Pest Detection and Classification using Image Processing

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Abstract
Early pest detection is a major challenge in agriculture field. The easiest way, to control the pest infection is the use of pesticides. But the excessive use of pesticides are harmful to plants, animals as well as human beings. Integrated pest management combines biological and physical methods to prevent pest infection. The techniques of machine vision and digital image Processing are extensively applied to agricultural science and it have great perspective especially in the plant protection field, which ultimately leads to crops management. This paper deals with a new type of early detection of pests system. Images of the leaves affected by pests are acquired by using a digital camera. The leaves with pest images are processed for getting a gray colored image and then using feature extraction, image classification techniques to detect pests on leaves.

Keywords: Neural Network, DBSCAN

I. INTRODUCTION

India is an agricultural country. 70 percent of the people mainly depends upon agriculture. So increasing the productivity of crops is an important matter now. Most of the scientists are doing their researches on this field. By using their new techniques and practical implementations this is very easy. But one of the most important problem now exists is „pest infection" on plants. A lot of research has been done on greenhouse agrosystems and more generally on protected crops to control pests and diseases by biological means instead of pesticides. Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure and with increased profit, which has received importance in recent time. A strong demand now exists in many countries for non-chemical control methods for pests or diseases. Greenhouses are considered as biophysical systems with inputs, outputs and control process loops. Most of these control loops are automatized (e.g., climate and fertirrigation control). However no automatic methods are available which precisely and periodically detect the pests on plants. In fact, in production conditions, greenhouse staff periodically observes plants and search for pests. This manual method is to time consuming. Diagnosis is a most difficult task to perform manually as it is a function of a number of parameters such as environment, nutrient, organism etc.

This paper mainly focuses on greenhouse crops. There are different crops cultivated under greenhouse. For example, vegetables like cucumber, potato, tomato etc and flower plants like rose, jasmine etc. The most common pests which will effect on this greenhouse crops are whiteflies a, aphids and thrips. One way to control the pest infection is by using the pesticides. Pesticides will suppress particular species of pests.

Pesticides are detrimental for the environment and produce considerable damage to eco systems. The excessive use of pesticides will pollute air, water, and soil. Carried by the wind pesticides suspensions contaminate other areas. In this paper, we focus on early pest detection. This implies to regular observation the plants. Images are acquired using cameras. Then the acquired image has to be processed to interpret the image contents by image processing methods. The focus of this paper is on the interpretation of image for pest detection.

II. LITERATURE REVIEW

Background History

Below provided is a brief overview of the algorithms that are currently used for pest identification by different scholar's research.

In paper [1] authors present image processing technique for Rice disease identification and considered the two most common diseases in the north east India, namely Leaf Blast (Magnaporthe Grisea) and Brown Spot (Cochiobolus Miyabeanus). Image acquisition is basic step, after that author use segmentation, boundary detection and spot detection method for feature extraction of the infected parts of the leave. In this paper author introduces zooming algorithm in which SOM (Self Organising Map) neural network is used for classification diseased rice images. There are two methods to make input vector in SOM. First method is the padding of zeros and the second method is the interpolation of missing points. For fractional zooming to normalize the spots size, interpolation method is applied. Image transformation in frequency domain does not give better classification. For testing purposes, four different types of images are applied; the zooming algorithm gives satisfactory results of classification for test images.

In paper [2] authors present image-processing technique for Leaf & stem disease detection. The author used a set of leaf images from Jordan's Al-Ghor area. The five plant diseases namely: Early scorch, Ashen mold, Late scorch, Cottony mold and Tiny whiteness is tested by image processing technique. In this technique at starting, image acquisition is obtained and then K-Means clustering method is used for segmentation. After that in feature extraction, CCM (Colour Co-occurrence Method) is used for texture analysis of infected leaf and stem. Lastly paper presents Back propagation algorithm for neural network in

classification of plant diseases. Result of this image processing technique shows accurate detection and classification of plant diseases with high precision around 93%.

III. PROPOSED METHODOLOGY

Methodology

In the proposed method, pre-processing is added before the segmentation and volume estimation is added after the segmentation. Also an image subtraction step is added after the algorithm. Proposed method reduces the problems due to noises and other irregularities in acquired images and also it overcome the disadvantages like intensity in homogeneity and artefacts, etc.

Clustering To Separate Plant and Pest

a. Masking and Removing green pixels:

Masking means setting the pixel value in an image to zero or some other background value. In this step, we identify mostly the green coloured pixels. After that, based on specified threshold value that is computed for these pixels. The green components of the pixel intensities are set to zero if it is less than the pre-computed threshold value. Then red, green and blue components of this pixel is assigned zero value by mapping RGB components. The green colored pixels mostly represent the healthy areas of the leaf and they do not add any valuable weight to disease identification.

b. Segmentation:

From the above steps, the infected portion of the leaf is extracted. The infected region is then segmented into a number of patches of equal size. In this approach patch size of 32X32 is taken.

c. Obtaining Useful Segments:

In this step the useful segments are obtained. The size of the patch is chosen in such a way that the significant information is not lost. Not all segments contain significant amount of information. So the patches which are having more than fifty percent of the information are taken into account for the further analysis.

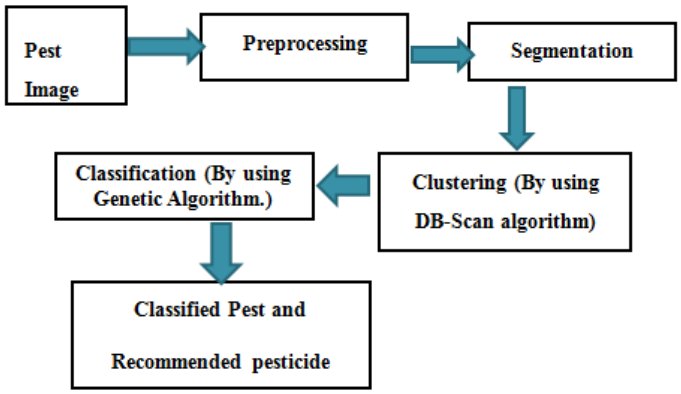
d. Final Clustering To Separate Pest Images Based On Image Subtraction

The final clustering called differential clustering is done by subtracting the clustered plant image from the acquired image.

Algorithmic Steps

Image Pre-processing

Image pre-processing creates an enhanced image that is more useful in processing the still image. In RGB color model, each color appears in its primary spectral components of red, green, and blue. The color of a pixel is made up of three components; red, green, and blue (RGB), described by their corresponding intensities. RGB color image require large space to store and consume much time to process. In image processing it needs to process the three different channels so it consumes large time. In this study, grayscale image is enough for the method so we convert the RGB image into grayscale image.



Detection of Pests in the Image

The detection mechanism used to detect the insect pests in the image is simple and yet efficient. The authors compared the image pixel values of the successive captured images from the camera. Two images are used in detecting the difference. The first image served as the reference image that represents the reference pixel values for comparison purposes, while the second image served as the input image. The two images were compared to each other and the differences in pixel values were determined. If the inputted image pixel values are not equal to the reference image pixel values, the inputted image pixel will be saved as the output image pixel. If the pixel value of the input image is equal to the reference image then the background will be white (pixel value is 255).

Filtering of the Image

Filtering is a process of cleaning up the appearance of the image from noise caused by different lighting conditions. Digital image processing required filtering to yield a usable and attractive end result. There are different techniques available and the best options depend on the image and how it will be used. In this study the authors use median filter. Median filter looks at its nearby neighbor's pixel values to decide whether or not it is representative of its surrounding pixels and replaces with the median of those values.

Extraction of the Detected Pests

This phase is the extraction of the detected insect pest from the image. The output image which was obtained at the end of the previous phase was used in this phase. The image pixel values of the output image will be scanned both horizontally and

vertically to determine the coordinates of each insect in the image. The width and height of the extracted image was determined by using its starting and ending coordinates. Once the start and end coordinates of the objects are determined, the width and height of the matrix as defined by those coordinates will take note and the matrix will be saved. The method used in extracting has two steps. First, the value of the output image in pixels is scanned horizontally which starts at the first x-direction, then the pixel values are summed up to the corresponding columns. The coordinate value in x-direction is incremented by one and the total pixel value in the next column is calculated. The process is repeated until reaching the last value in the x-direction. As a result, the total pixel values of each column are calculated. In order to determine the x-coordinate where an object starts or ends within the image, each total value is compared to a certain threshold value. Second, it will vertically repeat the horizontal scanning method; therefore the total pixel value in each row is calculated. Then, to determine the y coordinates, the thresholding will apply where start or end within the image objects.

IV. CONCLUSIONS

Image processing technique plays an important role in the detection of the pests. Our first objective is to detect five types of pest on leaf. We will be proposing an approach for early detection of pests. It illustrates the collaboration of complementary disciplines and techniques, which led to an automated, robust and versatile system. The prototype system proved reliable for rapid detection of pest. All methods in this paper save time and provide efficient result. The methods used are DBSCAN and Neural Network algorithms. The overall accuracy of system is 98% based on total dataset used in project.

V. REFERENCES

[1]. Santanu Phadikar and Jaya Sil "Rice Disease identification using Pattern Recognition Techniques" Proceedings of 11th International Conference on Computer and Information Technology (ICCIT 2008)2527 December, 2008, Khulna, Bangladesh, pp. 1-42442136-7/08.

[2]. Dheeb Al Bashish, Malik Braik and Sulieman BaniAhmad "A Framework for Detection and Classification of Plant Leaf and Stem Diseases" 2010 IEEE International Conference on Signal and Image Processing, pp. 978-14244-8594-9/10.

[3]. Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin Md Shakaff and Rohani Binti S Mohamed Farook "Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques" 2012 IEEE Third International Conference on Intelligent Systems Modelling and Simulation, pp. 978-0-7695-4668-1/12.

[4]. Sabah Bashir and Navdeep Sharma "Remote Area Plant Disease Detection Using Image Processing" IOSR Journal of Electronics and Communication Engineering (IOSRJECE) ISSN : 2278-2834 Volume 2, Issue 6 (Sep-Oct 2012), PP 31-34.

[5]. Murali Krishnan and Dr.M.G.Sumithra "A Novel Algorithm for Detecting Bacterial Leaf Scorch (BLS) of Shade Trees Using Image Processing" 2013 IEEE 11th Malaysia International Conference on Communications 26th - 28th November 2013, Kuala Lumpur, Malaysia pp. 978-1-4799-1532-3/13.

[6]. Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande and Mr. Kamal O. Hajari "Unhealthy Region of Citrus Leaf Detection Using Image Processing Techniques" 2014 IEEE International Conference for Convergence of Technology, pp. 978-1-4799-3759-2/14.

[7]. Wan Mohd Fadzil W.M.N, Shah Rizam M.S.B and R. Jailani, Nooritawati M.T "Orchid Leaf Disease Detection using Border Segmentation Techniques" 2014 IEEE Conference on Systems, Process and Control (ICSPC 2014), 12 - 14 December 2014, Kuala Lumpur, Malaysia, pp. 978-1-4799-6106-1/14.

[8]. Usama Mokhtar, Mona A. S. Alit, Aboul Ella Hassenian, Hesham Hefny "Tomato leaves diseases detection approach based on support vector machines" 2015 IEEE pp. 978-1-5090-0275-7/15.

[9]. Sachin D. Khirade, A. B. Patil, "Plant Disease Detection Using Image Processing" 2015 IEEE International Conference on Computing Communication Control and Automation, pp. 978-1-4799-6892-3/15.

[10]. Ghulam Mustafa Choudhary and Vikrant Gulati "Advance in Image Processing for Detection of Plant Diseases" International Journal of Advanced Research in Computer Science and Software Engineering 5(7), July- 2015, pp. 1090-1093 [ISSN: 2277 128X].

[11]. Ramakrishnan.M and Sahaya Anselin Nisha.A "Groundnut Leaf Disease Detection and Classification by using Back Probagation Algorithm" IEEE ICCSP 2015 conference, pp. 978-1-4 799-8081-9/15.

[12]. Prakash M. Mainkar, Shreekant Ghorpade and Mayur Adawadkar "Plant Leaf Disease Detection and Classification Using Image Processing Techniques" International Journal of Innovative and Emerging Research in Engineering Volume 2, Issue 4, 2015, eISSN: 2394 – 3343, p-ISSN: 2394 – 5494.

[13]. Prajakta Mitkal, Priyanka Pawar, Mira Nagane, Priyanka Bhosale, Mira Padwal and Priti Nagane "Leaf Disease Detection and Prevention Using Image processing using Matlab" International Journal of Recent Trends in Engineering & Research (IJRTER) Volume 02, Issue 02; February– 2016 [ISSN:2455-1457].