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A Review of Grape Plant Disease Detection

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Abstract -Productivity of plant decreases due to infections caused by variety of diseases. The diseases not only restrict the growth of plant but also reduce quality and quantity of plant. Different technique is adopted for detecting and diagnosis the diseases but the better way is by using Image Processing. Initially the infected region is found then different features are extracted such as color, texture and shape. Finally classification technique is used for detecting the diseases. Different feature extraction technique is there for extracting the color, texture and edge features such as color space, color histogram, grey level co-occurrence matrix (CCM), Gabor filter, Canny and Sobel edge detector. There are also different classification techniques such as Support Vector Machine (SVM), Artificial Neural Network (ANN) Back propagation (BP) Network, Probabilistic Neural Network (PNN), Radial Basis Function (RBF) Neural Network. This paper reviews various image processing and classification techniques to detect and further eliminate plant diseases which has tremendous significance on the productivity of agriculture.

Index Terms: Classification technique, Disease Detection, Feature Extraction, Image Processing

1. INTRODUCTION

India is an agricultural country where more than 65% population depends on agriculture. Due to disease on plant there is loss of 10-30 % of crop. Farmers do the naked eye observation and judge the diseases by their experience. But this is not accurate and proper way. Sometimes farmers call the experts for detecting the diseases but this also time consuming way. Most of the disease on plant is on their leaves and on stem of plant. The diseases are classified into viral, bacterial, fungal, diseases due to insects, rust, nematodes etc. on plant. The important task for farmers is to find out these diseases as early as possible. Following example shows that how diseases on grape plant reduces the productivity. There is 20 to 25% of cotton loss due to diseases on plant.

So, there is necessity of accurate, automatic and rapid method for detecting the diseases. This paper has been organized into FOUR sections. In section II gives the brief review different plant disease detection and SECTION IV gives the comparison of different classifier along with its advantage and disadvantages . Finally the paper is concluded in section V.

Fig (a) Downey Mildew

Fig (b) Phomisis

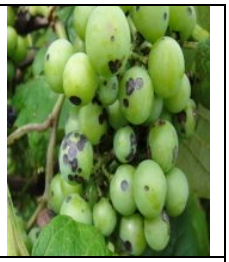

Fig (c) Black rot

Fig (d) Powdery Mildew on leaf

Fig (e) Powdery Mildew on berries

Fig 1. Infected Grape plant images

This paper gives an overview of different features extraction and classification techniques for plant disease detection and classification.

2. REVIEW

Maharashtra Government is working on the project named as the Crop Pest Surveillance and Advisory Project (Cropsap), which consist of Pest monitoring-cum-surveillance based advisory system, Creation of Awareness, Supply of chemical and biological pesticides in critical situations on 50% subsidy as a plant protection measures.

Pest Scouts: They collect data as per pest/disease wise from selected fixed and random plots in field. Each week one Pest scout collects the data from 8 villages allotted.On Monday, Tuesday and Thursday, Friday from 16 fixed and random plots observations are recorded. The observations are recorded on data sheets, are submitted to pest monitor on every Wednesday and Saturday.

Pest monitor: Scout collects the data of scouts on each Wednesday and Saturday. They also monitor the activities of pest scouts through surprise checks and conduct a roving survey @ 5-8 villages /day.

Data Entry Operators: They feed the data and upload it on website (www.ncipm.org.in). The existing system deals with the paper work. The employees working on this project pre[are the manual reports during their field work on they feed data manually and the messages are sent to the farmers. The Cropsap project is relatively slow because the messages are sent at the end of the week even if the survey of the field is done at the beginning of the week. Suppose if one of the fields needs the fast and quick treatment for the crop and the system gives the preventive measures vary late then it is the loss of that farmer and the current system also.

Many literatures is available for different plant disease detection using different techniques. Some of them are highlighted as below. Various papers are suggesting to diagnosis of different cropes using various approach suggesting the various implementation ways as illustrated and discussed below.

In 1983 Lindow and Webb proposed one of the first methods to use digital image processing Analog video camera was used to captured the images,red light illumination was used to highlight the necrotic region.Images were digitized and stored in the computer. Using leaves from tomatoes test was performed, bracken fern, sycamore and California buckeye. Identification of the necrotic regions is done by a simple thresholding process. The algorithm applies the correction factor for reductionof pixel variations in the healthy parts of the leaves, so some of the pixels from healthy regions that were misclassified as part of the diseased areas can be reassigned to the correct set[1].

In 2008 Meunkaewjinda. A, et al., proposed the work on cotton leaf disease .In his work modified self organizing feature map that uses genetic algorithms for optimization segmentation is performed and support vector machines is used for classification. The segmented image is filtered with Gabor wavelet that allows the system to detect and analyze leaf disease color features more efficiently classification of the cotton diseases [2]

In 2008 Santanu Phadikar, et al, have proposed Rice Disease Identification using Pattern Recognition Techniques describes a software prototype system for rice disease detection based on the infected images of various rice plants. To detect infected parts of the plant, digital camera images was used Images of infected rice plants using image growing, image segmentation techniques is detect infected parts. Then the classification of infected part of leaf is done by neural network.[3]

In 2011 Ajay A. Gurjar, Viraj A. Gulhane proposed Detection of Diseases on Cotton Leaves and Its Possible Diagnosis. The features could be extracted using self organizing feature map together.Back-propagation neural network is used to recognize colour of image.Information is used to segment cotton leaf pixels within the image,now image is well analyzed and depending upon software perform further analysis based on the nature of this image. They concluded that system provides 85 to 91% of exact disease detection depending upon the quality of image [4].

In 2011 Hui Li et al., proposed the work based on the Web-Based Intelligent Diagnosis System for Cotton Disease Control system. In their research they used the proposed method in a BP neural network which is based on decision-making system. A research scheme includes system test, in which different 80 samples, including number of main species of diseases, and samples iof 10 in each sort were included. The final result shows that the rate of correctness. The system identifies the symptom was 89.5% in average, and the average running time for a diagnosis was 900ms [5].

In 2011 Xu et al. proposed a method to detect nitrogen and potassium deficiencies in tomato plants. The algorithm starts with extracting a different feature from the color image. The color features are based on the b*component of the L*a*b* color space. The texture features are extracted using three methods i.e. difference

operators, Fourier transform and Wavelet packet decomposition. By means of a genetic algorithm selection and combination of the features was carried out and finally the optimized combination of features is used as the input of a fuzzy K-nearest neighbor classifier, which is responsible for the identification.[6]

In 2012 P. Revathi and M. Hemalatha proposed Homogeneous Segmentation using Edge Detection Techniques for Proficient Identification of the Cotton Leaf Spot Diseases. They proposed a system that uses mobile to capture symptoms of cotton leaf spot images and Neural classifier was used in their technique to diagnose disease in cotton plant. The main objective of their Research work is to use Homogeneity-base edge detector segmentation. It takes the result of any edge detector and divides it by the average value of the area.The division removes the effect of uneven lighting in image and then area is tested by using classifier. [7]

In 2012 Meenu Dadwal, V.K.Banga, proposed a method to Estimate the Ripeness Level of fruits using RGB Color Space and Fuzzy Logic Technique. In this paper they showed that tomato crop ripeness level may be estimated using colour analysis. A ripeness level of crop image can be decided using histogram technique. Image histogram processing and analysis will be used to get the exact color range for ripen and unrippen tomato. Further the leaf color may also be used to predict or correlate the level of ripeness [8].

In 2012 Dheeb Al Bashish,et al., have proposed A Framework for Detection and Classification of Plant leaf and Stem Diseases. In this scheme the images are segmented using the K-Means technique, RGB input images are converted into HIS color space. Then calculation of color and texture based features is done. Neural network classifier that is based on statistical classification is used for classification.[9]

Identification of nitrogen deficiency in cotton plant by using image processing was proposed by Swapnil Ayane, M. A. Khan and S. M. Agrawal in 2013. They considered the pattern that appeared on the leaf for detection of disease. The features such as rea, shape, shape of holes present on the leaf, diseases spot, etc were extracted from image of leaf. using different image processing techniques. These extracted feature are used describe the occurrences of particular deficiency related to primary nutrient of cotton leaf. Nitrogen deficiency can be detected by two steps, firstly by histogram analysis and measurement of leaf area. The leaf with deficiency id compared with normal leaf , The leaf with deficiency has reduced area compared to that of normal leaf.[10]

In 2013 Qinghai He et al. Proposed the work based on cotton leaf in which three different color models for extracting the injured image. Images were developed, then converted into the RGB, HIS, and YcbCr color models. The ratio of damage (γ) was chosen as feature to measure the degree of damage which is caused by diseases or pests. By implementing different colour model comparative results are obtained. The comparison of result shows good accuracy in both color models as well as in YCbCr color space.Out of there two models is considered as the better color model for extracting the infected leaf images [11]

In 2013 S. Arivazhagan, et al proposed The Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features [12] developed processing scheme in which a color transformation structure for the input RGB image is created, and then the green pixels are masked. Shape and texture features are extracted. Minimum Distance Criterion and Support vector machines (SVMs) classifier are used.[12]

In 2014 Shruti 1 and Nidhi Seth proposed a method of Fungus/Disease Analysis in Tomato Crop using Image Processing Technique. In this paper the image of the crop leaves are taken by a camera and processed for getting a gray colored and segmented image depending upon the nature and size of the fungus. A reference is set for acceptable and rejects crop quality based on the growth of fungus level. [13]

Elham Omrani, et al[14] have proposed Potential of radial basis function-based support vector regression for apple disease detection in 2014. Detection of leaf diseases has been done in threefold: Leaf images were stored in RGB color space which is device dependent. To segment the images, they had to be transferred to the device independent color space CIELAB.Region-Based Segmentation was employed to extract the infected area,K-means cluster is an important technique implemented in the segmentation phase. To extract the color, shape and texture-based features they a used for region description. To obtain the texture features, wavelet and gray level co-occurrence matrix techniques were employed. To classify apple leaf diseases support vector regression (SVR) technique is used.[14]

Haiguang Wang, et al have proposed Image Recognition of Plant Diseases Based on Principal Component Analysis and Neural Networks. From the images of wheat and grape diseases different color features, shape features and texture features were extracted . Using principal component analysis (PCA) features were extracted.Neural networks including back propagation (BP) networks, radial basis function (RBF) neural networks were used as the classifiers to identify wheat diseases, generalized regression networks (GRNNs) and probabilistic neural networks (PNNs) were used as the classifiers to identify wheat diseases and grape diseases.[15]

In 2014 P. Revathi, et alhave proposed Cotton Leaf Spot Diseases Detection Utilizing Feature Selection with Skew Divergence Method in this work enhanced PSO feature selection method adopts skew divergence method and to extract Edge, CYMK color feature , GA feature, Color, Texture variances features. input to the SVM was the extracted feature. Back propagation neural network (BPN), Fuzzy with Edge selection and classification is done by them.[16]

3. COMPARISON OF DIFFERENT CLASSIFIER ALONG WITH ITS ADVANTAGE AND DISADVANTAGES

Sr.No	Technique	Advantages	Disadvantages
1	K-Nearest Neighbor (KNN)	Simpler classifier as exclusion of any training process. Applicable in case of a small dataset which is not trained	Speed of computing distance increases according to numbers available in training samples. Expensive testing of each instance and sensitive to irrelevant inputs
2	Radial Basis Function (RBF)	Training phase is faster. Hidden layer is easier to interpret	It is slower in execution when speed is a factor.
3	Probabilistic Neural Networks (PNN)	Tolerant of noisy inputs. Instances classified by more than one output	Long training time. Large complexity of network structure. Need lot of memory for training data
4	Back-propagation Network (BPN)	Adaptive to changing data. Easy to implement. Applicable to wide range of problems. Able to form arbitrarily complex nonlinear mappings	Learning can be slow. It is hard to know how many neurons as well as layers are required.
5	Support Vector Machine (SVM)	Simple geometric interpretation and a sparse solution. Can be robust, even when training sample has some bias	Slow training. Difficult to understand structure of algorithm. Large no. support vectors are needed from training set to perform classification task

4. CONCLUSION

The present paper reviews and summarizes image processing techniques for several plant species that have been used for recognizing plant diseases. The major techniques for detection of plant diseases are: BPNN, SVM, K-means clustering, and SGDM. These techniques are used to analyses the healthy and diseased plants leaves. Some of the challenges in these techniques viz. effect of

background data in the resulting image, optimization of the technique for a specific plant leaf diseases, and automation of the technique for continuous automated monitoring of plant leaf diseases under real world field conditions. The review suggests that this disease detection technique shows a good potential with an ability to detect plant leaf diseases and some limitations. Therefore, there is scope of improvement in the existing research.

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