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Implementation of Plant Leaf Diseases Detection and Classification using Image Processing Techniques: A Review

Chandan Kumar Singh[1], Dr. Sandeep Patil[2]

[1](M.Tech, Student) Department of Electronics & Telecommunication Engineering, Shri Shankaracharya Group of Institutions SSTC Junwani, Bhilai (CG).
[2]Associate Professor, Department of Electronics & Telecommunication Engineering, Shri Shankaracharya Group of Institutions SSTC Junwani, Bhilai (CG).

ABSTRACT: India is a developing country and about 70% of the Indian population depends on agriculture sector. In tradition method framer can supervised the plant leaf disease through the naked eye observation, which is more time consuming, expensive and less reliable method. So, in order to increase the efficiency to detect the plant leaf disease at the early stage automatic detection technique is used to recognize this disease which they appear on plant leaves. Plant leaf disease detection and classification includes the Image acquisition, Image pre-processing, image segmentation, feature extraction and classification. This paper review the survey of various plant leaf disease and different technique is used to detect these diseases.

Keywords: Disease Leaf, Gray level Co-occurrence matrix, Grayscale Conversion, Principal Component Analysis, Support Vector Machine.

1. INTRODUCTION

Agriculture sector plays a role in Indian economy and it contributes 6.1% in India GDP. Plant disease related to cereal crop is blast of paddy, False smut, Sheath blight, Stem Rust, Strip rust, rust of maize and head smust of maize. Early detection of disease lead to less loss and preventative measure will be taken. Cash crop plays a dominant role in Industry and Agriculture economy. In India 6 million framers get directly live hood from agriculture sector.

Various image processing concepts are image filtering, segmentation, image feature extraction have emerged to detect the plant leaf disease. For classifier SVM, Decision tree, CNN and ANN can be used for classification. Depending on the applications, many systems have been proposed to solve or at least to reduce the problems, by making the use of image processing, pattern recognition and some automatic classification tools. In the next section paper tries to present the proposed system in meaningful way.

2. LITERATURE REVIEW

Kishori Patil et al. [1] Leaf Disease Detection using Deep Learning Algorithm. CNN algorithm includes two layers .First is the extraction layer of the feature and other layer is feature extraction layer. CNN method gives the accuracy up to 86.26 for recognition of plant leaf disease.

Simranjeet kaur et al. [2] Image Processing and Classification, A Method for Plant Disease Detection. Author applied Gray-Level Co-Occurrence Matrix (GLCM) for feature analysis and KNN classifier is used for detection. This system gave the accuracy up to 95% for recognition.

Khaing War Htun et al. [3] identified the development of paddy diseased leaf classification system using modified color conversion.143 no's of data samples are used for classification and identification of diseased paddy leaf. This system is applicable for only four diseases namely leaf blight, brown spot, leaf blast and leaf streak. The paddy diseases can be detected and classified efficiently using statistical, color and texture features based on SVM.

Saradhambal.G et al. [4] Proposed an approach for Plant disease detection and its solution using image classification. Infected area of leaves predication is carried out by K-means clustering algorithm and Otsu's classifier. Shape and texture were extracted in the proposed work. Extraction work includes area, color axis length, eccentricity; solidity and perimeter whereas the texture oriented features were contrast, correlation, energy, homogeneity and mean. Neural network based classifier was used by the researcher.

Shanwen Zhang et al. [5] Plant disease leaf image segmentation based on super pixel clustering and EM algorithm. Super pixel clustering is used which is comparing with neighboring pixel with some feature with respect to brightness, texture and color are grouped into homogenous region. EM algorithm is used for image segmentation.

Vijai Singh et al. [6] Detection of plant leaf diseases using image segmentation and soft computing techniques. Author proposed the image recognition and segmentation process for plant leaf disease and for classification minimum distance criterion and SVM is used. A MATLAB to perform the experiment. Data sample is taken from rose leaf, lemon leaf, banana leaf and beans leaf.Co-occurrrence features is used for mapping the R,G,B components of the input image to the threshold images. The Co-occurrence features of the leaves are extracted and compared with the corresponding features stored in the feature library.

Rajleen Kaur et al. [7] An Enhancement in classifier Support Vector Machine to improve Plant disease detection. Two data sets contain training dataset and train data sets which are implemented by Support Vector machine. Here training image is compared with trained image. After that image masking is done which will find healthy image, diseased image and histogram of the images. Finally diseased and healthy image area is compared and finally the result is shown in percentage of fraction of disease with name of disease is mentioned.

Kiran R. Gavhale et al. [8] An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques. Author proposed five steps for detection and classification of plant leaf viz. Image Acquisition, Image Preprocessing, Image Segmentation, Feature extraction, classification and diagnosis of diseases. K-means clustering is used for feature extraction and for classification SVM technique is implemented.

Sanjay B. Dhaygude et al. [9] describes the agricultural plant leaf diseases detection using image processing. Four steps are developed for scheme processing, first step is color transformation structure RGB is converted into HSV. In second step, removing and masking of green pixels with pre-calculated threshold level. Third step, Patch size of 32*32 segmentation is obtained by useful segments and these segments are used for texture analysis by color co-occurrence matrix. Fourth step, texture parameters are compared to texture parameters of normal leaf.

Anand.H.Kulkarni et al. [10] Gabor filter and ANN classifier is applied on plant leaf to detect the diseases. Images is first captured and then data base is prepared .Gabor filter is applied for feature extraction and recognition is done in two steps raining and for classification ANN classifier is applied and gives us the recognition rate up to 91%.

Table 1: TABLE OF COMPARISON

Authors	Year	Description	Outcomes
Kishori Patil et al.	2020	Convolution Neural network (CNN) is applied.	The proposed system gives the accuracy up to 86.26%.
Simranjeet kaur et al.	2019	Plant leaf Image detection technique is based on segmentation, feature extraction and Segmentation. GLCM method is applied feature extraction and KNN classifier is used for detection.	The accurateness of accessible method is 95 %.
Khaing War Htun et al.	2018	The author is used the Support Vector machine (SVM) algorithm which has five kernel function i.e., Linear, quadratic, radial basis function, sigmoid and polynomial. This method gives us the grayscale conversion. Classification was done on the basis of statistical, color and texture features based on SVM.	The classification rate of the proposed system is achieved 90%.Feature extraction includes Statistical feature extraction, color feature extraction and texture feature extraction.
Saradhambal.G et al.	2018	Author proposed a system for automatic plant disease	The infected area of leaf is segmented and analyzed. The images of

		detection. In this system predication of infected area of the leaves by k-means clustering algorithm and Otsu's classifier.	diseases are identified by application. Efficient system in terms of reducing the clustering time and area of infected region. Feature extraction technique helps to extract the infected leaf and also to classify the plant diseases.
Shanwen Zhang et al.	2017	Simple linear iterative clustering (SLIC) is widely applied to super pixel clustering due to its simplicity and practicality. SLIC performs a 5-D space (L*a*b*x y) clustering by K-means guideline, where L*a*b* are components of CIELAB color space and x and y are the pixel coordinates in the image. EM algorithm (expectation and maximization) is good approach for image segmentation.	The color image is firstly divided into several super pixels to improve the initial estimation and possibly reduce the unlikely segmentation, and then, segmentation is carried out by EM algorithm. The proposed method is appropriate for dealing with plant disease leaf image segmentation and has certain superiority in the field of plant disease detection.
Vijai Singh et al.	2016	For clustering, search capabilities of genetic algorithm are used to set the unlabeled points in N-dimension into K cluster and for feature extraction color co-occurrence method are used. Two methods are used for Minimum distance criterion i.e. K-means clustering and Genetic algorithm.	Features included in texture are Local homogeneity, contrast, cluster shade, energy and cluster prominence. The minimum distance criterion with K-means clustering gave an accuracy of 86.54% and with SVM the accuracy was 95.71%.By using the Genetic algorithm along with the Minimum distance criterion increased the accuracy to 93.63%
Rajleen Kuar et al.	2015	Author is used two types of recognition that are statistical and structural recognition. The statistical recognition of patterns totally depends upon the pattern characteristics which are also statistical in nature. Structural recognition of characterizes depend on the interrelationship among the structure which contain	Hue and Saturation part of image is also separated. And finally infected part and infected area % and name of disease are acquired proposed methodology. Main aim of this work is to provide the advancement and enhancement in computing classifiers of neural network approach and provide better

		features.	results.
Kiran R. Gavhale et al.	2014	Image detection and classifications is completed in five steps viz. Image Acquisition, Image Preprocessing, Image Segmentation, Feature extraction, classification and diagnosis of diseases. Technique used for detection of plant leaf are BPNN, K-means clustering and SGDN. For classification of plant leaf disease SVM technique is implemented.	Disease detection technique analyses the healthy and disease plant leaves.
Sanjay B. Dhaygude et al.	2013	Author used the algorithm which is based on Vision-based detection algorithm with masking of the green pixels and color co-occurrence method.	Work will based on focus the developing algorithm and NN's in order to increase the recognition rate of classification process.
Anand.H. Kulkarni et al.	2012	Artificial neural network and Gabor filter is used for implementation. Images of leaf are captured first and then data base is prepared. For detection of images first image is segmented and then Gabor filter is applied for feature extraction. Recognition is done by two steps raining and classification is done by ANN.	Gabor filter is used for feature extraction and ANN classifier is used for classification which gives the recognition rate up to 91%

3. CONCLUSION

This paper reviews the different techniques of plant leaf disease detection using image processing that have been used by a numbers of researchers in the past few years. The major technique is GLCM and KNN classifier, Convolution Neural Network, SVM, K-means clustering algorithm and Otsu's classifier, Super pixel and EM algorithm, K-means clustering and Genetic algorithm, Neural Network, Vision based detection algorithm, Gabor filter and ANN classifier.

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