Diseases Detection of Various Plant Leaf Using Image Processing Techniques: A Review

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Abstract— **Agriculture is a key source of livelihood. Agriculture provides employment opportunities for village people on large scale in developing country like India. India's agriculture is composed of many crops and according to survey nearly 70% population is depends on agriculture. Most of Indian farmers are adopting manual cultivation due to lagging of technical knowledge. Farmers are unaware of what kind of crops that grows well on their land. When plants are affected by heterogeneous diseases through their leaves that will effects on production of agriculture and profitable loss. Also reduction in both quality and amount of agricultural production. Leaves are important for fast growing of plant and to increase production of crops. Identifying diseases in plants leave is challenging for farmers also for researchers. Currently farmers are spraying pesticides to the plants but it effects human directly or indirectly by health or also economically. To detect these plant diseases many fast techniques need to be adopt. In this paper, we have done survey on different plants disease and various advance techniques to detect these diseases.**

Keywords—Crops, Cultivation, pesticides, Plant diseases.

I. INTRODUCTION

Indian economy is dependent of agricultural productivity. Over 70% of rural homes depend on agriculture. Agriculture pays about 17% to the total GDP [1] and provides employment to over 60% of the population. Therefore detection of plant diseases plays a vital key role in the arena of agriculture. Indian agriculture is composed of many crops like rice, wheat. Indian farmers also grow sugarcane, oilseeds, potatoes and non-food items like coffee, tea, cotton, rubber. All these crops grow based on strength of leaves and roots. There are things that lead to different disease for the plant leaves, which spoiled crops and finally it will effect on economy of the country. These big losses can be avoided by early identification of plant diseases. Accurate detection of plant disease is needed to strengthen the field of agriculture and economy of our country. Various types of Disease kill leaves in a plant. Farmers get more difficulties in identifying these diseases, they are unable to take precaution on those plants due to lack of knowledge on those diseases. Biomedical is one of the fields to detect plant diseases. In current day among this field, the image processing methods are suitable, efficient and reliable field for disease detection with help of plant leaf images. Farmers need fast and efficient techniques to detect all types of diseases of plants that can save time. These systems that can reduce efforts and use of pesticides. For measurement of yields in agriculture different ideas are proposed by scientists with the help of laboratory and systems for efficient identification of plant leaf diseases. The paper we presented here is survey of various types of plant diseases and techniques for detection of disease by different researchers.

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II. KEY ISSUES AND CHALLENGES IN THE FIELD OF DISEASE ANALYSIS

Many researchers had done research on various plants and their diseases also they had given some techniques to identify that disease. Automation of identifying disease entails the input date collected from different sources. In this review, considering all different research papers we are identifying and discussing key issues, challenges on disease and techniques are as follows.

- Quality image of plant leaves
- Data set need to be considered in large amount.
- Acquired images are affected by background data and noises.
- Segmenting the exact spot in a leaf into meaningful disease. Preparation of training and testing samples from input image.
- Classification plays a role in recognizing segmented spot into meaningful disease.
- Colour of plant leaf, size and texture are varying when climate changed.
- Regular observation is needed for particular plants.
- Identifying diseases for different plant leaves is challenging.
- Reviews suggest that image processing and machine learning techniques have more potential to find diseases so, there has to be improving in existing research.

Keeping all these in mind and to discuss the techniques used to accomplish these challenges, the literature survey is discussed.

III. LITERATURE SURVEY ON VARIOUS PLANT DISEASE

Many researchers had done research on various plants and their diseases also they had given some techniques to identify that disease. To get understanding of this research area, we carry out a study on various types of plants with diseases. This

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survey will help to propose novel idea for identification of diseases.

A. DIFFERENT TYPES OF PLANT DISEASE

The reason for this section is that researchers can understand type of image processing operation and type of feature need to be considered by observing various diseases.

Disease to the plants that takes place when a virus, bacteria infects a plant and disorders its normal growth. Effect on plant leaves can vary from discoloration to death. Disease causes due to including fungi, microbes, viruses, nematodes. Here we are discussing some common diseases in Maize, arecanut, coconut trees, Papaya, Cotton, Chilli, Tomato, Brinjal. The images of plant disease are shown in Fig.1. Several variants of Diseases are explained further.

- **Rust:** It is usually found on leaves lower surfaces of mature plants. Initially raised spots on the undersides of leaves. As time passes these spots become reddish-orange spore masses. Later, leaf postules turn to yellow-green and eventually black. Severe infestations will bend and yellow leaves and cause leaf drop [2].
- **Kole Roga:** It is a major disease of arecanut. The pathogen is a fungus Phytophthora palmivora [3].
- **Yellow leaf disease:** This disease caused by pathogen Phytoplasma in arecanut where green leaves tuning into yellow that gradually decline in yield.
- **Leaf rot:** It is caused in coconut tree. It is caused by fungi or bacteria. Leaf spot vary in size, shape and colors [4].
- **Leaf curl:** Disease is characterized by leaf curl. It can cause by fungus, genus Taphrina or virus [5].
- **Angular leaf spot:** Most of cotton plants die due to this disease because it appears on leaves first then water soaked. Finally turn black and form holes in leaves [6].
- **Leaf spot:** It is serious bacterial disease found in chili spread by Xanthomonas campestris pv vesicatoria [7]. The symptoms like small yellow green legions and patches on leaves.
- **Late Blight:** Late Blight spreads rapidly. The development of the fungus due to Cool and wet weather. It forms irregularly shaped ashen spots signs on leaves. Around the spots there will be a ring of white mold [8].
- **Bacterial wilt:** Brinjal cultivation yield drops due to bacterial wilt. Entire plant has fall down due to wilting of the foliage [9].

Rust: Maize

Kole Roga: Arecanut

Leaf Rot: Cocunut

Papay Leaves Curl

Angular Leaf spot: Cotton

Leaf Spot: Chilli

Tomato Late Blight

Bacterial wilt: Brinjal

Fig.1. Plant Diseases in various Plants

IV. REVIEW OF LITERATURE

Automation of identifying disease is of great interest in the agriculture field around the world. Many researchers are carried out in detection of those diseases. Below are the various plant disease studies of the techniques used by the researchers in meeting the endeavour. The survey has been made on the major disease on various plants.

Gittaly Dhingra [10] describes application of agriculture using computer vision technology to recognize and classify disease of plant leaf. The paper deals with correlation between disease symptoms and impact on product yield. It also deals with increase the number of training data and testing to accomplish better accuracy.

Shitala Prasad [11] proposed mobile based client-server design for leaf disease detection using Gabor wavelet transom (GWT). In this system first carried out color conversion from the device dependent to colour space model. Mobile pre-processing can be done after acquiring leaf and converting color space. For human vision system Human perception*a*b colour space was designed. Making human perception of lightness more accurate by changing output curves in a & b components. To perform analysis of leaf image, K-means unsupervised algorithm was used. To perform feature extraction Gabor wavelet conversion

was used. Author of this paper experimented with homemade dataset. In future proposing efficiently processing of Captured Leaf images in a complex background with different lightening condition.

Shanwen Zhang[12], discussed hybrid clustering method. Leaf segmentation is important in detection of plant diseases which affects reliability of feature extraction. Author used super pixel clustering in which neighboring pixels with some feature with respect to brightness, texture, color are grouped into homogeneous regions. This can reduce complexity of images from more pixels. Author suggest that Expectation maximization (EM) algorithm may be good approach for color image segmentation.

Keyvan Asefpour Vakilian[13] demonstrate that detect two types of fungus in cucumber plant leaves. ANN model with 3 layers were utilized to identify P.cubensis and S.fuliginea infection. Author has taken real time germinated seeds of cucumber on moist paper which is at degree c for 3 days. Further research is needed to increase the ability of farmers assisted robots in real time detection of fungal and viral disease

Mohammed Brahimi [14] proposed deep learning method to create classifier for detection of disease. Also proposed the occlusion concept to localize the disease regions & help to understand the disease. Author uses datasets which is published in good fellow, Bengio etc, further research is need to reduce the computation & size of deep models for small machine like mobiles

H.Al-Hiary[15],proposed detection of plant diseases using automation and classify its diseases. Here pixels are grouped on set of feature into total k classes. When leaf has more than one disease then there is more clusters that cause disease. ANN is used to detection and classification of disease. Further research need to increase the accuracy of detection.

Yuanyuan Shao[16] discussed multi feature and genetic algorithm BP neural network. Otsu method were used for segmentation & extraction. Practically in real time tobacco disease can be identified through mobile client and server can make a diagnosis on diseases which were uploaded by user. Here Otsu method was used to extract spot disease. Genetic algorithm can reduce training times and improve recognition accuracy. Further research needs other method describe tobacco disease feature and to improve accuracy.

Vijai Singh[17] presented an algorithm for segmentation of plant leaf image. Author proposed image recognition and segmentation process. First, devices were used to capture image of different types and applied different segmentation method to process image. The author taken image of size m*n & every pixel has R,G,B components. Color co-occurrence method was used for feature extraction. Above experiments are done in MATLAB. Author demonstrates the results only for beans, leaf, lemon and banana leaf. Further research is needed for all types of leaves.

Shanwen Zhang[18] proposed method for recognizing disease for cucumber leaves. Due to irregular shapes, complexity, shadows existing classifiers are not suitable for detection. From image of leaf, Author proposed a method using combined shape and color features. Author performed region segmentation from diseased image using K-means clustering algorithm. First system can collect images from data set. Image are converting from Red, Green, Blue space to Luminance*a*b* color model. Then classify color using k-means clustering. Here each image is processed using techniques of smoothing, enhancing, denoising, alignment and segmented by k-means clustering techniques.

Amar Kumar Dey[19] used image processing algorithm for betel vine to detect leaf rot disease. They proposed vision based method to detect and observe peripheral disease features. Based on color feature of rotted leaf area disease are identifying. Author chooses Bangla desi varieties of betel vine. They used cannon scanner with 300 PPI resolutions for detection. A leaf disease severity can be identified as leaf total area calculation and percentage diseased area. Author used Otsu thresholding method for segmenting leaf rot diseases.

Srdjan Sladojevic [20] used deep convolution network approach for leaf disease recognition using classification method. Researcher proves that climate change can alter stage and pathogen development rate. Trained deep neural network to differentiate surrounding of leaves. To highlight region of interest all images are cropped manually by making square around the leaves. Author applied augmented process to increase dataset. Augmentation includes rotations, transformation and affine transformation. This paper presented caffe as a deep CNN framework.

Manisha Bhangea [21] designed modern techniques which is web based tool for identifying disease from the image. In this techniques, first uploaded image in the web portal is resized and extracted image feature such as color, morphology etc. Author uses K-means for clustering and for classification SVM was used. In this paper farmers need to upload the plant leaf for disease detection in real time. Proposed framework that maintains two image databases for disease detection. One for training and other for testing. Author used erosion morphology techniques for description and representation of region shape. Author categorizes three stages for infection such as infected first stage, second stage, and Third stage. The paper presented for bacterial blight disease in pomegranate fruit. Further research is improving system performance to detect disease in large dataset.

Usama Mokhtar[22] presented Gabor wavelet transform techniques to extract tomato leaf feature. They used SVM to detect leaf diseases. For experiments considering real sample images of tomato leaf and author observing two types of disease in tomato leaves including early blight and powdery mildew. In preprocessing phase images are resized to 512*512 resolutions to deduce the computational time. Applied background subtraction method to remove background of image. In the classification, using of kernel function the SVM was trained and tested.

V. IMPORTANCE OF AUTOMATION

The agriculture department has taken initiative in the prevention of plants from different types of diseases in all seasons. The automation can overcome the manual observation of disease in plants by applying image processing

practices plays a role in the computers era. Over decades many researchers have experimented lot of research on plant leaves to detect and recognize a type of diseases, this automation can find early disease that helps to prevent damages for plants and list of some diseases and techniques are specified above in the literature review, which actually bring to a close the importance of continuing the research for the next level of competency. The semantic gap in the identification of disease is growing day by day, as finding pathologists are difficult. Automation helps to prevent the spraying large amount of pesticides to plants. Moreover this automation can prevent human life also.

VI. OVERALL REVIEWS

The above Literature survey has detailed explanation of the importance of disease detection both to plants and to mankind. To have a meaningful impact of plant diseases & techniques in the area of agriculture, deliberation of proper input is necessary. Research issues addressed here are to develop a systematic approach to detect and recognize the plant diseases would assist farmers and pathologist in prospect exploration. The paper depicts the importance of image processing in agriculture field and considering the type of disease for further research work

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