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A Survey on Plant Leaves Disease Identification and Classification

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Abstract:

India is an agricultural based country where approximately 70% of population depends on agriculture. Our lives are completely dependent on plants. So the plant disease detection is very important. We get various raw materials from agriculture and especially crops, which serve as a staple food for people. But the crops and plantations get destroyed mainly due to two major reasons, first reason is destruction by natural calamities such as flood, earthquake, drought, famine, etc. and second reason is the destruction by the pathogens such as viral, bacterial and fungal. Farmers are not aware about what type of disease affects the plants and how to prevent them. To overcome this few techniques are developed in which plant disease is detected using image processing technique. This paper is the survey presented on the various existing methods for detection and identification of plant leaf diseases.

Keywords **—Leaf disease identification, SVM, GLCM, Quality Analysis, Segmentation**

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I. INTRODUCTION

Plant diseases play a vital role in reducing both quality and quantity of agricultural products. Automatic detection and classification of plant diseases is required to observe large area of crops and detect the plant diseases at the early stage which is impossible with naked eyes. Recent trends have developed various methods to detect and classify the plant disease based on the symptoms. This paper presents the survey on the various image processing technique, their application and classification methods.

II. PLANT LEAF DISEASES

Organisms that cause infectious disease include fungi, oomycetes, bacteria, viruses, viroids, virus-like organisms, phytoplasmas, protozoa, nematodes and parasitic plants. Symptoms differ based on the internal and external expression of the disease. General classification includes local (within a limited area of host tissue), systemic (reaction of a greater part or all of the plant), primary (pathogen activity on invaded tissues), secondary (physiological effects of disease on distant tissues and uninvaded organs), microscopic (disease in cell structure or cell arrangement) or macroscopic (abnormal effects on host cells, tissues, and organs). Few diseases with their symptoms and characteristics are explained below;

A. AlternariaAlternata

It is a fungus that causes leaf spots, rots, blights and other diseases on over 380 host species of plant. It can also cause upper respiratory tract infections and asthma in humans.

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Fig. 1. Example of Alternaria Alternata

B. Anthracnose

It is a fungus that causes leaf spots, rots, blights and other diseases on over 380 host species of plant. It can also cause upper respiratory tract infections and asthma in humans.

Fig. 2. Example of Anthracnose

C. Bacterial blight

It is a disease caused by the bacterial pathogen *Xanthomonascampestris* which is characterized by small, pale green spots or streaks which soon appear water-soaked. Infections are spread by splashing of bacterial ooze by rain drops, plant to plant contact and insects. This develops on the upper leaves during cold and wet weather.

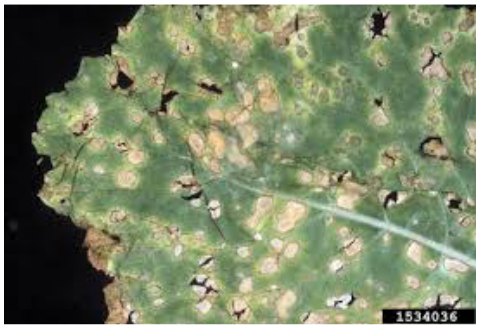

Fig. 3. Example of Bacterial blight

D. Cercospora Leaf Spot

It is a common disease in beetroot, capsicum, carrot, avocado and coffee crops. It causes small, brown flecks develop with a reddish border, round water-soaked lesions on leaves, petioles and stems. This tissue also becomes thin and brittle.

Fig. 4. Example of Cercospora Leaf Spot

III. LITERATURE SURVEY

Siddharth Singh Chouhan et al., (2018), in the paper introduced an automatic soft computing approach Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases. To assign optimal weight to RBFNN and to increase the speed and accuracy Bacterial foraging optimization (BFO) is used. The region growing algorithm finds and groups the seed points which share the common attributes for feature extraction process. Identification and classification of fungal diseases like common rust, cedar apple rust, late blight, leaf curl, leaf spot, and early blight is done. This method attains higher accuracy in identification and classification of diseases with specificity 0.8231 and sensitivity 0.8357. [1]

S. Arivazhagan et al., (2013), proposed a software solution for automatic detection and classification of plant leaf diseases. This process consists of four main steps. The collected image undergoes colour transformation from RGB to HSI format then masking of green pixels and removal of masked green pixels. The third step is the segmentation of texture statistics with color co-occurrence method and finally the extracted features are classified with Minimum distance criterion and with SVM classifier. The efficiency of this

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algorithm is an accuracy of 94% to detect and classify 500 leaves from 30 species. [2]

Fanfengmeng et al., (2018), suggested a method to improve the identification accuracy of mai ze leaf diseases. Two improved convolutional neural network modals: deep GoogLeNet was used to reduce the numbers of network parameters and Cifar10 model was used to train the maize leaf image dataset. 9 kinds of maize leaf images were collected, 8 representing infected ones and 1 the healthier leaves. The CNN data set not only contains the original images but also the variations including 90^{o}, 180^{o} and 270^{o} rotation. The images are pre-processed to improve feature extraction and increase x`consistency. GoogLeNet uses pyramid model with the concepts of Inception Module to measure accuracy and system loss. The Cifar10 takes care of pooling and Relu operation after each convolution layer. With the help of the two deep CNN models accuracy of 98.9% and 98.8% is obtained. [3]

Sushil R. Kamlapurkar, (2016), proposed a method to identify Powdery Mildew and Downey Mildew in Grape fruit at the earlier stage. The images were collected from a nearby farm and stored in JPEG format. To reduce the effect of background pre-processing was done. Image enhancement was by transforming the image to HSI colour space. Intensity of the image is adjusted by applying threshold which is obtained by analysing histogram of the intensity channel. Features including major axis, minor axis and eccentricity are extracted from image by Gabor filter is used for the classification of disease. Classification is done by Artificial Neural Network. Discontinuity and similarity are the two principles in segmentation. [4]

Ayesha. L Tilwani et al., (2017), presents a method to detect and classify diseases of strawberry leaves. Pre-processing which includes image enhancement and color space conversion is done with the collected images. Histogram equalization is done on grey scale image which is converted into RGB and then to YCbCr. In color conversion RGB images are converted to HSV image. Image segmentation is done using K-means clustering. Finally the classification is done by SVM due to its robustness in training the images. [5]

AshwiniVedula et al., (2018), describe an automatic plant disease detection and classification method. Images with various diseases are collected. Pre-processing includes RGB image to Gray image, image resizing and median filter to remove unwanted data and enhance important features. The disease affected area is separated and grouped using K-means clustering algorithm. The two Neural Networks used for the classification and detection of leaf disease are Feed Forward Back Propagating Neural Network and Cascaded Feed Back Propagating Neural Network. This method can be used to detect the disease in the very earlier stages.[6]

C. Lalitha, et al., (2017), have discussed a method to identify disease in betel plant at the earlier stage using image processing techniques with an accuracy of 95.85%. Healthy and diseased betel leaf are collected as digital images from the agriculture farm and are being transformed into l*a*b model using CIELAB color space. Preprocessing is done with the help of Median filter and segmentation is carried out by Watershed transformation algorithm. Histogram of Oriented Gradient (HOG) is the technique used to extract the features and multiclass SVM classifier identifies the disease.[7]

N. Neelaveni, et al., (2016), has proposed an approach for identification, classification and remedy for disease in paddy leaves using data mining and image mining. Healthy and affected paddy leaves are collected and preprocessed to remove the noise and the boundary of the leaves. Feature extraction is done for the classification of the disease by neural networks and segmentation is by K-means clustering and image mining. This approach helps in making decision at the very earlier stage of disease and to protect the crops. [8]

Shweta.S. Kothawale, et al., (2018), discussed the classification and identification of the grape leaf disease using the SVM classifier technique. All the samples are collected from the grape farm were in RGB format. Preprocessing is done for noise removal, contrast enhancement and illumination equalization. During segmentation a histogram is formed to measure the intensity and then GLCM and Radon technique is used to extract the texture features. Classification is by SVM which

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is used to train and test the process. This approach is found to give the output at accuracy of 89.90%. [9]

GayatriAvinashDeore, et al., (2018), proposeda method to detect and classify diseases in plants based on Smart Agriculture. It monitors the soil properties and is possible to control using remote sensing. Identification of leaf spot diseases is done by image acquisition followed by preprocessing where the RGB images are converted to gray scale images using color conversion and histogram equalization to distribute the intensity. Image segmentation is by K mean clustering and feature extraction is by Colour co-occurrence method. Classification is by Back propagation neural network where the input layer detects the diseased region and the output layer denotes the affected region. The IOT model consists of Controller, Arduino and sensors to monitor and control the field properly. [10]

TABLE I. COMPARISION OF THE VARIOUS EXISTING METHODS

Author name	Paper	Techniques	Application
Siddharth Singh Chouhan, Uday Pratap Singh, Sanjeev Jain.	Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases: An automatic approach towards Plant Pathology.	BRBFNN, BFO, Region growing algorithm, K-mean, Genetic Algorithm.	Fungal diseases like common rust, cedar apple rust, late blight, leaf curl, leaf spot, and early blight
Arivazhagan, S., R. NewlinShebiah, S. Ananthi, and S. Vishnu Varthin.	Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features	Co-occurrence matrix, HSI, segmentation, SVM	30 different native plant Species
Sushil R. Kamlapurkar	Detection of Plant Leaf Disease Using Image Processing Approach	Gabor filter, discontinuity and similarity	Powdery Mildew, Downey Mildew in Grape fruit
Ayesha .L Tilwani , Prof. Devang G. Jani	Disease Detection in Leaves using Image Processing Techniques	HSV color space, K-mean clustering	Strawberry leaves diseases
Sanjay Mirchandani, MihirPendse, PrathameshRane, AshwiniVedula	Plant disease detection and classification using image processing and artificial neural networks	K-means Clustering, ANN,FFNN, CFNN	Black Spot, Powdery Mildew, Yellow Sigatoka, Tobacco Ringspot, Tomato Leaf Disease, Frog Eye and Valedinsia Leaf Spot
Dr. S. K. Jayanthi, C.Lalitha	Betel Leaf Disease Detection Using Histogram of Oriented Gradients and Multiclass SVM	CIELAB Color Space Model; Watershed Segmentation; Histogram of Oriented Gradient; SVM	Betel leaf disease detection
Shweta.S. Kothawale , S.R.Barbade, Pradnya .P.Mirajkar	Grape Leaf Disease Detection Using SVM Classifier	GLCM, Histogram thresholding , Radon transforming	Grape Leaf Disease
Nikhil GovindaDhakad, UmeshShyamkantYewale, TejalYuvrajPatil, GayatriAvinashDeore	Leaf disease detection using Image Processing	K-means clustering, HIS color space, color co-occurrence, BPNN, Smart Farming, IOT	Early scorch, Ashen mould, Late scorch, Cottony mold and Ting whiteness diseases
N.Neelaveni, S. Rajeswari	Paddy Leaf Disease Detection Classification and Remedy Finder Using K means Clustering and Image Mining	Data mining, image mining, k-means clustering, neural network	Paddy Leaf Disease

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IV. CONCLUSION

In this paper we have discussed the various Plant leaf disease detection and classification techniques. Many automated techniques with K-means clustering, GLCM, co-occurrence matrix, histogram, watershed segmentation with classifiers like BRBFNN, ANN and SVM were used by the researchers. The main focus of all the methods was to detect the disease in the earlier stage which improves the quality and quantity of the plant products.

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