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Recent Advancements in Image Processing Techniques for Detection of Disease in Plants– A Review

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Abstract: The main objective of this study was to recognize various techniques which have been introduced recently to detect and identify plant diseases using various image processing. Here researchers had proposed many techniques in order to identify, feature selection, image segmentation and to classify plant diseases, techniques like artificial neural network, RGB color model, edge detection hyper spectral image, and histogram based analysis and so on are used to identify plant diseases. Feed forward neural network, fuzzy surface, and k mean clustering etc techniques were used for feature selection. For image segmentation and diseases classification, techniques like thresholding, k-means clustering, A bayes, first level haar wavelet texture and color analysis etc. were used. Advantages as well as limitation of these techniques are presented in the paper.

Keywords: SVM, k-means clustering, sobel filter, prewitt filter, PCA, Haar wavelet texture.

I. INTRODUCTION

Plant diseases pose a great threat to agricultural sector reducing the life of plants. With the increased plant diseases, it became quite difficult and expensive to relay on pure naked eye observation to detect and classify plant diseases. Various image processing tools and techniques were widely used in order to identify and detect various plant diseases. These techniques helped farmers and agriculture scientist to identify the various diseases that caused the reduction of life cycle of the plants; also they helped farmers to take proper measure in order to prevent the plants from diseases. In this paper various techniques have been formulated, that can be used to identify and classify the various plant diseases. Various techniques like thresholding, K- means clustering, segmentation, neural network, RGB color model, fuzzy logic etc. were identified.

II. ANALYSIS

[1] Sachin Digambar Chavhan, A.S. Dudhe [1] : Researchers have proposed an approach that extracts and regularizes the Eigen features from the cotton leaf image. On the basis of regularized Eigen features Eigen spectrum is modeled. Now the comparison of these features with the features that are extracted from the healthy leaf results into disease identification.

Critical Remarks: For extracting the Eigen features from the cotton leaf image scatter matrix is used in the proposed work by the researchers. Classification method when used with Support Vector Machine (SVM), Back Propagation Network (BPN), and Fuzzy Classifiers gives the accuracy of 91% - 93%. Disease like Bacterial leaf blight, Red Leaf Blight, Black Spot, Fungus, and Anthracnose can be diagnose with the help of the method provided in the paper, So that appropriate treatment for the disease can be provided.

[2] Piyush Chaudhary, Anand K. Chaudhari, A. N. Cheeran [2] : In the proposed method researchers have been presented the method to find the nitrogen deficiency in the soya bean plant. As the Nitrogen is one of the most important nutrient in the plant. In the proposed method first the input image of diseased leaf has been captured. Now image has been converted using different edge detection operators. Then comparison of normal image and edge detected image is done and pixel variation in both the image is noted. Now the comparison between pixel variation of diseased leaf image and normal image has been compared with gives the deficiency.

Critical Remarks: In the proposed method different edge detection operators like Sobel operator, Kirsch operator and homogeneity operator are described for edge detection. Sobel filter gives the best result for this method. The described technique is fast and accurate technique for nitrogen deficiency detection in Soya bean plant.

[3] Ravi C. Shinde, Jibu Mathew C , C. Y. Patil [3] : In this paper Researchers have been proposed an approach for disease detection in soya bean plant using segmentation based on edge detection. Image is captured and a filter is applied to remove noise. After that histogram has been created and normalized. Then image has been segmented using various edge detection methods and each pixel of image has been labeled. Comparison of the image will gives the diseased area of the leaf.

Critical Remarks: In the proposed work Sobel operator, Prewitt operator and Canny edge detector operators are described for edge detection. Canny Edge detector operator gives the better result for edge detection for this method than the Sobel and Prewitt operator. Labeling of each pixel has been done using k-means clustering. K-means clustering is used because it gives the best result for the detection purpose.

[4] Aradhana Shukla, Pooja Tripathi , Komal Priya [4] : The researchers have been purposed a method to improve the soil health and the crop health for better results in agriculture. In this paper two aspects are covered. First is measuring various soil parameters like Ph, moisture content, humidity, infiltration rate etc are calculated using various sensors and second is early detection of plant disease by using Digital Image Processing.

Critical remarks: To implement the above approach the authors have been proposed a method to first obtain the RGB image. After that Green pixels have been removed using mask and rest of the image is segmented into a number of patches of equal size (32x32). Segmentation useful segments are extracted. From the segments texture features like contrast, energy, local homogeneity, and cluster shade and cluster prominence are computed for the HSI image using color co – occurrence methodology. And in the last step from the texture features the plant disease are classified into various types using MATLAB Code.

[5] R. Revathy, R. Roselin [5]: In the proposed research technique is defined to find the bacterial infection detection on tomato and crape jasmine leaves as brown-black color spot and centre becomes dry. The developed method consists of six steps: Image Acquisition, Colour Transformation, Filtering, Segmentation, Feature Extraction and Classification. Final step provides the bacterial infection detail of the plant.

Critical remarks: In the proposed research image is captured in RGB Format and convert it into YIQ color format and median filter is applied to remove the noise and preserve the sharp high frequency details. Now the image has been segmented into various segments on the basis of thresholding. So the resultant value of any pixel in the image is 1 if it is having the value more than threshold and Zero otherwise. After thresholding grey level histogram is acquired. Now features are extracted using Grey Level Co - occurrence matrix (GLCM). Finally classification is done using SCG, Backpropogation, logistic, ADTree, SPegasos, naïve bayes and multilayer perceptron algorithms. For this proposed method, SCG provides the best results and highest accuracy of more than 86% on both the tomato and jasmine plants.

[6] S. S. Sannakki, V. S. Rajpurohit [6]: This paper describes an image processing based approach for detection and classification of pomegranate leaf diseases. Using k-means and thresholding based segmentation approach it extracted lesions of disease. Haar Wavelet Transform method extracts a set of visual features of diseased portions. Based on the extracted features set, a Fuzzy Logic classifier identifies the affected disease type.

Critical Remarks: The approach effectively segments the diseased portion of the image of pomegranate leaf sample using color based segmentation using k-means clustering and thresholding based region extraction. It accurately detects diseased spots present if any and classifies the type of the disease being affected using fuzzy classifier based on the features extracted from the diseased portion using first-level Haar Wavelet Transform.

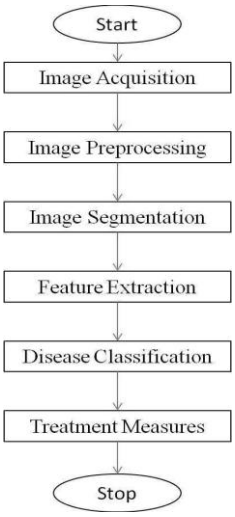

Fig. 2 system flow diagram

[7] Nutankumar S. Jane, Anupama P.Deshmukh et al. [7]: In the proposed paper analysis of the digital images of the betel vine leaves is done using the MATLAB. Using the RGB encoding processes, the RGB components of the betel vine leaves are separated using algorithm rate of diseases. Finally this analysis helps to recognize the powdery mildew diseases can be identified before it spreads to entire crop.

Critical Remarks: The mean values for all the sample leaves are computed and calculated values are compared with normal and infected leaves. By doing analysis of the entire graph, as compared to low resolution images, rate of disease reorganization is increased with high resolution images.

[8] John A. Quinn, Ernest Mwebaze, James Lwasa [8]: The researchers have been proposed a diagnosis technique for banana bacterial wilt disease and black sigatoka disease. In this method first image is acquired and different feature extraction techniques have been applied use for texture analysis for banana leaves. Color transform has been applied in order to find morphological features which give the disease details.

Critical Remarks: To implement the proposed method image should be cropped and background should be removed as it is very difficult to work with images with background. And for color transformation RGB to HSV transformation have been used. And at last for disease classification support vector machine (SVM) or randomized trees have been used. . Randomized tree yields very high score and gives the better performance than the other classifiers for the proposed method.

[9] J. Vijayakumar, S. Arumugam [9]: The main aim of this paper is to detect powdery mildew diseases in betel vine leaves using image processing techniques. The digital image analyses of the leaves are done using the image processing toolbox in MATLAB.

Critical Remarks: Here, histogram based analysis were done. Histogram were plotted of infected and uninfected betel vine leaves and compared. Finally this investigation helps to recognize the powdery mildew disease can be identified before it spreads to entire crop. This technique can also be extended to detect fungus or diseases of all kind plants to recognize starting stage preventive action.

[10] P. Revathi, M. Hemalatha [10]: This research work exposes the novel approach of analysis at existing works based on machine vision system for the identification of the visual symptoms of Cotton crop diseases. Researchers had proposed new feature extraction method using Enhance PSO with Skew divergence technique. The obtained features have been classified using SVM, BPN and Fuzzy classifiers.

Critical Remarks: The results obtained showed higher accuracy when proposed EPSO algorithm is combined with fuzzy classifiers. The accuracy of 94% is obtained using proposed EPSO feature extraction which extracts Edge, Color and texture features and a feature vector is constructed using Skew divergence distance methods

[11] Savita N. Ghaiwat, Parul Arora [11]: Proposed work present survey on different classification techniques that can be used for plant leaf disease classification. There are so many classification techniques such as k-Nearest Neighbor Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic.

Critical Remarks: Work proposed here that the k-nearest-neighbor method is perhaps the simplest of all algorithms for predicting the class of a test example. An obvious disadvantage of the k-NN method is the time complexity of making predictions. Additionally, neural networks are tolerant to noisy inputs. But in neural network it's difficult to understand structure of algorithm. SVM was found competitive with the best available machine learning algorithms in classifying high-dimensional data sets. Drawback of SVM is it's difficult to determine optimal parameters when training data is not linearly separable.

[12] Hrishikesh P. Kanjalkar, S.S.Lokhande [12]: This proposed paper presents some important features of diseased leaves which will help us to find exact disease of plant, where feature extraction is done on segmented diseased area. In this Threshold operation is used to remove the unwanted disease areas

Critical Remarks: The proposed methodology uses leaf features for disease detection where feature extraction is done on segmented diseased area. Hue image from HSI gives clear discrimination of diseased spots, and which is more helpful for extracting size, color and centroids.

[13] P.R. Rothe, R. V. Kshirsagar [13]: In this proposed paper Feature extraction is a significant constituent of a pattern recognition system. It carries out two assignments: converting input parameter vector into a feature vector and/or reducing its dimensionality. The allocation and recognition of cotton leaf diseases are of the major importance as they have a cogent and momentous impact on quality and production of cotton.

Critical Remarks: In this work they present a snake based approach for the segmentation of images of diseased cotton leaves. They extract Hu's moments which can be used as shape descriptors for classification .Three diseases have been considered, namely Bacterial Blight, Myrothecium and Alternaria.

[14] S.Lakshmi, V. Sankaranarayanan [14]: In the proposed paper the mobile captured images of aloe Vera are used to detect the infected part of the plant for further processing. The system applies image processing techniques such as image acquisition, image pre-processing and edge detection to identify the diseases. Three different color models for extracting the damaged image from aloe Vera plant are implemented namely RGB, YCbCr and HIS.

Critical Remarks: The damage ratio was calculated by extracting the disease affected aloe Vera leaf. The comparison results of the percentage of damage cells in the three color showed that the YCbCr model is the better choice to identify rot diseases like base rot, tip rot. The RGB model suits to identify bulging and smooth diseases and soft leaf rot.

[15] Sachin B. Jagtap, Shailesh M. Hambarde [15]: In the Proposed work an integrated image processing, Image enhancement, Image segmentation, Feature extraction, & classification system has been used to help automated inspection of leaf batches and helps identify the disease type.

Critical Remarks: In order to diagnose a disorder from leaf image four image processing phases have to be applied: Image enhancement, Image segmentation, Feature extraction, & classification. In order to employ proposed system we first have to train it with a set of images of disorders. Applying this model to any other crop disorder requires only spatia1 care to be taken in order to acquire a sufficient set of images for training purpose as representative of these disorders.

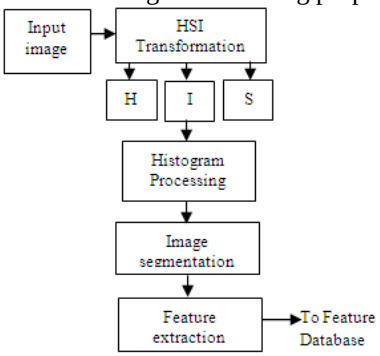

Fig 2: Block diagram of Image analyzer

III. CONCLUSION AND FUTURE SCOPE

Reviews on various techniques have been done in order to identify and classify the various plant diseases. Various techniques like K-Mean Clustering, Histogram Analysis, and Segmentation for feature extraction, Fuzzy Logic, Threshold, Feature Extraction, Image Processing, MATLAB tools have been used. Limitations and advantages of these techniques are reviewed.

The main aim of this review paper was to identify and detect various plant diseases that affect the life span of plants. We have observed there are various techniques that are very useful, and detect the various plant diseases with at most 94-95% accuracy. Apart from that each technique has their own accuracy in finding out the particular diseases. Also it has been observed that these techniques can also be used in detecting, identifying various other diseases apart from the disease for that it has been proposed.

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REFERENCES

[1] Sachin Digambar Dhavhan, A.S.Dudhe "An efficient disease diagnostic and treatment system for cotton plant using digital image processing" ,(2015), international journal of advanced research in computer science and applications, Volume 3, ISSN 2321-872x online ISSN 2321-8932.

[2] Snehal M. Kalmegh, S. V. Dhopte," Determination of Nitrogen Deficiency in Soya Bean Using Edge Detection", (2015), international journal of mechanical engineering and information technology , volume.03,Page No.1376-1382//ISSN-2348-196x.

[3] Ravi C.Shinde, Jibu Mathew C and Prof. C. Y. Patil," Segmentation Technique for Soybean Leaves Disease Detection",(2015) INTERNATIONAL JOURNAL OF ADVANCED RESEARCH , VOLUME 3, issue 5, 522-528.

[4] AradhanaShuklaa, Pooja Tripathia and Komal Priyaa," Application of Modern Technology in Agriculture", (2015), International Journal of Innovative and Emerging Research in Engineering, VOLUME 2, e-ISSN: 2394-3343,p-ISSN: 2394-5494.

[5] R. Revathy, R. Roselin," Digital Image Processing Techniques for Bacterial Infection Detection on Tomato and Crape Jasmine Leaves",(2015), International Journal of Scientific & Engineering Research,VOLUME 6,ISSN 2229-5518.

[6] S. S. Sannakki, V. S. Rajpurohit, 'An Approach for Detection and Classification of Leaf Spot Diseases Affecting Pomegranate Crop", (2015), International Journal of Advance Foundation and Research in Computer (IJAFRC), VOLUME 2, ISSN 2348-4853.

[7] Nutankumar S. Jane, Anupama P.Deshmukh," Study and Identification of Powdery Mildew Disease for Betelvine Plant Using Digital Image Processing With High Resolution Digital Camera", (2015), International Research Journal of Engineering and Technology (IRJET),VOLUME e:02 Issue :03, e-ISSN:2395-0056,p-ISSN:2395-0072.

[8] Godliver Owomugisha, John A. Quinn, Ernest Mwebaze, James Lwasa," Automated Vision-Based Diagnosis of Banana Bacterial Wilt Disease and Black Sigatoka Disease", (2014), 1st international conference on the use of mobile ICT in africa 2014,ISBN-978-0-7972-1533-7.

[9] J.Vijayakumar and S.Arumugam." Powdery Mildew Disease Identification in Karpoori Variety of Betel Vine Plants using Histogram Based Techniques",(2014), Society of science and Education, United Kindom, VOLUME 2, ISSN-2054-7412.

[10] P. Revathi, M. Hemalatha," Cotton Leaf Spot Diseases Detection Utilizing Feature Selection with Skew Divergence Method",(2014), International Journal of Scientific Engineering and Technology , Volume No.3, Issue No.1 pp : 22-30 , ISSN : 2277-1581.

[11] Savita N. Ghaiwat, Parul Arora," Detection and Classification of Plant Leaf Diseases Using Image processing Techniques: A Review",(2014), International Journal of Recent Advances in Engineering & Technology (IJRAET), ISSN (Online): 2347 - 2812, Volume-2, Issue - 3, 2014.

[12] Hrishikesh P. Kanjalkar, S.S.Lokhande," Feature Extraction of Leaf Diseases" ,(2014), International Journal of Advanced Research in Computer Engineering & Technology (IJARCET),Volume 3, Issue 1, ISSN: 2278 – 1323.

[13] P.R. RotheȦ and R. V. KshirsagarȦ," A Study and Implementation of Active Contour Model For Feature Extraction: With Diseased Cotton Leaf as Example",(2014), International Journal of Current Engineering and Technology , Vol.4, No.2 , E-ISSN 2277 – 4106 , P-ISSN 2347 – 5161.

[14] S.Lakshmi , V.Sankaranarayanan," Diseases detection of God's plant - Aloe vera using image processing",(2014), IJIPDV INTERNATIONAL JOURNAL OF IMAGE PROCESSING AND DATA VISUALIZATION , VOL.1, NO.2.

[15] Sachin B. Jagtap, Shailesh M. Hambarde," Agricultural Plant Leaf Disease Detection and Diagnosis Using Image Processing Based on Morphological Feature Extraction",(2014), IOSR Journal of VLSI and Signal Processing , Volume 4, Issue 5, e-ISSN: 2319 – 4200, p-ISSN No. : 2319 – 4197.

