Plant Health Monitoring using Digital Image Processing

Shambhuraj Porob
Final year student BE
Gajant Naik
Final year student BE
Harish Velingkar
Assistant prof.AITD
Dheeraj Amonkar
Final year student BE
Rahul Patil
Final year student BE
Prathamesh Bhat
Assistant prof.AITD

Abstract: The major cause for decrease in the quality and amount of agricultural productivity is plant diseases. Farmers encounter great difficulties in detecting and controlling plant diseases. Thus, it is of great importance to diagnose the plant diseases at early stages so that appropriate and timely action can be taken by the farmers to avoid further losses.The project focuses on the approach based on image processing for detection of diseases of cashew plants. In this paper, we propose an Android application that help farmers for identifying cashew disease by uploading leaf image to the system. The system has set of algorithms which can identify the type of disease. Input image given by the user undergoes several processing steps to detect the disease and results are returned back to the user via android application.

Keywords-disease, android, segmentation, k-mean, SVM (Support Vector Machine).

I .INTRODUCTION

The most widely used method for plant disease detection is simply naked eye observation by experts through which identification and detection of plant diseases is done. For doing so, a large team of experts as well as continuous monitoring of experts is required, which costs very high when farms are large. At the same time, in some countries, farmers don't have proper facilities or even idea that they can contact to experts. Due to which consulting experts even cost high as well as time consuming too. In such condition the suggested technique proves to be beneficial in monitoring large fields of crops. And automatic detection of the diseases by just seeing the symptoms on the plant leaves makes it easier as well as cheaper.

Plant disease identification by visual way is more laborious task and at the same time less accurate and can be done only in limited areas. Whereas if automatic detection technique is used it will take less efforts, less time and more accurately. In plants, some general diseases are brown and yellow spots, or early and late scorch, and other are fungal, viral and bacterial diseases. Image processing is the technique which is used for measuring affected area of disease, and to determine the difference in the color of the affected area [1].

Image segmentation is the process of separating or grouping an image into different parts. There are currently many different ways of performing image segmentation, ranging from the simple thresholding method to advanced color image segmentation methods. The segmentation process is based on various features found in the image. This might be color information, boundaries or segment of an image.

II .LITERATURE SURVEY

Extensive research has been conducted to explore various methods for automated identification of plant diseases. The disease can manifest in various parts of the plant such as roots, stem, fruit or leaves. As stated before, this work concentrates particularly on leaves.

Paper [2] discussed a methodology for recognition of plant diseases present on leaves and stem. The proposed work is composed of K-Means segmentation technique and the segmented images are classified using neural network. They developed a method for detecting the visual signs of plant diseases by using the image processing algorithm. The accuracy of the algorithm was tested by comparing the images, which were segmented manually with those automatically segmented.

Paper [3] discussed various techniques to segment the disease part of the plant. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of ANN methods for classification of disease in plants such as self-organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, we can accurately identify and classify various plant diseases using image processing techniques.

In paper [4] an approach based on image processing is used for automated plant diseases classification based on leaf image processing the research work is concerned with the discrimination between diseased and healthy soybean leaves using SVM classifier. They have tested our algorithm over the database of 120 images taken directly from different farms using different mobile cameras. The SIFT algorithm enables to correctly recognize the plant species based on the leaf shape. The SVM classifier can help in recognizing normal and diseased soybean leaves with an average accuracy as high as 93.79%. The main aim of the proposed work is to provide inputs to an autonomous DSS which will provide necessary help to the farmers as and when required over the mobile. This system will provide help to the farmer with minimal efforts. The farmer only needs to capture the image of the plant leaf using mobile camera and send it to the DSS, without any additional inputs.

In paper [5] the work represents groundnut leaf disease extraction and classification using color imagery. The color imaginary transform, color co-occurrence matrix, feature extraction will be done and get a efficiency output with neural network, Back propagation gives efficient ground nut leaf detection with complex background, in this work we classified only four different disease with 97 Al % of efficiency. But in future the work carried out more diseases by using this method.

Paper [6] contain the study of detection of plant diseases and detection of infected part of plants. Initially input images are taken and then image processing is started. Background and Black pixels are both segmented in first step. Then Hue and Saturation part of image is also separated. And finally infected part and infected area % and name of disease is acquired which is main work using our proposed methodology. Main aim of this work is to provide the advancement and enhancement in computing classifiers of neural network approach and provide better results. This study contains a unique work that is it will calculate the % of infected area of plants.

III. PROPOSED TECHNIQUE

In this section, we consider the general flow of the various steps that are being performed in order to achieve the desired result. The proposed approach consists of four main steps: image acquisition of cashew leaves, feature extraction of cashew leaves, statistical analysis and disease classification. The general flow of the disease detection system is illustrated in Figure 1.

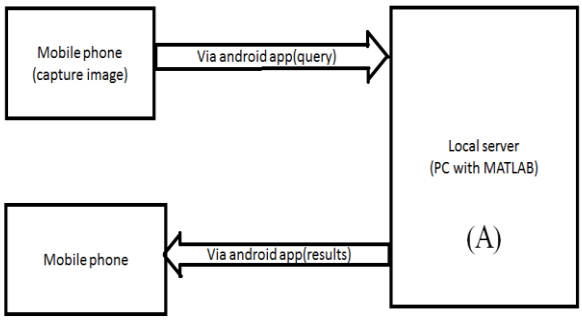
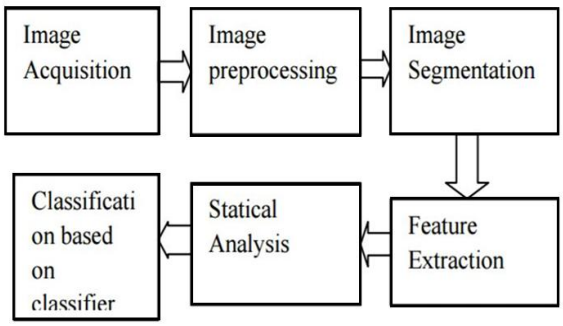


Fig.1. General block diagram



(A) Fig.2.Block Diagram for Image Processing at Server

In the proposed approach, the initial step is acquiring images of cashew leaves using mobile camera.

A. Image Acquisition

The images of the plant leaf are captured through the camera. This image is in RGB (Red, Green and Blue) for color transformation structure for the RGB leaf image is created, and then, a device-independent color space transformation for the color transformation structure is applied [6].

B. Image Pre-processing
To remove noise in image or other object removal, different pre-processing techniques is considered.

C. Image Segmentation
Segmentation means partitioning of image into various part of same features or having some similarity. The segmentation can be done using various methods like k-means clustering, converting RGB image into HIS model etc.

K-means clustering:
The K-means clustering is used for classification of object based on a set of features into K number of classes. The classification of object is done by minimizing the sum of the squares of the distance between the object and the corresponding cluster.

The algorithm for K –means Clustering:
1. Pick center of K cluster, either randomly or based on some heuristic.
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster center.
3. Again compute the cluster centers by averaging all of the pixels in the cluster. Repeat steps 2 and 3 until convergence is attained.

An algorithm for partitioning (or clustering) $\boldsymbol{N}$ data points into $\boldsymbol{K}$ disjoint subsets $\boldsymbol{S}_j$ containing $\boldsymbol{N_j}$ data points so as to minimize the sum-of-squares criterion

$$J = \sum_{j=1}^{K} \sum_{n \in S_j} |x_n - \mu_j|^2,$$

Where $\boldsymbol{x_n}$ is a vector representing the n^{th} data point and $\boldsymbol{\mu_j}$ is the geometric centroid of the data points in $\boldsymbol{S_j}$.

D. Feature Extraction
Feature extraction plays an important role for identification of an object. In many application of image processing feature extraction is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease detection [3].
The features normally used for analysis are contrast, energy, correlation, homogeneity etc. [4].

E. Statistical analysis and classification
The next step is extracting unique features from the leaf and classifying the images as healthy or disease.
The classifier used for this purpose is Support Vector Machine (SVM). This classifier belongs to a group of supervised learning methods which are normally used for classification and pattern recognition. Supervised learning is a machine learning algorithm that uses a known dataset i.e. the training dataset to make predictions for a new dataset i.e. the testing dataset. The accuracy of SVM classifier gets better as the number of samples in the training dataset increases.

IV. RESULTS

1. Image is captured through the mobile camera.
2. The captured image is uploaded to the local server using android application.
3. Image undergoes various image processing algorithms at the server to determine the disease.
4. The determined disease is sent back as a result on mobile application.

The following figure shows step by step procedure of the process.

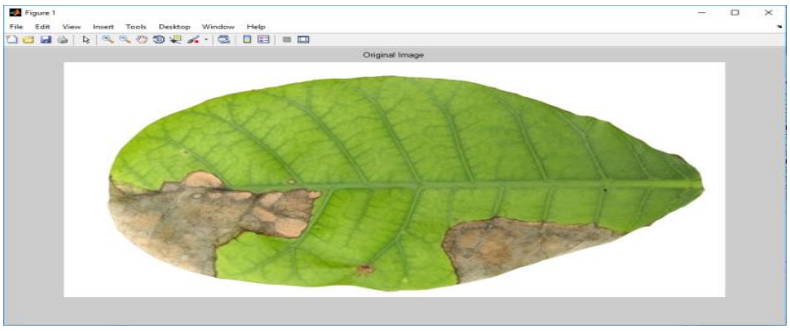


Fig.3.Original image

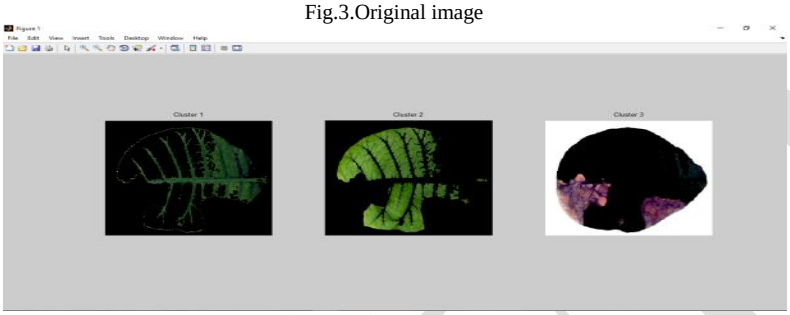
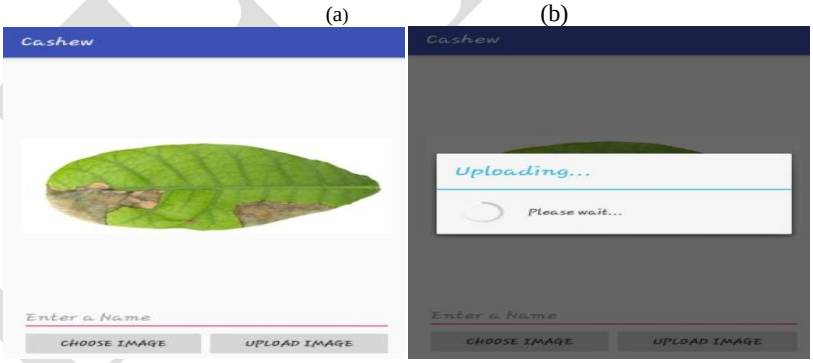


Fig.4. 3 clusters formed after k-mean clustering algorithm

(a) (b)



(c) (d)

(e)

Fig.5.Screenshots of process in mobile application, (a)home page of app (b)after clicking upload button (c)selecting an image to upload (d)uploading the image to local server (e) results of disease obtained from the server.

V. ACKNOWLEDGEMENT

The authors would like to thank Mr. Tejas Pathak, Professor,COMP, AITD. Sincere thanks to Prajay P. Shirodkar, Sameer M. Narvekar (Founders, Garage guy) and Deepak Agarwal, Swastek Enterprises.

VI. CONCLUSION

The detection and classification of the plant disease is very important for the successful cultivation of crop and this can be done using image processing. This paper discussed automated technique to segment the disease part of the plant. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases.

REFERENCES

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

[2] Dheeb Al Bashish, Malik Braik, and Sulieman Bani-Ahmad, "A Framework for Detection and Classification of Plant Leaf and Stem Diseases", IEEE International Conference on Signal and Image Processing, 2010

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

[4] Yogesh Dandawate,Radha kokare"An Automated Approach for Classification of Plant Diseases Towards Development of Futuristic Decision Support System in Indian Perspective" 2015 InternationalConference on Advances in Computing, Communicationsand Informatics (ICACCI).

[5] Ramakrishnan.M, Sahaya Anselin Nisha. A," Groundnut Leaf Disease Detection and Classification by using Back Probagation Algorithm" IEEE ICCSP 2015 conference.

[6] Rajleen Kaur, Dr. Sandeep Singh Kang," An Enhancement in Classifier Support Vector Machine to Improve Plant Disease Detection" 2015 IEEE 3rd InternationalConference on MOOCs, Innovation and Technologyin Education (MITE)

[7] Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande, Mr. Kamal O. Hajari," Unhealthy Region of Citrus Leaf DetectionUsing Image Processing Techniques"2014 International Conference for Convergence of Technology.

[8] Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin Md Shakaff, Rohani Binti S Mohamed Farook," Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques"2012 Third International Conference on Intelligent Systems Modelling and Simulation.

[9] Jagadeesh D. Pujari, Rajesh Yakkundimath, Abdulmunaf S.Byadgi," Identification and Classification of Fungal disease Affected on Agriculture/Horticulture Crops using Image Processing Techniques" 2014 IEEE International Conference on Computational Intelligence and Computing Research.

[10] Santanu Phadikar, Jaya Sil," Rice Disease Identification using Pattern Recognition Techniques"Proceedings of 11th International Conference on Computer and Information Technology (ICCIT 2008) 25-27 December, 2008, Khulna, Bangladesh.

[11] Davoud Ashourloo, Hossein Aghighi, Ali Akbar Matkan, Mohammad Reza Mobasheri, and Amir Moeini Rad," An Investigation Into Machine Learning Regression Techniques for the Leaf Rust Disease Detection Using Hyperspectral Measurement" 2016 IEEE.