

**International Journal of Innovative Research in Science,
Engineering and Technology**

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

Plant Disease Detection Using Image Processing Techniques

Y.Sanjana¹, AshwathSivasamy², SriJayanth²

Lecturer, Dept of CSE, SSEC, Bangalore, India¹

Student, Dept of CSE, SSEC, Bangalore, India²

Student, Dept of CSE, SSEC, Bangalore, India³

ABSTRACT: The uploaded pictures captured by the mobile phones are processed in the remote server and presented to an expert group for their opinion. Computer vision techniques are used for detection of affected spots from the image and their classification. A simple color difference based approach is followed for segmentation of the disease affected lesions. The system allows the expert to evaluate the analysis results and provide feedbacks to the farmers through a notification to their mobile phones.

The goal of this research is to develop an image recognition system that can recognize crop diseases. Image processing starts with the digitized color image of disease leaf. A method of mathematics morphology is used to segment these images. Then texture, shape and color features of color image of disease spot on leaf were extracted, and a classification method of membership function was used to discriminate between the three types of diseases.

KEYWORDS: Digital Photographs, Matlab, Image Processing.

I. INTRODUCTION

The classification and recognition of crop diseases are of the major technical and economical importance in the agricultural Industry. To automate these activities, like texture, color and shape, disease recognition system is feasible. Images were acquired under laboratory condition using digital camera. Three major diseases commonly found are Rice blast (*Magnaporthe grisea*), Rice sheath blight (*Rhizoctonia solani*) and Brown spot (*Cochiobolus miyabeanus*) were selected for this research. The management of plants requires close monitoring especially for the management of disease that can affect production significantly and subsequently the postharvest life. The naked eye observation of experts is the main approach adopted in practice for detection of plant diseases. However this requires continuous monitoring of experts which might be prohibitively expensive in large farms. Automatic detection of plant diseases is an essential research topic as it may prove benefits in monitoring large fields of crops and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves. Therefore looking for fast, automatic, less expensive and accurate method to detect disease by calculating leaf area through pixel number statistics.

The leaf area monitoring is an important tool in studying physiological features related to the plant growth, photosynthetic & transpiration process. Also being helpful parameter in evaluating, damage caused by leaf diseases and pests, to find out water and environmental stress, need of fertilization, for effective management and treatment.

This paper also presents an automated system integrated with machine vision techniques that will assist the farmers get the accurate information about their crops using their mobile phone. The uploaded pictures of paddy captured by the mobile phones will be processed in the central server and the analysis report will be presented to an expert group for their opinion, who will then be able to send proper recommendations through a simple notification using the system, according to the severity of the situation.

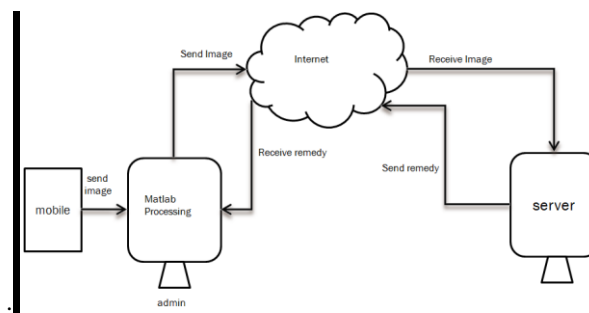
International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

System Overview

The system consists of a mobile application, which will enable the farmers to take images of plants using their mobile phones and send it to a central server where the central system in the server will analyze the pictures based on visual symptoms using image processing algorithms in order to measure the disease type. An expert group will be available to check the status of the image analysis data and provide suggestions based on the report and their knowledge, which will be sent to the farmer as a notification in the application



Mobile Application Development

The mobile application consists of 5 basic functionalities. They are

- 1) Image capture,
- 2) Image selection,
- 3) Image zoom and crop,
- 4) Share image with expert group,
- 5) Receive notification from central server.

Image capture: At the very first page of the application, the application bar shows the icon for capturing image using the application. On navigation of the menu, the user gets to take image on shutter click event using the phone.

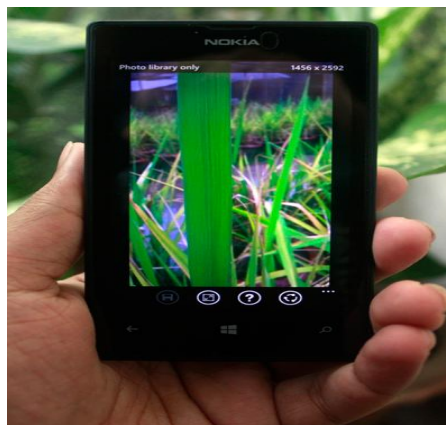


Photo capture using mobile application

Image selection: In case of previously taken pictures of paddy, the application navigation menu also contains the option of selecting an image from the existing photo library of the phone.

Image zoom and crop: The leaf of paddy is a very thin one, and it is important that the targeted area of the leaf gets focus in the image. The mobile application lets the farmer to zoom the affected region of paddy using pinch with two fingers. The test images were taken with a phone which has a camera in it. The application allows to zoom 4x times the

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

original image. In addition, once the targeted region has been selected, the crop button of the crops the image in a 170x400 pixel frame, which in the targeted resolution for processing images in the server image processing application.
Selecting target region of paddy leaf in mobile application

Share image with expert group:

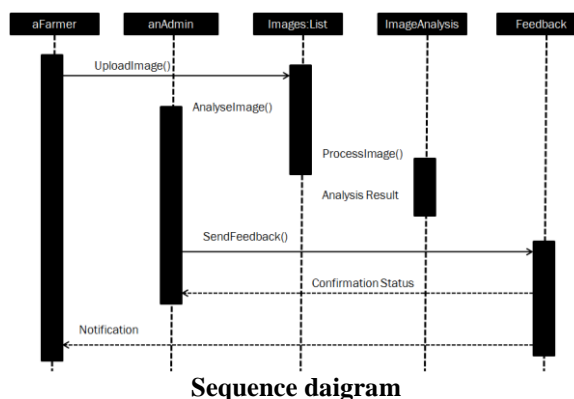
This functionality of the application enables the farmer to send the captured/ selected image to be uploaded in the remote server using HTTP Web Services in Windows phone. The client mobile application uploads two basic types of data in the server for every request, the image that the farmer selects for seeking suggestion and a unique URL created through windows live services which is created for communicating with the mobile phone from a



remote application. The URL created using Windows Live service is used for sending notification from the server application of sent by the expert groups with their feedback.

Receive notification from central server:

Once the image has been uploaded in the remote server, the expert sends feedback to the client mobile application via notification. This notification is sent through a URL generated by Windows Live Services which is unique for every device. Once the notification is received, it is displayed in the application which the user will be able to view for taking appropriate steps suggested by the experts.



Server Script for Storing Data:

The image and the data uploaded from Windows Phone application is received in the server using a script. The images are stored within the assigned directory and the device URL is mapped in the database against every uploaded image in the database.

International Journal of Innovative Research in Science, Engineering and Technology

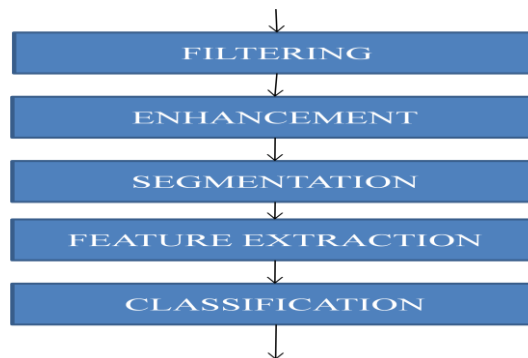
(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

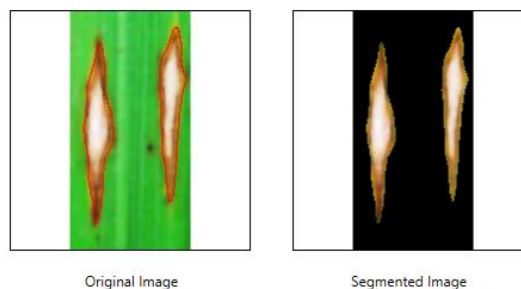
Local Server Application Development:

Every image in the server application is analyzed using machine vision techniques for identification of possible disease of plants presented in the image. Below figure shows the steps of image processing for both training and analysis stages of the process cycle. An image goes through the following steps for analysis.

Steps in Image Processing



Filtering: Filtering in image processing allows for selective highlighting of specific information. A number of techniques are available such as median filter, Gaussian filter, SRAD (speckle Reducing Anisotropic Diffusion) etc
Enhancement: Enhancement refers to accentuation, or sharpening of image features such as boundaries or contrast. Histogram Equalization, AHE(Adaptive Histogram Equalization), CLAHE(Contrast Limited Histogram Equalization).
Segmentation: Segmentation is the process of partitioning a digital image into multiple segments. Multilevel thresholding, Edge detection, active contours. Typically used to locate objects and boundaries in the image.



Feature Extraction: Transforming the input data into the set of features is called feature extraction. Geometric features-area, perimeter, circularity, eccentricity. Statistical features- mean, variance, entropy, correlation.

Classification: We used the idea of maximum feature similarities as the basis for classification of the input image. In this stage, we measure the feature values of the input image and compare the Euclidean distance with features of already the learned images.

$$DDff = FFiiiiiii - FFUUUUUUUU$$

Here,

$DDff$ = Euclidean distance between feature of a input image and already learned image,

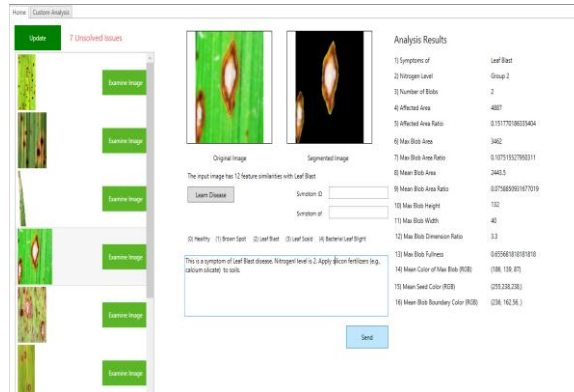
$FFiiiiiii$ = feature value for the input image .

$FFUUUUUUUU$ = feature value for the learned image

International Journal of Innovative Research in Science, Engineering and Technology

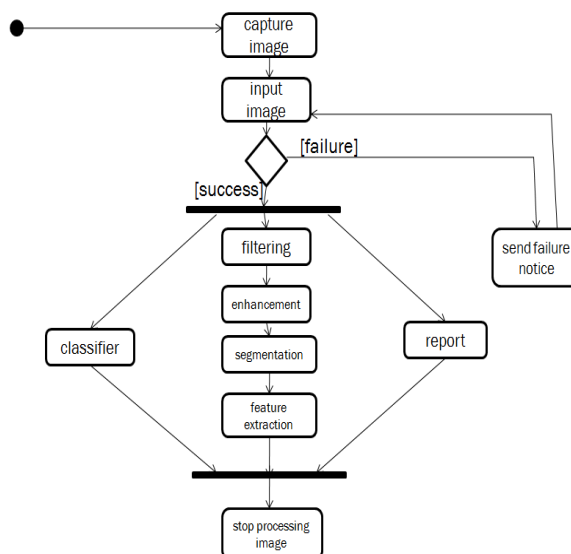
(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015



Presentation of classification results

Use case daigram



International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

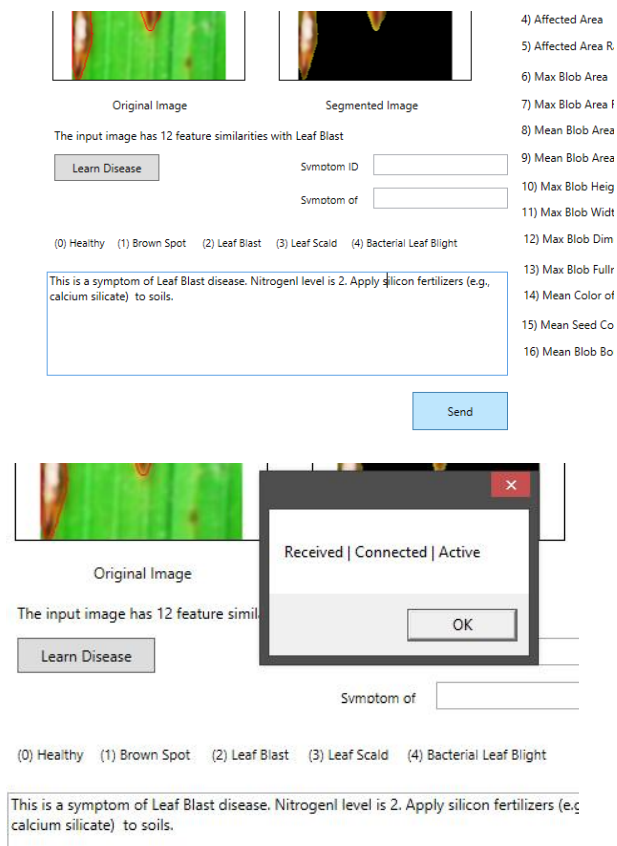
Activity diagram

Every image in the database stores a device URL against it which is used for sending notification to the corresponding the farmer who posted the image for suggestions. A form is displayed in the software window where the expert can write his observations and suggestions and send to the farmer.

Once the farmer receives the notification, the receipt confirmation is displayed at the expert software panel.

Sending feedback from the local server application

View in expert panel



The screenshot displays the expert panel interface. It features two image thumbnails: 'Original Image' (a green leaf with brown spots) and 'Segmented Image' (the same leaf with a black background). Below the images, a text box states: 'The input image has 12 feature similarities with Leaf Blast'. A 'Learn Disease' button is present. To the right, there are input fields for 'Symptom ID' and 'Symptom of'. Below these are radio button options: (0) Healthy, (1) Brown Spot, (2) Leaf Blast, (3) Leaf Scald, and (4) Bacterial Leaf Blight. A large text area contains the recommendation: 'This is a symptom of Leaf Blast disease. Nitrogen level is 2. Apply silicon fertilizers (e.g. calcium silicate) to soils.' A 'Send' button is located below the text area. On the right side of the interface, a vertical list of 16 numerical labels (4) through (16) is visible, corresponding to various image analysis metrics.

II. CONCLUSION

After reviewing above mentioned techniques and methods we can conclude that there are number of ways by which we can detect disease and nutrient deficiency of plants

Each has some pros as well as limitations .On one hand visual analysis is least expensive and simple method, it is not as efficient and reliable as others are Image processing is a technique most spoken of very high accuracy and least time are major advantages offered, but it backs away when implementing practically.

Alongside the supply of cultivation tools, the farmers also need access to accurate information that they can use for efficient crop management and there is no better way than providing them a service that they can use through their mobile phones.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

REFERENCES

- [1] <http://www.knowledgebank.irri.org/step-by-step-production/growth/pests-and-diseases>
- [2] <http://www.knowledgebank.irri.org/decision-tools/rice-doctor>
- [3] <http://www.knowledgebank.irri.org/step-by-step-production/growth/pests-and-diseases/diseases>
- [4] http://en.wikipedia.org/wiki/Blob_detection
- [5] <http://msdn.microsoft.com/en-us/library/windows/apps/hh464924.aspx>
- [6] Sylvain Paris, Pierre Kornprobst, Jack Tumblin, Fred Durand "A Gentle Introduction to Bilateral Filtering and its Applications"; http://people.csail.mit.edu/sparis/bf_course/course_notes.pdf
- [7] Lidi Wang, Tao Yang, Youwen Tian "Crop Disease Leaf Image Segmentation Method Based on Color Features", The International Federation for Information Processing, Volume 258, 2008, pp 713-717
- [8] <http://www.mathworks.com/matlabcentral/answers/110329-detecting-brown-spots-on-leafs>
- [9] Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification, Second Edition
- [10] D. Katsantonis, S.D. Koutroubas, D.A. Ntanos and E. Lupotto "EFFECT OF BLAST DISEASE ON NITROGEN ACCUMULATION AND REMOBILIZATION TO RICE GRAIN", Journal of Plant Pathology (2008), 90 (2), 263-272
- [11] S. D. Koutroubas, D. Katsantonis, D. A. Ntanos, D and E. Lupotto "Nitrogen utilisation efficiency and grain yield components of rice varieties grown under blast disease stress", Australasian Plant Pathology, 2008, 37, 53-59
- [12] Anne S. Prabhu; Morel P. Barbosa Filho; Lawrence E. Datnoff; George H. Snyder; Rodrigo F. Berni; Fabricio A. Rodrigues; Leandro J. Dallagnol "Silicon reduces brown spot severity and grain discoloration on several rice genotypes", Tropical Plant Pathology, vol. 37(6):409-414, 2012
- [13] <http://www.knowledgebank.irri.org/step-by-step-production/growth/soil-fertility/leaf-color-chart>
- [14] <http://www.aforgenet.com/framework/docs/html/c855bd08-b121-7233-cd64-294801f5a201.htm>
- [15] Shilpa Dantulwar, R.K.Krishna "PERFORMANCE ANALYSIS USING SINGLE SEEDED REGION GROWING ALGORITHM", International Journal of Innovative Research in Advanced Engineering, Volume 1 Issue 6 (July 2014), ISSN: 2349-2163.
- [16] Phadikar, S., Sil, J. "Rice disease identification using pattern recognition techniques", 11th International Conference on Computer and Information Technology (ICIT), 2008
- [17] Reinald Adrian D. L. Pugoy, Vladimir Y. Mariano "Automated rice leaf disease detection using color image analysis", SPIE 8009, Third International Conference on Digital Image Processing (ICDIP), 2011
- [18] Rahat Yasir, Nova Ahmed "Beetles: A Mobile Application to Detect Crop Disease for Farmers in Rural Area", Workshop on Human And Technology (WHAT), 8-10 March 2014, Khulna, Bangladesh
- [19] P. Revathi, M. Hemalatha, Homogenous Segmentation based Edge Detection Techniques for Proficient Identification of the Cotton Leaf Spot Diseases. International Journal of Computer Applications (0975 – 888) Volume 47– No.2, June 2012 (2012)