. Its tuber is the most popular form of consumption, although the leaves are also consumed at times for medicinal purposes. Even though cassava is a popular form of consumption, it is vulnerable to disease. The type of disease that can be found on cassava is bacterial blight and mosaic disease. Problems arise when farmers have to detect the disease using the expert's naked eyes which takes a lot of time and is a difficult process to be carried out on a large farm and it may lead to inaccurate results. This study is therefore proposed to solve this problem, which is to develop a prototype for the detection of cassava leaf disease by applying image processing techniques. In this project, a set of data is collected from Kaggle website, with a total of 200 images (100 images of bacterial blight disease and 100 images of mosaic disease) being successfully collected to take further steps in processing of the image. Image processing phases that are involved in this project are image acquisition, image pre-processing, segmentation, feature extraction and classification. All these phases are done to train the data before the prototype is ready to be tested. Support Vector Machine (SVM) is used to classify the disease as bacterial blight or mosaic disease. The accuracy of this prototype is 87.5%.**

***Keywords*—SVM, image processing, cassava, diseases**

I. INTRODUCTION

Cassava, one of the important food sources also known as Tapioca is one of the crops that made into industry consistently growing because of its benefits and versatility. In Malaysia, it is widely grown in the orchard or local houses. Despite being the third-largest human carbohydrates and nutrients supplier [1] in the world, it is still easy to get exposed to some diseases. This top staple food cassava can also easily get an infection, such as viruses, bacteria and fungus. Thus, such diseases by fungus and bacteria can causes brown streak disease, green mite damage, mosaic disease, brown leaf and red mite damage [2]. As cassava is known as the most plants production in industries, it is needed to be taken care of and treated well to preserves the plant quality well. Therefore, it is vital to know if there are any diseases or infection towards the plant well. Plants that are infected would impact production and affect major economic losses [3]. The infection could lead to plant unnatural growth, low quality and nutrients, decrease crop quantity production and wilting. Thus, the project aimed to use image processing to improve the manual and traditional method by using the computerised-based process to correctly recognize leaf diseases on cassava crops collected from the Kaggle dataset [4].

The method applied in almost all science and non-science field and the system is performed widely in image operations to generate and improve the image or to retrieve some useful information. Many features can use for image interpret the object with automated operation. Hence, such features are colour, form, size and textures are commonly used in the operations. Image processing is also mentioned uses in agriculture applications for disease detection [5], and it is the most outstanding technique that functions well in agricultural application. This technique can be a promising solution for the farmers to overcome the time-consuming problem and such human errors. Other than that, it is also hard to detect with naked eyes in large crops. Besides, manual classification requires a lot of work, plant disease knowledge and often insufficient processing time [6]. Therefore, this system proposed to solve this problem, by developing a detection for cassava lease disease by applying image processing

technique using support vector machine approach. The system not only designed to detect and classify the diseases, but it can also carry out the accuracy of the system for every crop detected.

II. LITERATURE REVIEW

A. Disease

Cassava also known as tapioca is the world's most cultivated root crop. In tropical countries, cassava, other than rice and maize, is the third major calories source [7]. The different plants suffer from different disease. There are various of factors that may cause the plant disease such virus, bacteria and fungi. Fungus and bacteria cause cassava disease such as cassava brown streak disease (CBSD), green mite damage (GMD), cassava mosaic disease (CMD), brown leaf spot (BLS), and red mite damage (RMD) [8]. Cassava Mosaic virus Disease (CMD) and Cassava Bacterial Blight (CBB) are the disease that have been used in this project. CMD is the most serious and common infection of the virus affecting cassava. It considered to be a significant constraint for the cultivation of cassava is transmitted by white flies, CMD's common symptoms are yellow or pale green. Leaves affected by CMD appear reduced in scale, twisted and distorted. CBB is caused by the fungus and is spread around the world. the disease is representing in brown circular leaf spot with several varieties around the spots displaying a chlorotic halo. Severe infections can turn yellow or brown at the leaves.

B. Support Vector Machine (SVM)

Support Vector Machine (SVM) classifier is ideally to differentiate proof and arrangement of plant infection affecting crops [9]. In terms of plant diseases classification, the support vector machine technique produced better classification result and generated higher accuracy as a classifier. Support vector machine learns the input data and classifies it into different classes once it has been trained.

III. METHODOLOGY

Total 200 images of cassava leaf disease which consists of Bacterial Blight disease (CBB) and Mosaic disease (CMD) are used in this project, which 100 images are Bacterial Blight and 100 images are Mosaic disease. The images have been divided into 80% for training and 20% for testing. To classify, the data set is trained using the Support Vector Machine classifier before the accuracy test is carried out.

A. Image Acquisition

This system analyses cassava leaf images taken from smartphone devices. Normal images are usually captured with the presence of various objects on complicated backgrounds.

B. Image Pre-processing

Aims to make the image data input size compatible before the image is processed using SVM. The activities include resize and enhance the brightness of the leaf image. This technique function would help to make computation in SVM faster.

C. Segmentation

The images divide into multiple segments to make processing easier and simpler. The results only extract leaf regions from a real image. For segment cassava leaf, ROI is used to separate the image from the background and unnecessary parts of the image. In this prototype, the *roipoly* function is used to allow the user to manually select the affected parts, so that no necessary elements of the image are removed. The extracted ROI will be displayed to the user after the process is completed.

D. Feature Extraction

This process involves extraction of the feature which consists of three features that are shape, color and texture. For disease spots, texture and colour features are extracted to identify diseases. Color Moment and Gray level Co-occurrence Matrix (GLCM) uses for calculating the frequency of various combinations of pixel brightness values in an image. The values calculated in color moment are mean, standard deviation and skewness. GLCM uses to extract statistical features such as contrast, similarity, energy and homogeneity.

E. Classification

Support Vector Machine (SVM) used as a classifier to classify the diseases. In SVM, each data item is plotted as a point in n-dimensional space where n is the number of features that were obtained with the value of each feature being the value of a given coordinate. Then, classification performed by finding the hyper-plane which differentiates the two classes very well. SVM classification consists of two phases, which are phases of training and testing. It will train all data classes in the training phase. Then, the data will be tested using the model obtained on the trained dataset during the testing phase.

IV. RESULTS AND FINDINGS

80 images of each disease are used to train the Support Vector Machine and the system produced an accuracy of 88.1% for training. The confusion matrix will summarize the results after the training is completed. Fig. 1 shows the positive predictive value and false discovery rate for bacterial blight disease and mosaic disease.

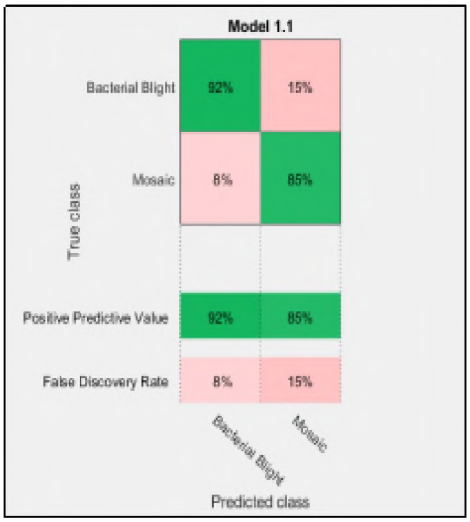

Fig. 1.Positive Predictive Value and False Discovery Rate.

To test the accuracy of the prototype, the remaining images are used. The example result of the testing images is shown in Table 1.

Table 1. Testing Images Result

Input Image	Expected Output	Prototype's Output	Result
	Bacterial Blight	Bacterial Blight	True
	Mosaic	Mosaic	True
	Bacterial Blight	Mosaic	False

By using a trained model of SVM, the result shows that 35 of 40 testing images produce the correct outcome and the accuracy is 87.5%.

V. CONCLUSIONS

The Cassava Leaf Disease Detection System is a system that can help users identify the type of disease on cassava leaf. The accuracy is 87.5%. With the help of this system, users can automatically detect the type of disease on cassava leaf either it is bacterial blight or mosaic disease. The manual disease monitoring does not produce satisfactory results because naked eye

monitoring is an old process that takes longer time to classify the diseases. This system can potentially help farmers with less experience to identify cassava leaf disease without taking too much time to find people who have knowledge or someone with expertise that takes time and sometimes the result can be inaccurate. So, this prototype is developed to save time and ease the farmer's work.

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