A Modern Approach for Plant Leaf Disease Classification which Depends on Leaf Image Processing

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Abstract— **Agrarian production is that trait on which our nation's economy immensely depends. This is the motivation that recognition of leaves unhealthiness is the solution for saving the reduction of crops and productivity. It requisite enormous amount of work, mastery in the leaf diseases, and additionally need the extreme amount of time. Thus, image processing techniques are applied for the discovering and recognition of plant leaf unhealthiness. Recognition of plant leaf diseases along some automatic method is useful as it decrease a huge effort of observing in large farms, and at initial phase itself it identify the signs of diseases. Plant leaf disease detection and identification includes the stages like image acquisition, image pre-processing, image segmentation, feature extraction and classification. This paper discusses techniques for image pre-processing, image segmentation algorithm used for automatic recognition and research on various plant leaf disease classification algorithms that may be used for leaves disease classification.**

Keywords—Image processing; segmentation; Support Vector Machine; Decision Support System.

I. INTRODUCTION

India is one of the developing countries wherein majority of population of country is depends on agriculture and agricultural production [8]. Studies show that the plant leaf disease reduces the quality and quantity of agricultural products. Therefore detect and identify disease at early stage is important task for farmers. Detection of disease at early stage can save the whole crops from a disease. The identification and recognition of plant leaf disease by open naked eye is quite difficult task for farmers and consult scientist or expertise person is very costly for farmers in our developing countries like India.

However, diseases are important cause for the reduction of agronomics in India. Farmers are faces several problems for control the diseases on crops. Detecting the disease is the important part in the agriculture field and these involves judicious diagnosis and appropriate supervision to control the massive losses.

Therefore, consider for quick, low cost and precise way to automatically recognize and identify disease from the leaf of plants is of pragmatic significance for large farms. The present Decision Support Systems (DSS) are establish on call center need that the farmers have to convey details about plant leaf through orally. DSS based on image processing can be useful to improve the production of agriculture.

In this work, we propose the system which concentrates on disease detection and recognition which helpful for decision making. The proposed system consists of four main phases are preprocessing, segmentation, feature extraction and classification. In this paper, we focus on the image segmentation and different image classification techniques

II. LITERTURE SURVEY

Wan Mohd Fadzil et al. [1], discussed a disease detection method for orchid plant leaves. The orchid plant leaflet images are received the usage of digital camera. The algorithm makes use of an aggregate of various strategies inclusive of border segmentation method, morphological processing and filtering technique used for categorizing input images into two disease class as black leaf spot and solar scorch.

Vijay Jumb et al. [4], discussed a techniques of segmentation victimization Otsu's thresholding and K-means clustering. The first images area units regenerate to HSV color space and therefore the V part is used for multi-thresholding. The projected work compares this segmentation technique with different techniques like fuzzy C-means, region growing etc. These techniques area unit compared using two metrics i.e. peak signal to noise magnitude relation (PSNR) and mean sq. error (MSE).

Rong Zhou et al. [5], explained method for resilient and advance identify of leaflet patch in sugar beet. For capturing images, Nikon photographic camera was used that was mounted on a stand to stay constant distance. The author used white background whereas capturing images to avoid the additional complications in process. The method implements hybrid methods of guide matching and support vector machine. This technique usage color primarily forms options

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for segmentation, orientation code matching and support vector machine classifier for final malady classification.

Dheeb Al Bashish et al. [9], examined the strategy to detect the plant leaf disease exist on leaflet and cane. The presented system is together of K-Means segmentation method and neural network used for classification of segmented images. Classification demonstrated average precision of 93%. J.S.Smith and A.Camargo [15], proposed a technique for recognizing the optical indications of plant leaf maladies by utilizing the image processing method. The accuracy of the algorithm is tested by matching the images, which were manually with those automatically segmented.

Di Cui et al. [14], explains the image processing techniques for multispectral images to detecting rust on plant leaf and its growth amount of disease. The dataset contains the images collected from a greenhouse of research institute. The explained method uses the concept of evaluate centroid for each image for further processing. Similar study is done by Youwen Tian and Lin Zhang [8], on cucumber downy mildew disease with the help of hyperspectral imaging.

Murali Krishnan et al. [16], represent technique which discovers the contaminated plant leaf region with the use of K-Means cluster and extracting the region of interest (ROI). The scale invariant method for locating the feature points referred to as keypoints from the input image for feature matching purpose explained in David G. Lowe [18]. The various views of an object or scene are accurately matched using SIFT algorithm. The features extracted are scale invariant, rotation, 3D viewpoint and illumination.

III. PROPOSED APPROACH

The proposed approach comprises of four fundamental stages: Image acquisition of plant leaf images, pre-processing of images, image segmentation, feature extraction and classification of images in different disease classes. The following fig. shows the general flow of system.

In proposed work the primary stage is the acquisition of leaf images with the use of mobile camera which have minimum 2 megapixels and above resolution. The dataset consists of healthy leaves and infected leaves images. In next stage the pre-processing techniques are apply on input leaves images for better results in next processing. Image resizing is one of the major tasks in order to keep up the consistency as far as size of the images.

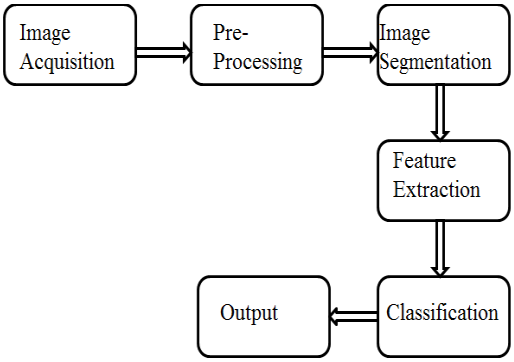

Figure 1. Flow of System

Next stage is extracting the features like color, correlation, texture etc. from the leaf image. The extracted features are used for classification of leaves in classes like healthy and diseased leaves images. The output of classification is used for the decision support system to gives the decision related health of plant leaves.

A. Image Acquision:

The leaf images of plant are acquired by using the camera of mobile. The dataset contains 120 images of healthy, infected leaf images set. Dataset having mainly two classes of image set- one if healthy leaf images and second class contains the infected leaf images which have disease wise sub classes.

B. Pre-Processing:

The pre-processing stages are applied on given image in order that made it appropriate for additional process. The primary pre-processing stage is to resize the given input image. The initial size of image is large that occupy longer for process time. Therefore, each image is converting into 512 X 512 sizes to evade prolonged. The following stage is to conversion of RGB to Hue Saturation Value (HSV). After that segmentation techniques are applied.

C. Segmentation:

Segmentation of image is applied for background subtraction. Two main techniques are mainly used for background subtraction: cluster based and color based. The proposed system will give better results using cluster subtraction. In color based subtraction unwanted background is removing by using R, G and B elements. Which pixel have G element more than the R and B that are keep and other part is removed.

In cluster based background subtraction, the connected elements in the image are discovered out. The immense part of the image is kept and other part is removed.

D. Classification:

After segmentation next stage is feature extraction. The feature extraction technique permits to extract the properties of an image which is able to facilitate in accurate classification. The co-relation, energy, homogeneity etc. are the features are used for analysis. There are several of approaches that are used for image classification. A number of the strategies are principal component analysis (PCA), fuzzy logic, K-nearest neighbor (KNN), support vector machine (SVM), artificial neural network (ANN), neuro-fuzzy interference system, etc. [21].

In KNN method classifies images with using nearest distance between trained dataset and testing dataset. Choosing the appropriate value for k is major drawback of KNN.

The ANN applies estimation functions that depend on lots of inputs given to the system, which are known. The disadvantage of this method is over fitting problem.

In proposed paper Support Vector Machine (SVM) technique is used for classification of images. SVM is the supervised learning method which usually applied for pattern recognition and classification.

In SVM classification, assume that the training data (xi,yi) for i=1,2,……N and $y \in \{-1, +1\}$, where N is the sample number $y = +1$ for class C1 and $y = -1$ for class C2.

Finding minimum one hyperplane, v is vector and b is bias,

$$yi(v.xi + b) > 0, \quad i = 1,2,...N \qquad ...(1)$$

The values of v and b are rescaled such that,

$\min yi(v.xi + b) \geq 1, \quad i = 1,2...N$

i.e. the distance between the hyperplane and a point class to $1/|v|$ equation (1) can be,

$$yi(v.xi + b) \geq 1 \qquad ....(2)$$

This technique creates the hyperplanes in high dimensional space for categories the datapoints into different classes. Support vector machine is does the classification by detecting the perfect hyperplane which differentiates the datum of different categories. The hyperplane having largest gap between two classes is the best hyperplane for SVM [6].

IV. Results and Discussion

The figure 2 shows some images of healthy plant leaf and figure 3 show the diseased and infected leaf images. In this approach, we apply techniques on various diseases like sun burn, yellow-mosaic and grass hopper etc.

The figure 4 shows the input image given to system. The final output given by the system is shown in figure 5. The system gives the output as healthy leaf or diseased, if leaf is infected then system will give disease type by using classification.

Figure 2. Healthy Leaves

Figure 3. Diseased and Infected Leaves

Figure 4. Input Image of Leaf

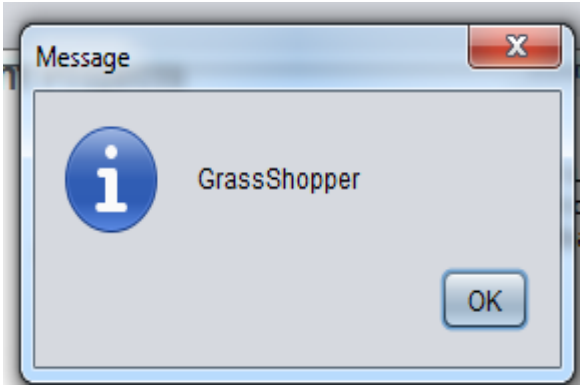

Figure 5. Output of System

In above figure 4, the image is given which is infected by grasshopper which show in output in figure 5.

V. CONCLUSION

A method focus on image processing is applied for automatic leaf unhealthiness classification which establish on leaf image processing. The project system can apply with the used of practical requisitions, due to the images are apprehended at once directly from the farmland without plenty efforts wanted through the farmers. The system approach will give advice to the farmer with minimum efforts. The farmer most effective require to seize the image of the plant leaf the usage of mobile camera and forward it to the DSS, without any additional inputs.

REFERENCES

[1] Wan Mohd Fadzil, Shah Rizam, Jailani R, Nooritawati M.T, "Orchid leaf disease detection using Border Segmentation technique," IEEE Conference on Systems, Process and Control (ICSPC), Vol.1, pp.168-179, December 2014.

[2] Ian M. Small, Laura Joseph, William E. Fry, "Development and implementation of the BlightPro decision support system for potato and tomato late blight management," ELSEVIER-ScienceDirect, May 2015.

[3] Rothe P.R, Kshirsagar R.V, "Cotton leaf disease identification using Pattern Recognition technique," International Conference on Pervasive Computing (ICPC), Vol.2, pp. 1-6, January 2015.

[4] Vijay Jumb, Mandar Sohani, Avinash Shrivas, "Color Image Segmentation using K-means Clustering and Otsu's Adaptive Thresholding," International Journal of Innovative Technology and Exploring Engineering (IJITEE), Vol. 3, Issue 9, February 2014.

[5] Rong Zhou, Shun'ichi Kaneko, Fumio Tanaka, Miyuki Kayamori, Motoshige Shimizu, "Early Detection and Continuous Quantization of Plant Disease Using Template Matching and Support Vector Machine Algorithms," IEEE International Symposium on Computing and Networking, 2013.

[6] Jayme Garcia Arnal Barbedo, "Digital image processing techniques for detecting, quantifying and classifying plant diseases," SpringerPlus, Volume-2, Issue-2, pp. 76-79, May 2013.

[7] Vidya Kumbhar,T.P .Singh, "A Comprehensive Study of Application of Decision Support System in Agriculture in Indian Context," International Journal of Computer Applications, Volume 63– No.14, February 2013.

[8] Youwen Tian, Lin Zhang, "Study on the Methods of Detecting Cucumber Downy Mildew Using Hyperspectral Imaging Technology," ELSEVIER-ScienceDirect, Vol. 11, No. 5 , pp.743-750, 2012.

[9] Al-Bashish, D.M.Braik and S. Bani-Ahmad, 2011, "Detection and classification of leaf diseases using K-means based segmentation and neural-networks based classification," Inform Technol, Vol.10, pp.267-275. 2011.

[10] Christoph Römer, Kathrin Bürling, Mauricio Hunsche, Till Rumpf, Georg Noga, Lutz Plümer, "Robust fitting of fluorescence spectra for pre-symptomatic wheat leaf rust detection with Support Vector Machines," ELSEVIER-ScienceDirect, Vol. 9, No.1, Pp.180-188, 2011.

[11] H. Hiary, S. Bani Ahmad, M. Reyalat, M. Braik and AL Rahamneh, "Fast and Accurate Detection and Classification of Plant Diseases," IJCA, vol. 17(1), pp. 31-38, March 2011.

[12] Otsu.N, "A threshold selection method from gray-level histograms," IEEE Trans. Sys., Vol. 9, pp. 62-66, 2010.

[13] Sindhuja Sankaran, Ashish Mishra, Reza Ehsani, Cristina Davis, "A review of advanced techniques for detecting plant diseases," ELSEVIER-ScienceDirect, Vol. 6, No. 2 , pp.1-13, 2010.

[14] Di Cui, Qin Zhang, Minzan Li, Glen L. Hartman, Youfu Zhao, "Image processing methods for quantitatively detecting soybean rust from multispectral images", ELSEVIER-ScienceDirect, Vol.22, No.4, pp.186-193, 2010.

[15] A.Camargo, J.S.Smith, "An image-processing based algorithm to automatically identify plant disease visual symptoms," ELSEVIER, Vol. 17, No. 1, pp.9-21, 2009.

[16] Murali Krishnan, Dr.M.G.Sumithra, "A Novel Algorithm for Detecting Bacterial Leaf Scorch (BLS) of Shade Trees Using Image Processing*"*,IEEE 11th Malaysia International Conference on Communications,November 2013.

[17] Pinaki Chakraborty, Dilip Kumar Chakrabarti, "A brief survey of computerized expert systems for crop protection being used in India," ELSEVIER-ScienceDirect, Vol.18,pp.469-473,2008.

[18] David G. Lowe, "Distinctive Image Features from Scale-Invariant Key points",International Journal of Computer Vision*,* Vol. 60, No. 2,pp. 91-110, 2004.

[19] Sachin.B.Jadhav and .Dr.Sanjay B Patil, "Grading of Soybean Leaf Disease Based on Segmented Image Using K-means Clustering", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE*)* Volume 4, Issue 6, January 2015.

[20] Manuel Grand-Brochier, Antoine Vacavant, Guillaume Cerutti, Camille Kurtz, Jonathan Weber and Laure Tougne, "Tree leaves extraction in natural images: Comparative study of pre-processing tools and segmentation methods", IEEE TRANSACTIONS ON IMAGE PROCESSING, 2015.

[21] Dandawate Yogesh, and Radha Kokare. "An automated approach for classification of plant diseases towards development of futuristic Decision Support System in Indian perspective", 2015 International Conference on Advances in Computing Communications and Informatics (ICACCI), 2015.