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Leaf Age and Diseases Detection Using Image Processing Techniques: A Review

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ABSTRACT: Agriculture is a key source of livelihood for human. Agriculture provides employment opportunities for the 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 the agriculture. Most of the Indian farmers are adopting manual cultivation due to lagging of technical knowledge. Farmers are unaware of what kind of crops those grow well on their land. When plants are affected by heterogeneous diseases through their leaves, which will effects on production of agriculture and profitable loss. Also reduction in both quality and amount of the agricultural production. Leaves age are the important for fast growing of plant and to increase production of crops. Identifying diseases in the plants leave is challenging for farmers also for researchers. Currently farmers are spraying pesticides to 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 now. In this paper, we have done survey on the different plants disease with age and various advance techniques to detect these diseases.

KEYWORDS: Crops, Cultivation, Pesticides, Plant age estimation and Plant diseases.

I. INTRODUCTION

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

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

Many researchers had done research on various plants and their diseases also they had given some techniques to identify that disease and age. Automation of identifying disease entails the i/p date collected from different sources. In

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this review, considering all different research papers we are identifying and discussing key issues, challenges on disease and techniques are as given below.

- Quality image of plant leaf.
- Data set need to be considered in large amounts.
- Acquired images are affected by background data and noise.
- Segmenting exact spot in a leaf into meaningful disease. Preparation of training and testing samples from input image.
- Classifications play a role in recognizing segmented spot into meaningful disease.
- Color of plant leaf, size and texture is varying when climate changed.
- Regular observation is needed for the particular plants.
- Identifying diseases for the 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.

III. LITERATURESURVEYONVARIOUSPLANT DISEASE

Many researchers had done research on various plants and their diseases also they had provided some techniques to identify that disease. To get understanding of this research area, we carry out study on various types of plants with diseases.This survey will help to propose novel idea for the identification of diseases.

A. DIFFERENT TYPES OF PLANTDISEASE

The reason of 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 it's a normal growth. Effect on plant leaves can vary from discoloration by age to death. Disease causes due to including fungi, microbes, viruses, nematodes etc. Here we are discussing some common diseases in Maize, arecanut, coconut trees, Papaya, Cotton, Chilli, Tomato and Brinjal. The images of plant disease are shown in Fig.(1). Several variants of the Diseases are explained further.

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

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Rust:Maize Kole Roga:Arecanut


LeafRot:Cocunut Papay LeavesCurl


Angular Leafspot:Cotton Leaf Spot:Chilli


TomatoLateBlight Bacterial wilt:Brinjal

Fig.1. Plant Diseases in various Plants

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Fig.2. Leaf Age Maturity of Plant

IV. REVIEW OF LITERATURE

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

Gittaly Dhingra [1] 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 the product yield. It also deals with increase number of training data and testing to accomplish better accuracy.

Shitala Prasad [2] proposed mobile based client-server design for a leaf disease detection using Gabor wavelet transom(GWT). Inthissystem1stcarriedoutcolorconversionfromthedevice dependent to color space model. Mobile pre-processing can be done after acquiring leaf and converting to color space. For human vision system Human perception*a*b color space was designed. Making human perception of lightness more accurate by changing output curves in a and b components. To perform analysis of leaf image, the K-means unsupervised algorithm was used. To perform feature extraction Gabor wavelet conversions was used. Author of this paper experimented with the homemade dataset. In future proposing efficiently processing of Captured Leaf images in a complex background with the different lightening condition.

Shanwen Zhang[3], discussed hybrid clustering method. Leaf segmentation is an important in detection of plant diseases which affects reliability of feature extraction. Author used super pixel clustering in which neighboring pixels with some features with respect to brightness, texture, color are grouped into homogeneous regions. This can reduce a complexity of images from more pixels. Author suggests that Expectation maximization (EM) algorithm may be good approach for color image segmentation.

Keyvan Asefpour Vakilian[4] demonstrate that detect two types of fungus in cucumber plant leaves. ANN model with three 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 three days. Further research is needed to increase ability of farmers assisted robots in realtime detection of fungal and aviral disease

Mohammed Brahimi [5] proposed deep learning method to create classifier for detection of disease. Also proposed 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 computation & size of deep models for small machine like mobiles

H.Al-Hiary[6],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 the reare more clustersthatcausedisease.ANN is used to detection and classification of diseases. Further research need to increase the accuracy of the detection.

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Yuanyuan Shao[7] discussed multi feature and genetic algorithm BP neural network. Otsu method were used for segmentation and 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 the user. Here Otsu method was used to extract a spot disease. Genetic algorithm can reduce training time and improve recognition accuracy. Further research needs other method describe tobacco disease feature and to the improve accuracy.

Vijai Singh[8] presented an algorithm for segmentation of plant leaf image. Author proposed image recognition and the segmentation process. First, devices were used to capture image of the 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 the feature extraction. Above experiments are done in the MATLAB. Author demonstrates the results only for the beans, leaf, lemon and banana leaf. Further research is needed for all types ofleaves.

Shanwen Zhang[9] proposed method for recognizing disease for cucumber leaves. Due to irregular shapes, complexity, shadows existing classifiers are not suitable for the detection. From image of leaf, Author proposed method using combined shape and color features. Author performed region segmentation from diseased image using the K-means clustering algorithm. First system can collect image from dataset. Image are converting from Red, Green and Blue space to Luminance*a*b* color model. Then classify color into k-means clustering. Here each image is processed using techniques of smoothing, enhancing, de-noising, alignment and segmented by k-means clustering techniques.

Amar Kumar Dey[10] used image processing algorithm for betel vine to detect leaf rot disease. They have proposed vision based method to detect and observe peripheral disease features. Based on color feature of the rotted leaf area disease are identifying. Author chooses Bangladesi varieties of betel leaf. They used cannon scanner with 300 DPI resolutions for detection. A leaf disease severity can be identified as the leaf total area calculation and percentage diseased area. Author used Otsu threshold method for segmenting leafrot diseases.

Srdjan Sladojevic [11] used deep convolution network approach for leaf disease recognition using classification method. Researcher proves that climate change can alter stage & pathogen development rate. Trained deep neural network to differentiate surrounding of leaf. To highlight region of interest all images are cropped manually by making square around the leaf. Author applied augmented process to the increase dataset. Augmentation includes rotations, transformation & affine transformation. This paper presented caffe as deep CNN framework.

Manisha Bhangea [12] designed modern techniques which is web based tool for identifying disease from the image. In this technique, 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 the classification SVM was used. In this paper farmers need to upload plant leaf for disease detection in real time. Proposed framework that maintains two image databases for the disease detection. One for training and other for the testing. Author used erosion morphology techniques for the description and representation of region shape. Author categorizes three stages for infection such as an infected first stage, second stage, and Third stage. The paper presented for a bacterial blight disease in pomegranate fruit. Further research is improving system performance to detect disease in large number of dataset.

Usama Mokhtar[13] presented Gabor wavelet transform techniques to extract tomato leaf feature. They used SVM classifier to detect leaf diseases. For experiments considering real sample images of tomato leaf and author observing 2 types of disease in tomato leaves including early blight and powdery mildew. In preprocessing phase images are resized to 512*512 resolutions to reduce the computational time. Applied background subtraction method to remove background of the 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 prevention of plants from different types of diseases in all seasons. The automation can overcome the manual observation of disease in plants by applying imageprocessing practices plays a main 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 the techniques are specified above in the literature review, which

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actually bring to a close the importance of continuing the research for the next level of competency. The semantic gap in 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 the human life also.

VI. OVERALLREVIEWS

The above Literature survey has detailed explanation of importance of disease detection both to plants and to mankind. To have a meaningful impact of the 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 plant diseases would assist farmers and pathologist in prospect exploration. The paper depicts importance of image processing in agriculture field and considering the type of disease for further research work.

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