

CROP PLANT DISEASE DETECTION USING IMAGE PROCESSING

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Computer Science and Engineering

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APPROVAL

This Project titled “Crop Plant Disease Detection using Image Processing”, submitted by Rakib Mahmud, ID NO 201-25-860 to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of M.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 3th June 2021.

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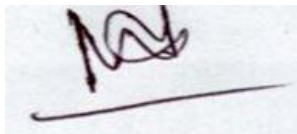
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DECLARATION

I hereby declare that, this project has been done by m under the supervision of **Md. Zahid Hasan, Assistant Professor, Department of CSE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

Our country depends greatly on the crop for its economy and to meet food needs. It is important to detect any disease in time to ensure healthy and proper growth of crop plants and before applying necessary treatment on the affected plants. Since the manual identification of the disease is much time and labor costs, so it is inevitably wise to take automatic system. The automatic method requires a towering lot of work, Plant diseases require efficiency and excessive processing time. In this project, the disease detection systems of rice leaves and various other plants and fruits presented using image processing. Most crop and fruit tree diseases such as Cercospora, leaf smut, bacterial blight, and Leaf Spot diseases are identified in this work. Hence, Steps such as detect the disease are involves image collection, image noise, and object removal prepared for pre-processing techniques, Using K-means clustering for segmentation and RGB to HIS, Color co-occurrence Strategy for Feature extraction then classified by utilizing SVM. This paper outlines the methods used to detect diseases in plant by identifying pictures of their leaves.

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CHAPTER 1

Introduction

1.1 Introduction

Bangladesh achieved its highest GDP, BDT 11.02 billion in 2020[1], from the agricultural sector. Half of the agricultural GDP is supplied through rice production. As a result, it also contributes about half to agricultural employment (48%) [2]. Providing an important role in the economy of the country, rice provides staple food to the masses and two-thirds of the daily caloric intake per capita. The whole rice yields range and corresponding production are estimated to be According to the USDA report, 11.8 million hectares in the whole rice yields and 35.3 million metric tons for the corresponding production is an estimate in 2020-2021 (May to April) [3].According to the USDA, Proper paddy plantation in future may get a priority for Bangladesh, because economic changes clearly shown and this information demonstrates this report. Disease free paddy plantation will play an effective role in ensuring stable economic processes and maintaining specific goals. Bangladesh must work for industrial progress to stay at pace with the fourth technology revolution. Through which Bangladesh can engage smart systems for industrial progress and which will take the right decision without human intervention. An automatic system, which automatically disease identifies the system and will classify the disease from the leaves.

1.2 Motivation

One of the reasons for the decline in quality and quantity is plant diseases of agricultural crops. The overall production of the crop may be affected in a country when quality and quantity decline. The main problem for plants is the lack of continuous observation. Newbie farmers in particular are not aware of these diseases and the timing of their occurrence. Usually in any plant, at any time disease can occur. Can prevent the transmission of the disease, only through continuous monitoring. A survey conducted in 1979-1981 revealed twenty diseases in rice [4]. Disease monitoring, very important are their frequencies and occurrences for early identification of

infected trees. Timely treatment of them, and importantly, to plan future strategies for disease prevention to reduce losses.

1.3 Objectives

- The aim of this study is to, Identification of plant diseases by image-processing based solutions in implementation and evaluation.
- Helps the farmer to diagnose diseases and take action on damaged plants.
- Increase in quality and quantity of agricultural crops.

1.4 Expected Outcome

The purpose of the project is all about disease detection. Giving newbie farmers ideas about plant diseases through automatic disease detection by image processing techniques. How to diagnose early disease and give timely treatment. To increase crop production by taking care of trees in time.

1.5 Report Layout

Chapter 1 presents the research introduction, objectives, and key research questions.

Chapter 2 highlights a detailed review of the related literature.

Chapter 3 describes the proposed methodology with detailed description.

Chapter 4 explains the result analysis and comparison with existing work.

Chapter 5 concludes the present research along with a direction for future work.

CHAPTER 2

Background

2.1 Introduction

My paper is based on image processing. As a plant disease detection, this project developed in Matlab R2015a. We perform image segmentation to identify diseased areas. And standard feature extraction techniques are used to extract properties from segmented regions. In the end, Image Features Uses Multiclass Support Vector Machine (SVM) classification which is used for classification and identification of various diseases. Used Matlab language.

2.2 Related Work

J. Monica identifies disease and fruit grading using image processing. Used artificial neural networks to detection the disease. Created two databases separately, Images of the disease are stored in a database for training and another database, to implement query images. Training databases of Back propagation is use for weight adjustment. Color, texture, and morphology consider these three characteristic vectors. [5]. The following figure 1 is about the final result of three features. The spread of the disease is done using the K-mean clustering method which is similar to our project.

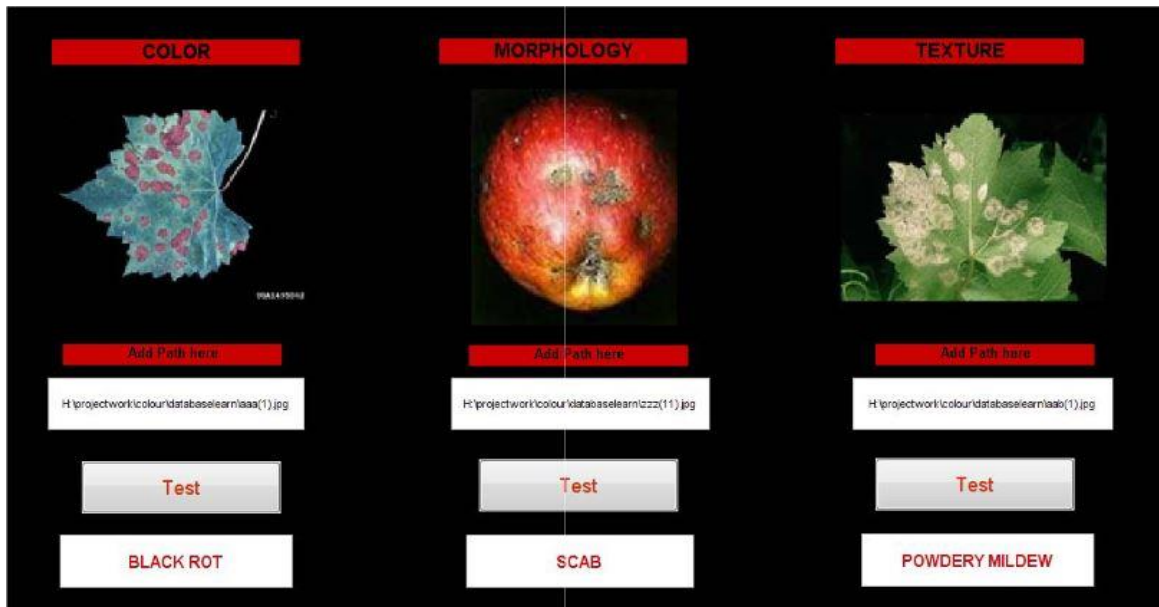


Figure 1 :Final result of Three Feature

RGB images are used to identification the disease. To identify the green pixels and then obtain different threshold values using Otsu's method, K-means clustering techniques are applied before these tasks are performed. The color co-occurrence method is used to extract features. The HSI translation has been converted from the RGB image. The SGDM matrix is generated and the feature is calculated using the GLCM function to computation the texture statistics. [6].

For rice disease detection, Jaya and Shantanu has used pattern recognition techniques [7]. A software prototype is described in this paper which detects rice disease on the basis of infected images of rice plants. After searching the area of interest, HIS used the model to segmentation the image. By identifying the borders and spots, the infected part of the leaf is detected. The following figure 2 and 3 is about infected rice leaves to segmentation of the image.

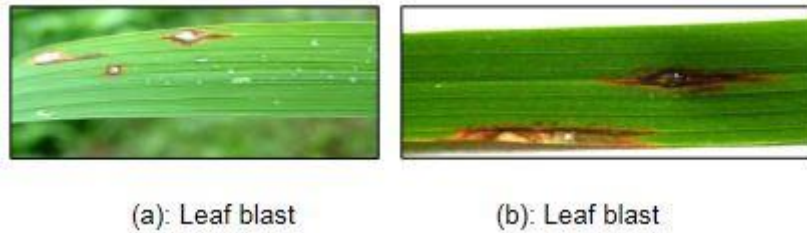


Figure 2: Infected rice leaves

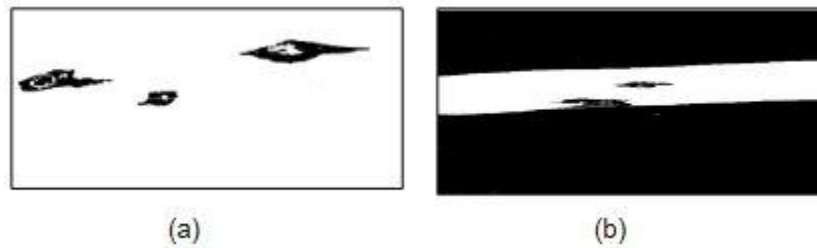


Figure 3: Segmented Images Corresponding to Fig.2

DSLR camera were used to capture RGB images of plant with varying degrees of canopy reduction. Multiple spectra of high-spatial resolution satellites are then used to indicate the severity of the disease or canopy reduction in the upper, middle and lower limits of the trees. A disease called powdery mildew occurs on cherry leaves. An algorithm proposed [8] to diagnose this disease is to remove the background from the image. The diseased part is extracted using morphological operators and intensity-based thresholds. Here is a description of image processing-based methods and color sensitivity, which are used to detect the severity of foliar disease in plants. This foliar disease occurs in soybean plants [9].

2.3 Challenges

a. Image Collection: Not easy to find out good resolution crop plant image. Therefore, collecting image data from the UCI [10] and QUAYES Agricultural Supplies [11].

b. Raw Image Processing: Images collected from different sources were sometimes low or high contrast or noisy. So, the challenge is to organize the pictures perfectly for classification which can be contrast-enhanced and noise-free.

c. Select Machine Learning Approach: Several researchers use different machine learning techniques to finish the work effortlessly. Thus, the selection of the best machine learning techniques can accurately classify different types of crop plant diseases.

CHAPTER 3

MATERIALS AND METHODS

3.1 Working Process

The proposed system through the block diagram is shown below fig.4.

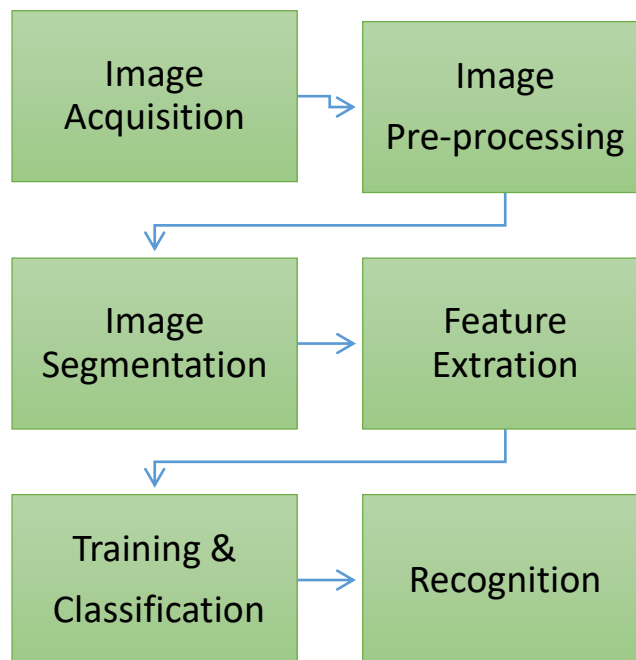


Fig.4 Framework of the proposed system

The proposed method includes a database collection of leaf and fruit images, Image pre-processing, Image segmentation is done by using the K-means clustering method. Feature are

extracted using the GLCM (gray layer co-presence matrix) method and the system is trained using the SVM algorithm.

3.2 Image Acquisition

For Matlab activities, it captures images stored in digital media and describes them as image capture with a digital camera, and some of the images acquired are the first method of image processing. In our work, we collected the image from UCI [11] and QUAYES Agricultural Supplies [12]. Healthy images of crops and fruit leaves are shown in fig.5, which will be used for the Matlab image processing system.



Fig. 5 Pictures of diseased fruits and crop leaves

3.3 Image Pre-processing

Further processing to enhance the properties of some images or strengthen image data for those who are unintentionally distorted these are the main objectives of image pre-processing. Various techniques are used in pre-processing methods, including image conversion, morphology operations, noise filtering, image enhancement, image resizing and shaping. RGB grayscale

conversions are shown in fig. 6. We've used different Matlab codes to resize images, reinforce contrast, RGB to grayscale conversions.

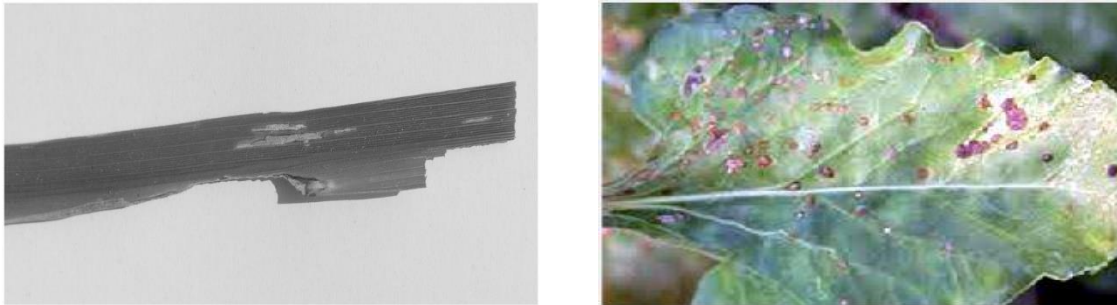


Fig.6 Contrast enhanced and RGB gray transformation leaf image

3.4 Image Segmentation

For easy analysis, how to render an image to something and the transformation of the digital image into several sections is called image segmentation. Image segmentation is used to identify objects in an image and to identify boundary lines. The input RGB image is divided into three sections by the segmentation algorithm. Like the original image, the RGB is also present in each section in color-space and shape. Each section has different areas of the original image where there is an area of interest and that is part of the original image disease. K-means the clustering algorithm is used to classify objects based on a set of properties within the number of classes. The squares of the distance between the corresponding clusters and the classification of objects are reduced by the sum of the objects. Algorithm for K-means clustering determining the center of a cluster, either randomly or on some heuristic basis, defining each pixel in the image is a cluster that reduces the distance between the pixels and the cluster. Repeat the previous two steps until integration is done and before that count, the cluster centers with the average of all the pixels in the cluster. Algorithm for input image division using K-means clustering. $l * a * b$ will be converted to colour space from

input image RGB colour space. From the image in L*a*b* colour-space, extract a* b* chroma components. Three clusters can be found by applying K-mean clustering to chroma elements. Three clusters back into the three-segmented RGB image. Fig.7 and Fig.8 respectively shows the crop leaves image and fruit leaves image segmentation by three clusters format and shown the area of interest.

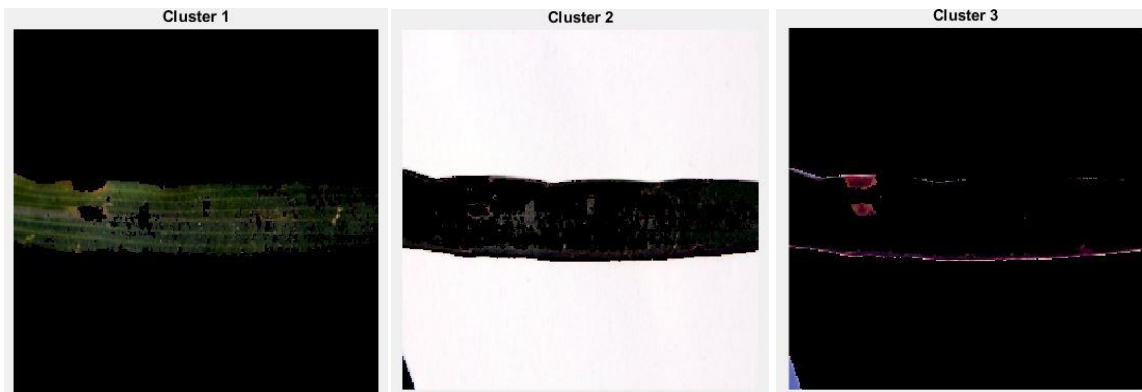


Fig.7 clusters of diseased crop leaves

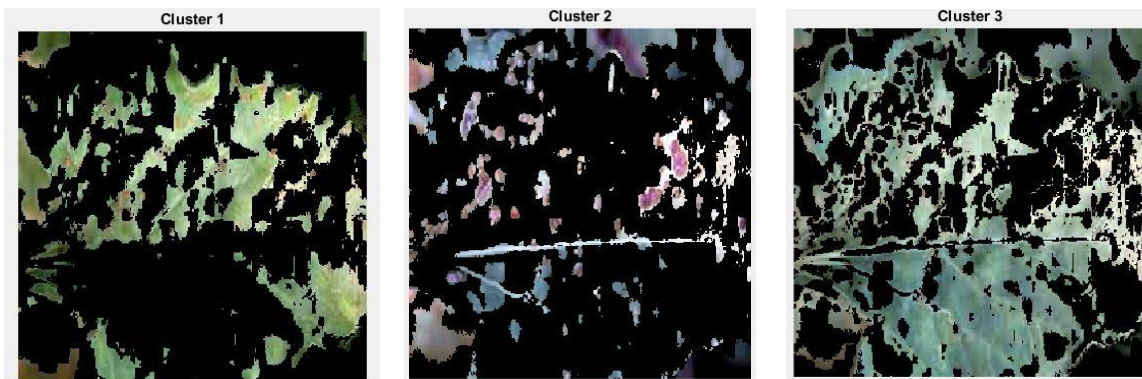


Fig.8 clusters of diseased fruit leaves

3.5 Feature Extraction

There are three sections in RGB color space after the splitting process. The area of interest is where one of the segments has the diseased part. The affected part has to be selected from the visual inspection of the three sections. This part of the system requires user intervention because the system is not automated in this part. The system will look for the characteristics of the diseased parts, when the user selects the affected parts. Mean, standard deviation, entropy, inverse difference, variance, smoothness, kurtosis, skewness, and root mean square (RMS) These 9 characteristics are determined from the diseased part in the RGB color space. After converting the disease-affected section into a grayscale intensity figure, the characteristics of contrast, correlation, energy, and homogeneity are determined.

3.6 Training & Classification

We use Support Vector Machine (SVM) for disease recognition. Use the radial basis kernel function (Gaussian kernel) and libsvm library for classification. For multiclass classification, kernel functions are commonly used. We created a multiclass SVM model, first we trained for sample leaves with pre-defined characteristics of diseased leaves and healthy leaves. Each type of diseases affected leaves belong to one separate class and there is a class of healthy leaves. Using the Multiclass SVM model, we build the data for a set of training sample images and save it in a file. At the test phase, the system must look for the disease class in a leaf image. First, we segment the test image and choose the region of interest (ROI), then we compute its feature vector. Finally, we pass this information to the classifier. The Multiclass SVM classifier compares the feature vector of ROI of an unknown test image with the pre-built database. Based on the best match, it predicts the disease class of the test image.

CHAPTER 4

Experimental & Results

4.1 Experimental

The proposed algorithm is applied to a data set of 125 images. A total of 125 images, all divided into two sets, training and test sets. The data set five types of leaves, one type is of healthy leaves and four types of leaves with diseases namely Bacterial leaf Blight, Cercospora Leaf Spot, Leaf smut and Anthracnose. Test accuracy of classification is 96.7742%.

4.2 Result

The results of the leaf disease detection are as follows:

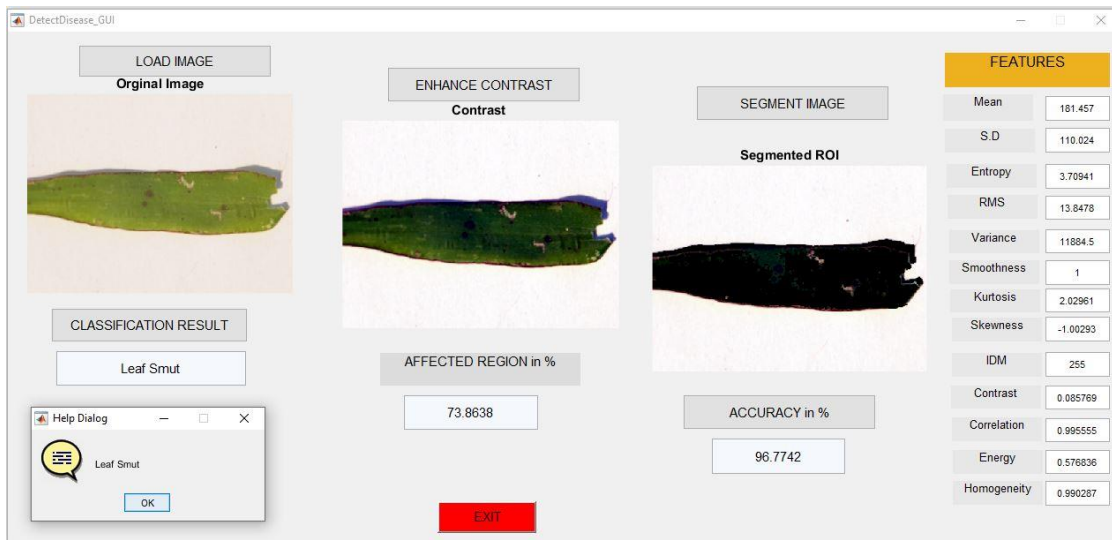


Fig.9 Rice plant disease detection result

4.3 Comparative Analysis

The paper needs to be equated with recently published papers to measure its significance. For this reason, some of its components are compared with other research works which are shown in Table I.

Plant disease detection through different machine learning techniques such as SVM [12]. Feature Extraction Shape, Texture, Dispersio, Grayleve, Histogram and to achieve 93.1% accuracy. Whereas Neural Networks to achieve approximately 94% accuracy[13]. In another research work, is described through Probabilistic Neural Network. The overall accuracy rate was 88.59% achieved in this study [14]. According to this study [15], the Neural Networks model with an accuracy of 93%.

TABLE I. COMPARATIVE ANALYSIS

Reference	Segmentation	Features	Classifier	Accuracy
Z.Rahamneh ,2011 [13]	K-Means Clustering	Texture Features	Neural Networks	94%
A. Smith, 2009 [12]	Threshold Segmentation	Grayleve Histogram Texture Dispersio Shape of Frequencies	SVM	93.1%
Bashish ,2010 [15]	K-means Segmentation	Texture Features	Neural Networks	93%
Manjunath,2011 [14]	Morphological Operation Technique	Texture Features	Probabilistic Neural Network	88.59%
Present Experimental Finding	K-means clustering	colour, texture, morphology, and structure	SVM	96%

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

The present study discusses crop and fruit image processing techniques related to automatic diagnosis with plant leaf detection. It involves image acquisition, image sorting, feature extraction, image preprocessing and classification. The development of automated detection systems using advanced computer technology to assist farmers in early detection of diseases and to provide useful information for its control We would like to further enhance our work in detecting more tree diseases.

5.2 Future Scope:

Accuracy can be enhanced by improving the classification of datasets and changing feature extraction techniques, and increasing the techniques of image processing and classification, which we plan to do in the future.

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