A Study on Plant Leaf Disease Detection Using Image Processing

Aryan singh[a], Shavez rahman [b], Abhishek Kumar[c]*

abc Student of BCA in Tula's Institute Dhoolkot Dehradun i, India,
*Under Guidance Assistant Professor **Mr.Rakesh Kumar** (Computer Science and Engineering)*

ABSTRACT

The first step in preventing reductions in agricultural product productivity and quantity is the identification of plant diseases. The research on plant diseases refers to examinations of patterns on the plant that may be observed with the naked eye. For agriculture to be sustainable, plant disease diagnosis and health monitoring are essential. Using image processing techniques, we demonstrate an automatic detection of plant diseases in this research. The system that is being introduced is a software tool for the automatic detection of plant leaf diseases and the computation of textural statistics. The four main steps of the processing system are as follows: creating a colour transformation structure for the input RGB image, masking and removing the green pixels using a specific threshold value, segmenting the image and extracting the useful segments, and computing the texture statistics. The illnesses, if any, that are present on the plant leaf are assessed by the texture statistics.

Keywords: Neural Network, Classification, Features Extraction, Pre-Processing, and Image Acquisition.

I. INTRODUCTION

India is a nation based on agriculture. India's economy is mostly dependent on agriculture. Crops become infected as a result of environmental changes including intense rainfall and abrupt temperature fluctuations. Spots on the leaf, leaf dryness, leaf colour changes, and defoliation are characteristics of this. The majority of people may not be able to quickly and accurately recognise the illness. The proposed project uses image processing to detect leaf infection because images contain crucial data and information for biological science, and because digital image processing and image analysis technology, which is based on advancements in micro electronics and computers, has many uses in biology. The technique for identifying and categorising leaf diseases relies on masking and eliminating green pixels from the affected area, using a particular threshold extract, and computing the texture statistics in MATLAB to assess the disease.

METHODOLOGY

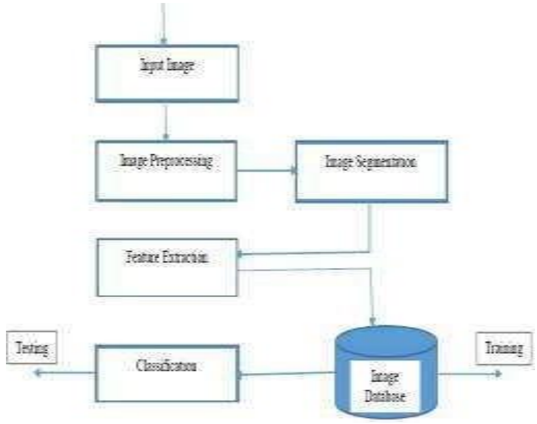

Figure 1. Block Diagram of Proposed Method

A. Input Image:

To identify illnesses, we used computerised photographs of leaves. The pictures came from several web resources. In this study, we employed three prevalent rose diseases: black spot, anthracnose, and rust. The illness photos are displayed in JPEG format in Fig. (a).

Figure 2

B. Image Preprocessing:

Prior to feature extraction, there is an initial stage of image pre-processing. Image preprocessing consists of three steps: image cropping, image converting, and picture enhancing. After being trimmed around the area with the leaf illnesses, the image is changed to grayscale. The laplacian filter was applied to improve the image.

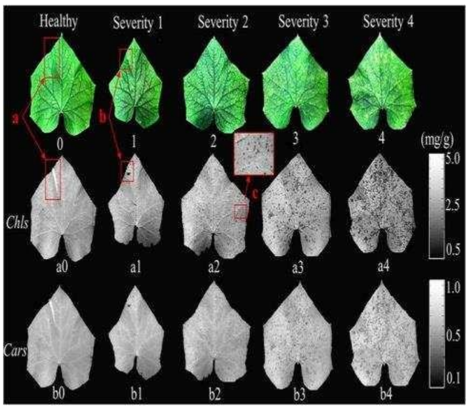

Figure 3

C. Image Segmentation:

One of the most vital steps before disease detection is done is image segmentation, which has a significant impact on how well the systems are working as a whole. In order to complete simple picture segmentation tasks, the K-Means clustering algorithm has been used. This convergent clustering technique seeks to maximise the partitioning choices made in light of a user-defined initial set of clusters. The k-means segmentation approach was suggested in the paper to segment target areas. The target area is the region where the disease is present.

D. The two characteristics included in the suggested method are colour texture and spatial features. There are 17 overall features, including 4 form features and 13 colour features. From the binary segmentation images, shape features like area, perimeter, circularity, and complexity were retrieved.

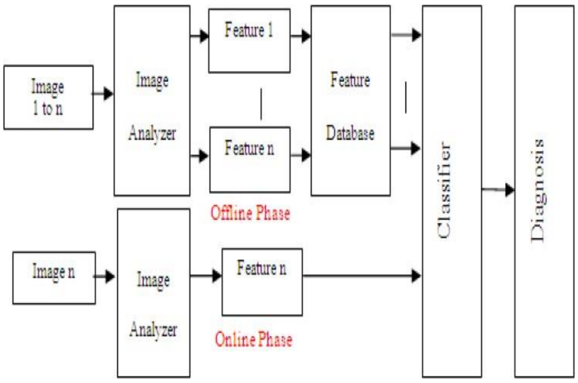

Figure 2. Block Diagram

A. Color Transformation Structure :

Initially, the RGB photos of leaves are transformed into a representation known as Hue Saturation Intensity (HSI) color space. The primary objective of the color space is to enable the precise definition of colors in a standardized and widely acknowledged manner. The HSI (hue, saturation, intensity) color model is widely utilized due to its foundation in human vision.

B. Hue Color Attribute:

The attribute of hue color is an important factor to consider in various academic disciplines.The term "dominant color" pertains to the primary hue perceived by an individual. Saturation pertains to the degree of purity or the quantity of The incorporation of white light into the hue and intensity of a light source pertains to the amplitude of the light. The conversion of color spaces can be readily achieved. Following the completion of the transformation procedure, the H component is subsequently considered for subsequent analysis. The omission of the pronouns "S" and "I" is justified as they do not provide any further information.

C. Masking Green Pixels:

In this analysis, we primarily focus on the identification of pixels that exhibit a green color. Subsequently, utilizing a predetermined threshold value calculated for these pixels, the predominantly green pixels are identified.

The pixels are masked based on the condition that the green component of the pixel intensity is below a certain threshold value, resulting in the masking of the red, green, and blue components.

The components of this pixel are assigned a value of zero.

D. Segmentation:

Segmentation is a process that involves dividing a larger entity or market into smaller, more manageable segments. This allows for a more targeted

The aforementioned procedure involves the extraction of the diseased section of the leaf. The affected area is thereafter divided into many patches of uniform size. The selection of the patch size is made to ensure that the important information is preserved without being compromised. The chosen technique utilizes a patch size of 32*32. The subsequent phase involves the extraction of pertinent portions. Not all segments contain a substantial quantity of that information. The patches that include more than fifty percent of the information are considered for subsequent examination.

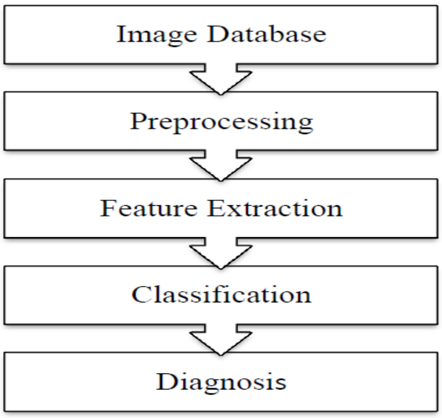

Figure 3. Flow Chart

A. Image Acquisition:

The plant leaf images are obtained by means of a camera. The presented image is represented in the RGB color model, which stands for Red, Green, and Blue. A structure for color transformation is established for the RGB leaf picture, followed by the application of a device-independent color space transformation to the aforementioned structure.

B. Image Pre-processing:

Image Pre-processing: Various pre-processing techniques are employed to eliminate noise in images or remove other objects. The process of picture clipping, specifically the cropping of a leaf image, is performed to isolate and extract the region of interest within the image. The process of image smoothing is performed.

Applying the smoothing filter. Image enhancement is performed with the objective of augmenting the contrast.The RGB images can be transformed into grayscale images using color conversion using the equation: $f(x) = 0.2989 * R + 0.5870 * G + 0.114 * B$ (1)

Next, the process of histogram equalization is employed on the image in order to enhance the visual representation of plant disease images by evenly distributing the intensities. The cumulative distribution functions are employed for the distribution of intensity data.

C. Image Segmentation:
it refers to the process of dividing a picture into distinct regions or segments based on their shared characteristics or similarities. Segmentation can be achieved through the utilization of different techniques, such as the Otsu's approach, k-means clustering, and the conversion of an RGB image into the HIS model.

1. Segmentation using Boundary and spot detectionalgorithm:
The process of segmentation is achieved by employing a boundary and spot detection method. To facilitate this, the RGB image is transformed into the HIS model, which enables effective segmentation. The utilization of boundary detection and spot detection techniques facilitates the identification of the affected region on the leaf, as previously described. The border detection algorithm is applied by considering the 8-connectivity of pixels.

2. K-means clustering:
K-means clustering is a categorization method that assigns objects to K classes based on a collection of features. The process of classifying objects involves minimizing the sum of the squares of the distances between each object and its respective cluster.

The algorithm for K –means Clustering:
1.One possible approach for selecting the center of a K cluster is to choose it either randomly or based on a heuristic.
2. The assignment of each pixel in the image is determined by minimizing the distance between the pixel and the center of the cluster.Once more, the cluster centers are determined by calculating the average of all the pixels within each cluster. Continue to go through steps 2 and 3 until the desired state of convergence is achieved.

II. FUTURE SCOPE

In this section, we will discuss the potential areas for future research and development in relation to the topic at hand.
The proposed methodology utilizes mobile cameras to capture photos of diseased subjects, eliminating the need for specialized training or advanced imaging equipment.
The approach being offered possesses several key characteristics. Firstly, it is entirely automated, allowing for the calculation of ROI, separation of background, and evaluation of disease parameters without any manual intervention. Secondly, it is a cost-effective solution that can be widely utilized in field situations. Lastly, the segmentation method employed is simpler, while the parameters used are more advanced in nature. A fully automated color image sensing system has been created for the classification of four highly hazardous foliar illnesses in soybean plants: bacterial blight, frog's eye, brown spot, and soybean rust. The four illnesses exhibit comparable coloration patterns, posing challenges for individuals lacking expertise in plant pathology. A novel approach was devised for the purpose of identifying and analyzing lesion texture histograms. This algorithm involves the application of the Discrete Cosine Transform (DCT) on the statistical features of the Refined Lesion Texture Histogram (RLTH), followed by a subsequent normalization step. In this study, we have devised a hybrid feature descriptor for lesion regions based on ST-NDCT. Through our experimentation, we have demonstrated the appropriateness of employing this descriptor for the classification of the infections under investigation.

The implemented methodology has been successfully applied and subjected to performance testing using a genuine dataset of soybean leaf samples. The outcome is highly persuasive and demonstrates extensive applicability in developing nations, where the acquisition of such knowledge plays a crucial role in enhancing agricultural productivity.

CONCLUSION

The primary objective of our study is to accurately identify and classify illnesses affecting plant leaves. The initial stage of preprocessing involves two processes, namely gray conversion. The subsequent phase involves employing k-means algorithm for the purpose of segmenting images, hence facilitating image analysis. The third stage involves the extraction of characteristics, specifically color features and shape features. Subsequently, the classification of disorders is conducted utilizing our proposed algorithm. The objective of this investigation is to create an advanced automated data processing system that utilizes image analysis techniques to identify and classify leaf spots caused by various illnesses. The completion of disease prediction and advice for treatment has been accomplished. The manufacturers intend to modify the Yield and reduce the extent of the loss. The implementation of this proposed approach has effectively alleviated the burdens faced by farmers, thereby significantly improving their livelihoods. Demonstrate superior performance relative to one's peers. The inclusion of a greater number of features in an SVM classifier has been found to enhance the accuracy of detection.

III. REFERENCES

[1]. Sandeep B. Patil& Santosh Kumar Sao "AN IMPROVED LEAF DISEASE DETECTION USING COLLECTION OF FEATURES AND SVM CLASSIFIERS".

[2]. RenukaRanjedraKajale „"DETECTION &RECOGNIZATION OF PLANT LEAF DISEASES USING IMAGE PROCESSING AND ANDROIDSYETEM".

[3]. Ms. Chithra J L (Government college)"LEAFINFECTION DETECTION AND DIAGNOSIS USING IMAGE PROCESSING TECHNIQUE.

[4]. Ms. Arti N. Rathod ,Computer Engineering ,Gujarat (Technical University), "IMAGE PROCESSING TECHNIQUES FOR DETECTION OF LEAF DISEASES".

[5]. Mrs. Jayme Garcia ArnalBarbedo Digital image processing techniques for detecting, quantifying and classifying plant diseases(SPRINGER PLUS-2013.

[6]. SmitaNaikwadi, NiketAmoda, "advances in image processing for detection of plant diseases" international journal of application or innovation in engineering & management, PP: 168-175,November 2013.

[7]. Kholis Majid, YeniHerdiyeni, AunuRauf "I- PEDIA: Mobile Application for Paddy Disease Identification using Fuzzy Entropy and Probabilistic Neural Network" IEEE ICACSIS 2013.

[8]. Al-Bashish, D., M. Braik, and S. Bani-Ahmad. 2011."Detection and classification of leaf diseases using Kmeans- based segmentation and neural networks based classification". Information Technology Journal, 10(2):267-275.

[9]. RakeshKaundal, Amar S Kapoor and Gajendra PS Raghava "Machine learning technique in disease forecasting: a case study on rice blast prediction, "BMC Bioinformatics, 2006.