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DETECTION OF FLORAL LEAF AFFLICTION USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

Plant disease automation in agriculture science is the primary concern for every country. Nowadays crops/plants face many diseases/traits. Damage by the insect is one the major trait/disease. Moreover, the increased use of the technology today has increased the efficiency and accuracy of detecting diseases in plants. The detection process marks the beginning of a series of activities to face the diseases and reduce their spread. Insecticides are not always effective because insecticides may be toxic to different kind of birds. However, there are still many parts of the detection and discovery of new process that have not been completed. Our focus is to clarify the details about the diseases and how to detect them promptly using image processing techniques. The methods studied aim to increase flow and reduce the subjectivity of human experts in detecting plant diseases. Our system predicts the type of disease considering normal plant. Our study also focuses on pre-processing techniques and K-means Colour Based Clustering for detection of spots on the diseased leaf. After detection of spot, it performs various segmentation techniques which are followed by classification process which makes use of shape and colour to state the type of disease present.

Keywords: Disease Detection, Image Processing Techniques, Pre-Processing, Image Segmentation, Feature Extraction, K-Means Colour Based Clustering, GLCM, Otsu, SVM.

I. INTRODUCTION

India is primarily an agricultural country, with agriculture providing employment to the majority of the population. Various Agricultural practices such as irrigation, crop rotation, fertilizers and pesticides were developed very long ago but they have made significant progress in the past. Fruits and vegetables are the most important agricultural products. A product quality control is essentially required in order to obtain more useful products. Plant diseases have been shown in numerous studies to impair the quality of agricultural goods. Pathogens, such as fungus, bacteria, and viruses, as well as bad environmental circumstances, cause these diseases. And it very costly to effort treatment on plant disease. It also difficult to identify multiple diseases together. And the early stage diagnosis of plant disease is an important task. Farmers require skilled monitoring on a constant basis, which can be excessively expensive and time intensive. Therefore, looking for fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear on the plant leaf is of great realistic eloquent.

Plant disease diagnosis is effective, time-saving, and accurate when using digital image processing and machine learning. The use of this technique saves time, effort, labour, as well as pesticides. Hope this approach will becomes a little contribution for agriculture fields.

1.1. Plant diseases analysis and its symptoms

Image analysis can be applied for the following purposes:

- To identify the percentage of the affected area.
- To recognize the disease.

Following are some common symptoms of fungal, viral and bacterial plant leaf diseases.

1.1.1. Fungal disease symptoms:

Among all plant leaf diseases, those caused by fungus are known as fungal disease. Some of them are discussed below and shown in figure 1. e.g. figure 2(a): Late blight caused by the fungus Phytophthora infesters. The disease spreads quickly in fields and can result in total crop failure if untreated.

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figure 2(b): Early blight is caused by the fungus Alternaria solani. The pathogen produces distinctive "bullseye" patterned leaf spots and can also cause stem lesions and fruit rot.

figure 2(c): In downy mildew yellow to white patches on the upper surfaces of older leaves occurs. These areas are covered with white to greyish on the undersides.

(a) late blight (b) early blight

(c) downy mildew

Figure 1: Fungal disease on leaves

1.1.2. Viral disease symptoms:

Virus-caused plant leaf diseases are the most difficult to diagnose of all plant leaf diseases. Viruses leave no visible indications and are frequently confused with dietary shortages and pesticide harm. Aphids, leafhoppers, whiteflies and cucumber beetle's insects are common carriers of this disease, e.g. Mosaic Virus, look for yellow or green stripes or spots on foliage, as shown in figure 2(a). Leaves might be wrinkled, curled and growth may be stunted.

(a) mosaic virus

Figure 2: Viral disease on leaves

1.1.3. Bacterial disease symptoms:

The condition is characterised by little pale green spots that appear as water-soaked quickly. The lesions expand and subsequently appear as dry dead spots, as seen in figure 3(a), for example, bacterial leaf spot causes brown or black water-soaked spots on the foliage, often with a yellow halo, that are all roughly the same size. When the spots are dry, they have a speckled appearance., sometimes with a yellow halo, generally identical in size. Under dry conditions the spots have a speckled appearance.

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(a) Bacterial leaf spot

Figure 3: Bacterial disease on leaves

II. LITERATURE SURVEY

With Reference to Vijai Singh and A.K. Misra, 2016[1], Their paper monitors the crop growth using the image segmentation techniques. We perform noise filtering, feature extraction, and further classification to detect diseased areas in the image. The information for ripening stages of crop and infected portion recognition is created using picture segmentation techniques and machine learning algorithms.

With Reference to Sabah Bashir and Navdeep Sharma,2012[2], The Infected part in the plant can be detected with help of colour, and other changing properties by using classification algorithm. Different pixel information is extracted and Green leaves pixel and diseased leaf pixel are compared by finding the ratio of pixel corresponding to the healthy leaf to the pixel corresponding to the infected leaf. Background is removed and different region of the images are formatted after the image acquisition.

According to Manisha Bhangea and H.A. Hingoliwala, 2015[3], The paper provides the image processing techniques and the algorithm which help the farmers to successfully identify the disease in pomegranate. Image acquisition and image processing of the input image is done using the filter commands in the MATLAB by pixel values of the input image gets more clarified and the disease that affects pomegranates is successfully detected. The approach also provides user two different options that is with intent search and without intent search.

As specified by Arti Singh, Baskar Ganapathysubramanian , Asheesh Kumar Singh and Soumik Sarkar, 2016[4], The aim of this paper is to give us an overview regarding the work done in application of Machine Learning, classification, and quantification to plant stress phenotyping. It will also tell about the general issues in Machine Learning strategy. The concepts discussed here it can be applied to data collected across the spectrum of complexity and sophistication. It helped us to identify several future avenues for using ML techniques that show tremendous promise but remain currently unutilized by the phenotyping community.

With Reference to A.Camargo and J.S.Smith,2009[5], The aim of this paper is to do the automatic identification of the plant disease by image processing from the visual symptoms by analyzing the colored images. The test set consisted of 20 images which were showing symptoms of plant disease in different crops used in the study. To create manual segmented set of images, a grid was overlaid on the image and each position was then evaluated the white color and black color. White color (1) depicted the pixel having diseased symptoms whereas the black (0) for non-diseased region.

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III. METHODOLOGY

3.1 Flowchart:

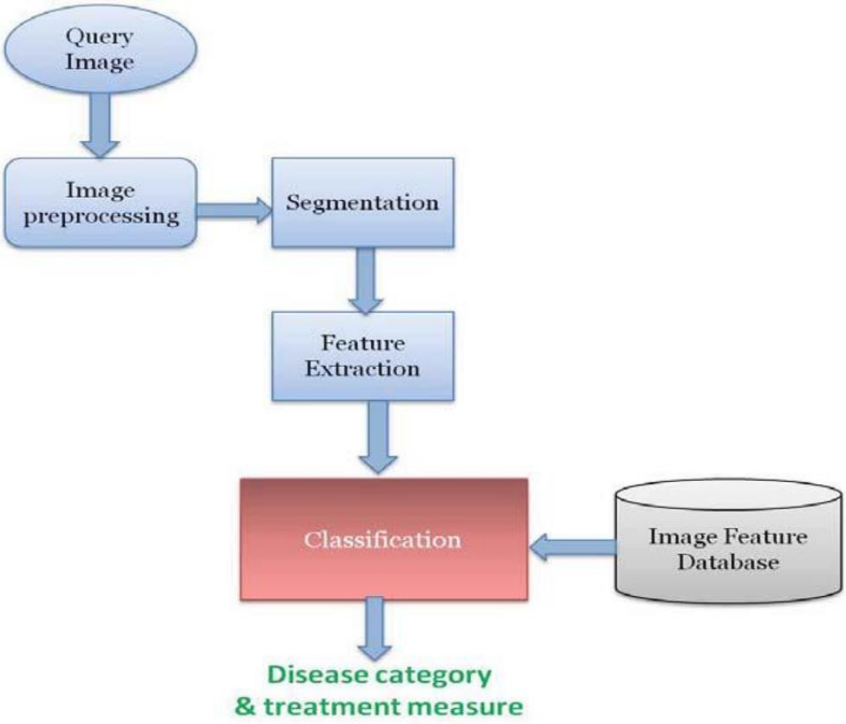

Figure 4: Image Processing Flowchart

3.1.1 Image Acquisition:

The first method of digital image processing is image acquisition, which is defined as collecting an image with a digital camera and storing it on digital media for later MATLAB processes. It's also the operation of recovering an image from hardware so that it can be processed further. We used a digital camera to obtain photographs of healthy and sick leaves in our work., so it can be passed through further process. In our work, using digital camera we captured healthy and diseased images of leaf.

3.1.2 Image Pre-processing:

The main purpose of image pre-processing is to improve the image data contained unwanted distortions or to enhance some image features for further processing. The pre-processing method employs a variety of techniques, including image resizing and shaping, noise filtering, image conversion, image enhancement, and morphological procedures. In this project, we utilized MATLAB code to resize images, improve contrast, and convert RGB to grayscale conversion.

3.1.3 Image Segmentation:

Image segmentation is a technique for breaking down a digital image into segments and converting it into something that can be analyzed more easily. The object and border line of an image are located via image segmentation. In segmentation, we used K-means clustering method for partitioning of images into clusters in which at least one part of cluster contain image with major area of diseased part.

- The k-means clustering algorithm is applied to classify the objects into K number of classes according to set of features. The classification is carried out by reducing the sum of squared distances between data objects and the associated cluster.
- Image is converted from RGB Color Space to L*a*b* Color Space in which the L*a*b* space consists of a luminosity layer 'L*', chromaticity-layer 'a*'and 'b*'.
- All of the color information is in the 'a*' and 'b*'layers and colors are classified using K-Means clustering in 'a*b*' space.
- From the results of K-means, labelling of each pixel in the image is done also segmented images are generated which contain diseases.

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- In this experiment we used segmentation technique so input image is partitioned into three clusters for good segmentation result.

3.1.4 Feature Extraction:

Feature extraction extracts desirable feature vectors such color, texture, morphology, and structure. Feature extraction is a technique for reducing the number of resources required to accurately describe a huge set of data. Texture features are generated from statistical distributions of observed intensity combinations at the specified point compared to others using the Gray level co-occurrence matrix (GLCM) algorithm for texture analysis. The number of grey levels is significant in GLCM, and statistics for the number of intensity points in each combination are classed in order of first, second, and higher. Different statistical texture features of GLCM are energy, sum entropy, covariance, information measure of correlation, entropy, contrast and inverse difference and difference entropy.

3.1.5 Classification:

Leaves are affected by diseases caused by fungi, viruses and bacteria. Sometimes insects also damage the leaf which appears as leaf spot disease. Depending on the stage and organism involved, the diseased section of the leaf will vary in size and colour. Spots of various colours, such as yellow, brown, tan, and black, will be seen.

3.2 Software used:

MATLAB R2020a

It is a tool that is used for the solving the disease detection problem. This provides strong support for the implementation of the advanced algorithms. Machine learning algorithms and classifier too are very easily implemented. MATLAB also allows user to testing and training of the data. User can set various cutoffs for all the attributes and train the data on a given dataset and also using testing tools we can verify the data.

3.3 Result:

Affected area in the plant leaf are detected based on a K-means clustering and GLCM techniques. Image processing algorithm are developed to detect the plant infection or disease by identifying the colour feature of the leaf area. Colour segmentation is done with the K-mean technique, while disease

classification is done with the GLCM algorithm.

IV. APPLICATIONS

This project useful in many different fields –

1) Agriculture: In developing countries agriculture/farming is main source of income to the farmers and for them yield estimation is the central challenge. A plant or crop can be monitored, i.e., agricultural monitoring, to predict the disease of a particular type of plant, thereby preventing disease outbreaks, famines and support our Indian farmers before harvesting any plant.

The advantage of using this method is that the plant diseases can be identified at an early stage or the initial stage.

2) Gardening: A individual who has very rudimentary knowledge regarding the plant diseases, can simply with a single click of a photograph of the plant can find out the affliction which is plaguing his/her plant and find remedy for them.

3) Green House: A greenhouse has different management requirements compared to outdoor production due to its relatively closed environment. Bugs and malady, and extremes of temperature and stickiness, ought to be controlled, and water system is essential to supply water.

V. CONCLUSION

There are number of ways by which we can detect disease of plants and suggest remedies for them. The current work discusses and summarises image processing strategies for identifying plant diseases in a variety of plant species. Each has some merits as well as demerits. The major techniques for detection of plant diseases are: K-means clustering and Neural Systems (NNs). These procedures are used to examine the leaves of both healthy and sick plants. Recognizing the disease accurately and efficiently is mainly the purpose of the proposed approach.

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