International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 8
August 2017

Detection of Diseases on Plant Leaf with the Help of Image Processing

Prajakta S. Garud
Karmaveer Bhaurao Patil, Collage of Engineering, Satara.
Shivaji University,Kolhapur.

Rajan Devi.
Karmaveer Bhaurao Patil, Collage of Engineering, Satara. Shivaji University,
Kolhapur.

ABSTRACT— *Indian Economy is highly dependent on the productivity of agricultural products. So, there is the need to provide extreme attention to take care of plants to achieve high yield. Crop diseases are the natural factor that can cause some serious effects on plants which ultimately reduces productivity, quality and quantity of products. Farmers do the naked eye observation and judge the diseases by their experience. But this is not accurate and proper way. In this paper, presented the detection of plant leaf diseases. The proposed method covers the steps of image processing technique. These image processing steps are image acquisition in RGB color value, image preprocessing using filters, image segmentation using k-medoids clustering, feature extraction with texture statistics, image classification using a Neural network. So, overall plant leaf disease detection is presented here.*

KEYWORDS— Image processing; image acquisition; preprocessing; segmentation; feature extraction; classification and detection

I. INTRODUCTION

India is an agricultural country; therefore most of the population depends on agriculture. Farmers have large range of diversity for selecting crops and finding pesticides for plant. Farmers judge the diseases by their experience, but this is not an accurate and proper way. The existing method for plant leaf disease detection is simply naked eye observation of experts through which identification and detection of plant diseases are done. For doing so, a large team of experts as well as continuous monitoring of experts is required, which costs very high. At the same time, farmers call the experts for detecting the diseases, but this also time consuming way. In such condition the image processing technique proves to be beneficial in monitoring large fields of crops.

The plant disease is the abnormal growth of a plant. Diseases may be the result of living and non-living causes. The diseases mostly on leaves and the stem of the plant. The diseases are viral, bacterial, and fungal. The diseases on plants are due to insects, rust, nematodes, etc. It is an important task for farmers to find out these diseases as early as possible. Plant disease identification by visual way is a more laborious task and at the same time less accurate and can be done only in the limited areas. Whereas if automatic detection technique is used, it will take less effort, less time and more accurately. Image processing is the technique which is used for detecting the plant leaf diseases.

II. LITERATURE REVIEW

V. A. Gulhane and Dr. A. A. Gurjar has presented research of identifying and diagnosing cotton disease, the pattern of disease is important part in that, various features of the images are extracted viz. the color of the actual infected image, there are so many diseases occurred on the cotton leaf so the leaf color for different

diseases is also different, also there are different shape of holes are present on the leaf image, generally image of the infected leaf has an elliptical shape of the holes at various orientation, so calculating the major and minor axis is the major task. The features could be extracted using self-organizing feature map together with an annual neural network is used to recognize the color of image [1].

S. Arivazhagan et al have presented system for automatic detection of plant leaf diseases. For disease identification four main steps they have used, first for the input RGB image, a color transformation structure they have done and then green pixels are masked and removed using specific threshold value. Then segmentation has done and texture statistics are computed for getting useful segments. Finally they have used classifiers for the features to be extracted. The shape and texture are the features they have extracted. It is noted that classification is done by using the Minimum Distance Criterion and Support vector machines (SVMs) [2].

Manisha Bhangea and H.A.Hingoliwalab has presented a web based tool that is proposed to help farmers for identifying fruit disease by uploading fruit image to the system. The system has an already trained dataset of images for the pomegranate fruit. Input image given by the user undergoes several processing steps to detect the severity of disease by comparing with the trained dataset images. The processing steps used are image resizing, extraction of feature, morphology, classification etc. The features are extracted on parameters such as color, morphology. Then clustering is done by using k-means algorithm. Next, SVM is used for classification to classify the image as infected or non-infected. An intent search technique has also provided which is very useful to find the user intension. Out of three features extracted the best results were noted by using morphology. Experimental evaluation of the approach given in this paper is more effective and 82% accurate to identify pomegranate disease. The same approach may be tested for plant leaf decease detection [3].

Arti N. Rathod et al have presented steps of disease detection. First they have used image filtering by median filter and convert the RGB (Red, Green, Blue) image to CIELAB model. This is a color model plus space combo in which L is brightness and a and b are chrominance components. In the second step image segmented using the k-medoid technique, As medoids is less influenced by outlines or other extreme values than the mean, the k-medoids are more robust than the k-mean, in the presence of noise and the outlines. Then masking green-pixels & Remove of masked green pixels, after in next step calculate the Texture features Statistics. In the final stage this features is passed to neural network. The Neural Network improves the recognition rate of the final classification process. [4].

Smita Naikwadi and Niket Amoda has presented there are the main steps for disease detection of leaf which are Image acquisition, Image Preprocessing, Image Segmentation, Feature Extraction and Statistical Analysis. First they have converted RGB image to HSI (Hue, Saturation and Intensity). Then masking the green pixels and remove of masked green pixels. Otsu's method is used for masking. If the green component of pixel intensities is less than the pre-computed threshold value, the red, green and blue components of the this pixel is assigned to a value of zero. T In segmentation k-means clustering technique is used. They have observed best results when the numbers of clusters are 3 or 4. In feature extraction color and texture features have extracted using Color-Co-Occurrence methodology (CCM) [5].

H. Al-Hiary et al have presented Otsu segmentation, K-means clustering and back propagation feed forward neural network techniques. Texture features could be extracted using Color-Co-Occurrence methodology (CCM). Recognizing the disease NN (Neural Network) is used. They have tested on five diseases which are early scorch, Cottony mold, ashen mold, late scorch, tiny whiteness [6].

Vijai Singh et al have presented an algorithm for image segmentation technique which is used for automatic detection as well as classification of plant leaf diseases and survey on different diseases classification techniques which are ANN (Annual Neural Network), NN (Neural Network) and SVM (Support Vector Machine) that can be used for plant leaf disease detection. They perform detection of bacterial, sun burn, early scorch, fungal diseases. Image segmentation, which is done by using genetic algorithm [7].

Sachin D. Khirade and A. B. Patil has presented identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. Health monitoring and disease detection on plant is very critical for agriculture. First they have presented color transformation structure of RGB leaf image. Then in image pre-processing image clipping, image smoothing, image enhancement steps are present. In that RGB image is converted to gray image. They have presented segmentation done by using various methods like Boundary and spot detection algorithm, K-means clustering, Otsu Threshold Algorithm. For feature extraction Color co-occurrence Method, Leaf color extraction using H and B components and in classification ANN, Back propagation, SVM methods they have discussed for leaf disease detection [8].

Savita N. Ghaiwat and Parul Arora have presented survey of different classification techniques that can be used for plant leaf disease classification. The k-nearest-neighbor (K-NN) method is simplest of all algorithms. The disadvantage of K-NN is slow learner, robust to noisy data and it is very sensitive to the irrelevant parameters. Neural networks are tolerant to noisy inputs but it is difficult to understand structure of the algorithm. The complexity of SVMs does not depend on the dimensionality of input space. It is easy to control complexity of decision rule and frequency of error. They have find drawback of SVM is that it is difficult to determine optimal parameters and also SVM is more complex to understand [9].

Sanjay B. Dhaygude and Nitin P. Kumbhar have presented four main steps, which are used for disease detection. A first RGB image is created, and this RGB is converted to HSV (Hue Saturation Value). Then green pixels are masked and removed by using specific threshold value. The infected region of leaf is segmented into a number of patches of equal size. In this approach patch size of 32X32 they have taken and the useful segments are computed. These segments are used to extract texture features by using color co-occurrence matrix and finally the presence of disease is detected [10].

Hrishikesh P. Kanjalkaret al have proposed methodology on feature extraction of leaf diseases. This paper have presented some important features like color, texture, shape of diseased leaves which will help us to find exact disease of plant. A first RGB image they have created, and this RGB is converted to HSI (Hue Saturation Intensity). Hue image from HSI gives diseased spots, and which is more helpful for extracting size, color and centroid features [11].

S. Arivazhagan et al have presented disease identification process include some steps out of which four main steps are as follows: first, for the input RGB image, a color transformation structure they have taken, and then using a specific threshold value, the green pixels are masked and removed, which is further followed by segmentation process, and for getting useful segments the texture statistics are computed. At last, classifier is used for the features that are extracted to classify the disease. They have proposed algorithm shows its efficiency with an accuracy of 94% in successful detection and classification of the examined diseases. The robustness of the proposed algorithm they have proved by using experimental results of about 500 plant leaves in a database [12].

Bed Prakash and Amit Yerpude has presented survey on the Fungal, Bacterial, Viral types of leaf diseases in plants and their identification process. An identification problem deals with associating a given input pattern with one of the distinct classes. Leaf spot disease is identified based on morphological features. They have observed Probabilistic Neural Network is much faster and more accurate than any other identification technique. PNN networks are relatively insensitive to outliers. PNN networks generate accurate predicted target probability scores [13].

Komal Bodkhe et al have presented a methodology for analysis of fungus in plant, using image processing techniques. They have captured images by digital camera mobile and processed using image growing, then the part of the leaf spot has been used for the classification purpose of the trait and test. The acquired image is in jpeg format and is converted to gray scale image. The gray scale images are enhanced and make noise free. The Otsu algorithm they have applied to get threshold image. The pixel neighborhood is applied to enhance the pixel of leaf to show clearly the fungus area. Then clustering is applied to get infected part of the leaf. RGB image is then segmented for analysis of fungus in plant. They have observed that the Canny Edge Detection algorithm is computationally more expensive compared to Sobel Edge Detection technique [14].

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 8
August 2017

Pradnya Narvekar and Prof. S. N. Patil have presented grape leaf disease detection techniques. First they have captured the image. Image stored in the („.jpg‟) format. Size of the image is 259*194 pixels. Then they convert the image into HSV format. Then Masking of green pixels of hue component take place. The infected portion of the leaf is extracted. By using SGDM matrix method they have got five features like Energy, homogeneity, contrast, cluster prominence and cluster shade. They conclude only cluster prominence and cluster shade give significant difference in their value. Value of Energy, homogeneity, contrast of all the diseases is almost same. They avoid the segmentation process. Due to this classify the black rot and downy mildew or black rot and powdery mildew diseases successfully but they cannot classify downy mildew and powdery mildew disease successfully. Because the value of the component of these two diseases nearly same [15].

III. SUMMARY ON LITERATURE SURVEY

Here below some features, there extraction techniques and classifiers are discussed: Below table Summary [1-6] shows that for detecting the diseases on plant the features such as color, texture are needed to extract. NN (Neural Network) and SVM (Support Vector Machine) are classified used to recognize the diseases.

Color features are important to sense image, recognize objects and convey information. There are so many diseases occurred on the leaf so the leaf color for different diseases is also different. Color feature extraction is used by [1-3] and [5]. There are various other features related to shape of leaf image. Shape feature extraction is used by [1] and [2]. Texture is one of the most important features which can be used to classify and recognize objects. Texture feature extraction is used by [2], [4-6].

Unsupervised self-organizing feature map extraction technique is used by [1] and Color-co-occurrence feature extraction technique is used by [2-6]. The color co-occurrence texture analysis method is used by SGDM (Spatial Gray Level Dependence Methodology) Matrix Generation for H and S, the Gray Level Co-occurrence Methodology (GLCM) function to calculate the texture features statistics. ANN classifier is used by [1]. SVM classifier is used by [2-3] and NN classifier is used by [4-6].

Table1. Summary of Literature Survey [1-6]

Paper	Feature Extraction	Feature Extraction Technique	Classifier	Plant
V. A. Gulhane, et al[1]	1. Color 2. Shape of holes	Unsupervised self-organizing feature map.	ANN	Cotton
S. Arivazhagan, et al[2]	1. Color 2. Texture	Color-Co-Occurrence methodology (CCM).	SVM	Native plant species
M.Bhange, et al[3]	1. Color 2. Shape	Color-Co-Occurrence methodology (CCM).	SVM	Pomegranate Fruit
A.N.Rathod, et al[4]	1. Texture	Color-Co-Occurrence methodology (CCM).	NN	Native plant species
S.Naikwadi,et al[5]	1. Color 2. Texture	Color-Co-Occurrence methodology (CCM).	NN	Potato leaf
H.Al-Hiary,et al[6]	1.Texture	Color-Co-Occurrence methodology (CCM).	NN	Native plant species

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 4, Issue 8
August 2017

IV. PROPOSED WORK

First the images of leaves are acquired using camera. Then image-processing techniques are applied to the acquired leave images to extract useful features that are necessary for further analysis. After that, several analytical techniques are used to classify the images.

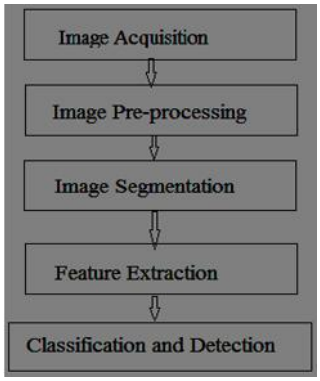

Fig 1: Basic Methodology

Figure1. Shows basic methodology which shows there are five main steps used for the detection of plant leaf diseases. The processing scheme consists of image acquisition through digital camera, image pre-processing includes image enhancement and image segmentation where the affected and useful area will be segmented, Significant features will be extracted and those features can be used to determine the meaning of a given sample in feature extraction and the extracted feature patterns is classified in order to identify the disease in the leaf. Finally the diseases on the plant leaf will be identified.

The step-by-step procedure as below:

1. In the initial step, RGB images of leaf samples were picked up. RGB image acquisition;
2. Convert the input image into gray image;
3. Segment the components;
4. Obtain the useful segments;
5. Computing the features;
6. Classification and detection of disease.

RGB Image Acquisition-

Leaf image will be acquired by camera. USB webcam camera will be used. Camera has max image resolution is 5500 pixels wide by 3640 pixels high. It is process in which image size640*480 of leaves will be acquired through the camera. This image is RGB form and converted to the gray output format.

Image Preprocessing –

Pre-processing images will be used to remove low-frequency background noise. Noises and other interference, present in the image. In the image clipping, smoothing, enhancement are the three steps included in a preprocessing step. The process of image collection and lots of information may bring noise which may easily remove from operating and saving of the image would make the quality of image dropped, thereby affects many of the diseases. To perform de-noising canny edge reduction technique are used. By choosing the appropriate threshold, median filter performs better with the salt and pepper noise. Median filter is a nonlinear filter which is an effective method to remove the noise. Black dots called pepper, median filter fill the image with bright dots called the salt. It simply placed each pixel value with the median of the intensity level in the neighborhood of pixels.

Image Segmentation –

Segmentation step will be used to find out infected region of leaf. According to the region of interest, the image will be segmented into different parts. To divide the image into same meaningful region is the image

segmentation. Segmentation is done by k-means clustering, k-medoids clustering, and edge detection. As medoids is less influenced by outlines or other extreme values than the mean, the k-medoids are more robust than the k-mean, in the presence of noise and the outlines [4].

Feature Extractions-

Color, texture, shape based features will be used in feature extraction. Color features are important to sense image environment, recognize objects and convey information. Feature extraction technique CCM will be used. The color co-occurrence texture analysis method is used by SGDM (Spatial Gray Level Dependence Methodology) Matrix Generation for H and S, the Gray Level Co-occurrence Methodology (GLCM) function to calculate the texture features statistics. It is the process done after segmentation. According to the segmented information and predefined dataset some features of the image should be extracted. The feature extraction is the input data transform into set of features. The feature set will extract the relevant information so should carefully choose. The GLCM is a statistical way to describe the shape by statistically sampling the way certain gray level occurs in relative to other gray levels. The SGDMs are represented by the function P (is, j, d, Θ) where I represent the gray level of the location (x, y) at an orientation angle of Θ. In a clockwise direction 1 to 8 are numbered, neighbor 1 and 5 are located at a distance of 1 and orientation on the same plant. The feature set of H and S will be calculated after transformation [2-5].

Classification based on classifiers-

It is the final stage in disease detection. It is identifying a rule according to selected features and assigning each disease to any one the predetermined classes. The Neural Network and Support Vector Machine are mostly used as a classifier. For automatic detection of leaf disease, the neural network is mostly used. The training feature set which is used to train the NN mode and whilst a testing feature state which verify the accuracy using the feed-forward, back propagation network, these are the two important steps for data set for training and validation. Until the connection weight reaches to the defined iteration number, they are always updated. Thus, using the mean square error the capacity of the ANN model to respond accurately is assured [1], [4], and [5].

CONCLUSION

The accurate detection of plant leaf disease is very important for the successful cultivation of crops and this can be done by image processing techniques. This paper describes different techniques of image processing for certain plant species that have been used for detecting plant diseases. Color features are important to sense image, recognize objects and convey information. Texture is one of the most important features which can be used to classify and recognize objects. The propose work is to extract the color, shape, texture features of all infected leaf (size 640*480). Then feature extraction technique CCM are used to extract the color, shape, texture features of leaf and classification technique NN is used for classification of diseases. In segmentation the k-medoids algorithm will be used for gray scale images and it has better performs for large databases, not sensitive to noisy data and outliers. K-medoids performs better than the K-Means algorithm. Hence, in this way accurately identify plant leaf diseases using image processing techniques that are image acquisition, image pre-processing, image segmentation, feature extraction, classification and detection.

In literature survey all authors have used computer based system for plant leaf disease detection, but this method can’t be implemented on the field. Plant disease detection is to be done on computer, but it is not useful to farmers to identify plant disease on farm. So there is a need of a standalone unit, like just click a photo and get result on display at farm site, instead of using a computer. By using Raspberry pi such standalone unit is possible. Raspberry pi is a credit card sized computer. It does all work same as desktop PC.

Standalone system will be implementing in farm for leaf disease detection. Therefore automatic plant leaf disease will detect in farm. So that farmer needs not to do naked eye observation and go to expert person for detection of disease. So that manual monitoring is not done. Plant disease will be detected at farm site. It will take fewer efforts, less time and more accurately. The proposed standalone system will help to analyze plant disease very accurately within less time and fewer effort

REFERENCES

[1] V. A. Gulhane, Dr. A. A. Gurjar, "Detection of Diseases on Cotton Leaves and Its Possible Diagnosis". International Journal of Image Processing (IJIP) 2011, Vol.5, Issue (5), pg.no.590-598.

[2] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", Agric Eng Int: CIGR Journal March 2013., Vol.15, pg.no.211-217,

[3] Manisha Bhangea, H. A. Hingoliwalab, "Smart Farming: Pomegranate Disease Detection Using Image Processing." Second International Symposium on Computer Vision and the Internet 2015.

[4] Arti N. Rathod, Bhavesh A. Tanawala, Vatsal H. Shah, "Leaf Disease Detection using Image Processing and Neural Network." International Journal of Advance Engineering and Research Development (IJAERD) Volume 1, Issue 6, June 2014, e-ISSN: 2348 - 4470, print-ISSN: 2348-6406

[5] Smita Naikwadi, Niket Amoda" Advances in Image Processing for Detection of Plant Diseases" , International Journal of Application or Innovation in Engineering & Management November 2013, Volume 2, Issue 11.

[6] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh, Fast And Accurate Detection and Classificationof Plant diseases, International Journal of Computer Applications, March 2011 (0975 –8887),Volume 17– No.1.

[7] Vijai Singh,Varsha,Prof. A K Misra," Detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm" IEEE International Conference on Advances in Computer Engineering and Applications (ICACEA) 2015.

[8] Sachin D. Khirade and A. B. Patil," Plant Disease Detection Using Image Processing" IEEE International Conference on Computing Communication Control and Automation 2015.

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

[10] Prof. Sanjay B. Dhaygude, Mr. Nitin P.Kumbhar, "Agricultural Plant Leaf Disease Detection Using Image Processing" IJAREEIE, vol. 2(1), pp. 599-602, January 2013.

[11] Prof. Hrishikesh P. Kanjalkar, Prof. S.S.Lokhande," Feature Extraction of Leaf Diseases", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3, Issue 1, January 2014.

[12] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", Agric Eng Int: CIGR Journal, Vol.15, pg.no.211-217, March 2013.

[13] Bed Prakash, Amit Yerpude, "A Survey on Plant Leaf Disease Identification "International Journal of Advanced Research in Computer Science and Software Engineering (IJARCSSE), Volume 5, Issue 3, March 2015.

[14] Komal Bodkhe, Nisha Thakur, Shraddha Deshmukh, Asst. Prof. Prerana Jaipurkar, "Analysis of Fungus in Plant Using Image Processing Techniques", International Journal of Recent Research in Mathematics Computer Science and Information Technology Vol. 2, Issue 1, pp: (12-18), Month: April 2015 – September 2015

[15] Pradnya Narvekar, Prof. S. N. Patil , "Novel Algorithm For Grape Leaf Diseases Detection ," International Journal of Engineering Research and General Science Volume 3, Issue 1, January-February, 2015.