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RESEARCH ARTICLE

EARLY PEST DETECTION USING IMPROVED FCM

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ABSTRACT

Early detection of pest in bio-aggressor is a major challenge in agriculture field. Many effective measures should be taken to control the uses of pesticides. By using image processing techniques, image analysis can be applied to agricultural science; it can provide maximum cultivation of crops by protecting them from pest. This paper proposed a various software prototype system for pest detection on infected images. Infected images are collected through digital camera and processed using image enhancement; which can enhance and provide better than it original image by removing blur and rectify foggy image, image restoration; which can remove the unwanted noise and detect the edge. The Final process is image segmentation; in this techniques image is segmented using the clustering method which detects infected part of leaves. Then by establishing feature extraction pest densities in leaves can be detected. This proposed system provides an easy and effective solution to detect pest and control pesticides in plants.

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INTRODUCTION

Cultivation plays an indispensable role in Indian country, production can be increased and healthy food can be cultivated only when pest and pesticides in the plants are controlled. In the early days, pest was detected by the human manually; they remove the pest in plants with their hands. Later to reduce the manual work and to rectify very minute pest they started using herbicides and hazardous chemical pesticide to control pest in the plant, such pesticide act upon both benefit and harmful pest in the plant. To overcome these problem image processing can be a good result, image processing techniques help farmers to detect pest shape, affected area of pest in leave, color variation due to pest infected region, change of shape and size of each leaf can identify separately and easily (Maria Petrou and Panagiota Bosdogianni, 2003). These results can be archived through MATLAB software: MATLAB mean MATRIX LABORATORY. It is a technical computing environment for high performance numeric computation and visualization. It integrates numerical values, matrix computation, signal processing and graphics in an easy-to-use environment. MATLAB can express the entire algorithm in a few dozen lines, to compute the solution with great accuracy in a few minutes in both 3D and 2D color image result.

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MATLAB is an interactive system which contains a matrix form of data as input. Areas in which toolboxes are available includes signal processing, Image processing, Control systems design, dynamic systems simulation, system identification, neural networks, wavelength communication and others. In many researchers found that pest in the leaves is the most important reason for losses in cultivating crops. By rectifying pest in leaves it can fulfill the demand that Indian country comes cross to produce organic food, which mean cultivating the plant without using high chemical pesticides.

Literature review

Many methods are used in pest detection, to classify the existing system these papers are discussed here, In previous paper they have detected only white flies in each leaflet, in this 180 input images has been processed and 162 images have detected the whiteflies in (Gonzalez, 2004). They also counted the number of whiteflies in each leaflet, it was 0 to 5 in each, and they used a cognitive vision system that combines image processing, learning and knowledge-based techniques (*www.researchpublish.com*). In pest detection and identification, input used is dynamic image, i.e., a video or a static image. Ying yang *et al.* (1993). From an input video image they calculate the number of pests in each leaflet and identify whether the pests are alive or not. Methods such as motion estimation, multiple-frame verification, etc are used. Early pest detection using vector machine by Latha *et al.*

(2008). They have implemented SVM (support vector machine) method to reduce the usage of herbicides by sprinkling them only in the areas where weed is present. In this paper, we implemented digital image processing using the MATLAB software to detect the weed areas in an image. A distinct algorithm name as the relative difference in pixel in densities (RDI) was proposed for detecting pest named as white fly affecting various leaves. The algorithm can only used in greenhouse based crops, but also agricultural based crops as well. The algorithm was tested over 100 images of white fly pest with an accuracy of 96% (Cho *et al.,* 2007). Proposed a new method of pest detection by binocular stereo to get the location information about pest affected in crops, which was used for guiding the robot to spray the pesticides automatically (Maria Petrou and Panagiota Bosdogianni, 2003). Presents an method for classification of the main agents that cause damages to soybean leaflets, i.e., beetles and caterpillars using the SVM classifier (Latha, 2014) proposed Back propagation neural network for recognition of leaves, diseases, pests.

Proposed Work

The proposed system used in this paper can clearly understand by Fig. 1. In image processing, it contain many step to process and detect. The image processing starts from image collection and to create a database. Image enhancement processing used to rectify blur images, so input data can be more accurate. Image segmentation is performed using clustering techniques. Segmented images are stored in database to analysis the pest and control it.

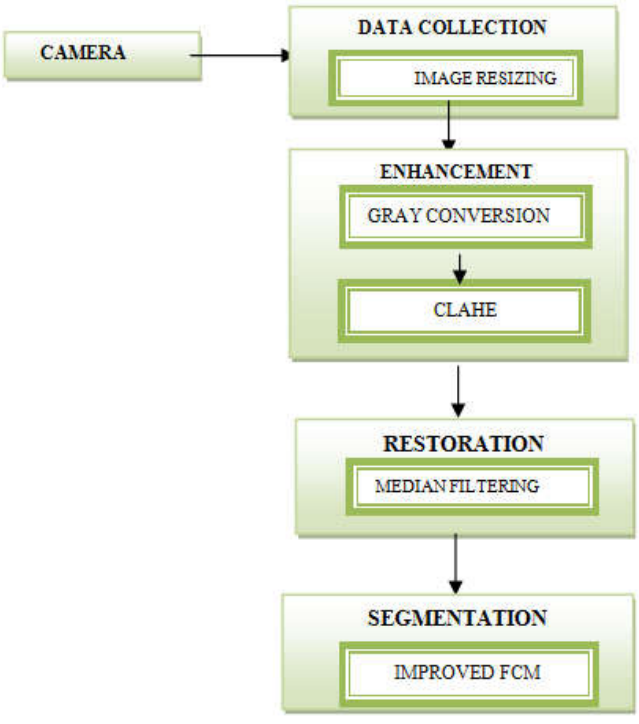

Fig. 1. Block diagram

Image Acquisition

Image processing is basically starts with the pre-processing before starting the pre-processing data collection is necessary to process and to detect the pest in the leaves. The images are captured using the digital camera in the agricultural field and these images are stored without processing it in a database. In this database, it can contain many types of pest detected leaves and they may and may not pest are collected to process

Image Resize

This process is done on the images to convert the size of original image to image which software can process and produce accurate results. In this paper captured image is resized in to 256X256, so image resolution can be high.

Fig. 2. Resized image

Image Enhancement

Image enhancement is an important process, which help to convert the image in high resolution, shape and size which can provide better result while processing. There are many methods and steps in the image enhancement process all method cannot be adopted in all type of image, in this paper, gray conversion and CLAHE method were used to produce input image to detect pest.

Gray conversion

Basically the image captured by the camera can be as same as human eye view, it mean image contain all primary and secondary colors, these colors should be removed because it consume more storage and time to complete the processing (Boissard, 2008). Primary colors are RGB colors they are Red(R), Green (G) and Blue (B). Secondary colors are cyan, magenta, and yellow present in the corner. In this black is at the origin; and white is at the corner farthest from the origin. The input image is converted into a gray image by extending from the origin of the image to corner of the image by joining the two points from origin to corner of the image (Zulkifli Bin Husin, 2013). This method is used in the resized leaf image to convert into a grayscale image. Fig3 shows a grayscale image. Formula to convert RGB to gray scale is:

$I(x, y) = 0.2989 \times R + 0.5870 \times G + 0.1140 \times B$ (Resource Manual on Integrated Production and Pest Management(IPPM))

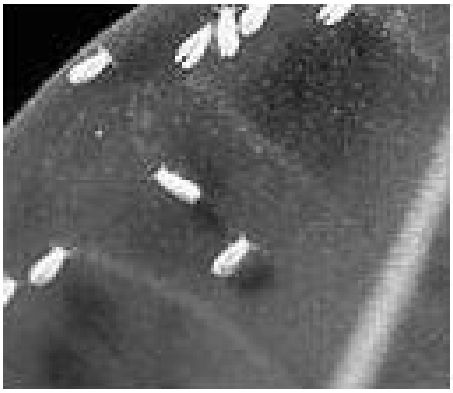

Fig. 3. Gray scale image

Clahe Method

CLAHE can be expanded as Contrast Limited Adaptive Histogram Equalization, this method helps in improving the image contrast so the not visible pest can clearly seen after applying CLAHE method. CLAHE method contains two basic features they are Adaptive HE(AHE) which separate image as small region, called tiles. Each tile performs histogram equalization and Contrast Limited AHE (CLAHE) partially reduces noise in each tile of AHE. So that histogram of the output region matches with the distributed parameter process will be continued until the last tiles to be processed. Artificial boundary is removed and contrast are applied in homogenous area to distinct pest form leaf (Homermj, 1991).

Image Restoration

The goal of restoration techniques is to improve an image in some predefined sense. Image restoration is objective, in the sense that restoration techniques tend to be based on mathematical or probabilistic models of degradation.

Median Filtration

Median filtration is also known as non-linear digital filtering, which help to reduce noise and detect edge by replacing the values of gray level of nearby pixel to its original image (Gajanand Gupta, 2011)

$F\hat{}(x, y)=median\{g(s, t)\}$
$(s, t) \in S\,xy$

By using this formula noise in input image can be reduced 90%, in Fig.4 it shows the noise reduced leave image

Fig. 3. Median filtering

Mproved FCM

Improved FCM as fuzzy c mean is a clustering algorithm which was introduced by Dunn and later was extended by Bezdek. This algorithm is used in an iterative method, which may repeat until all the tiles has been processed. They compare each pixel ratio with other in tile pixel value. The algorithm produces an optimal partition by reducing the weight within each tile. FCM is an unsupervised clustering algorithm that is applied to a wide range of problems connected with further analysis, clustering and classifier design. FCM can be applied in all fields of science, such as chemistry, botany by detecting pest and affected area in the plants, zoology to detect disease affected area. The algorithm can also analyze the distance between each input data point. The clusters are formed according to the distance between data points and the cluster centers are formed for each cluster. By using improved Fuzzy c mean gray scale image of leave with pest is given as an input image. (Premalatha *et al*., 2014) Fig4: improved fuzzy c means algorithm.

Fig. 4. Improved fuzzy c mean

RESULTS

The main goal achieved in this paper is to detect pest in early stage, so it help to reduce the use of pesticide and improve high cultivation, to achieve this Improved Fuzzy c mean clustering algorithm the segement the pre-processed image and detect pest by giving variation in color. This algorithm provide high PSNR value: 34.2233 and low MSE value: 0.7024. By this result it can clearly understand that when the MSE value is less than 1 then the clustering algorithm performed provide good result

Improved FCM	Psnr Value	Mse Value	Average Difference
	34.2233	0.7024	0.7328

Conclusion

Image processing technique using matlab has been proved to be more effective in agriculture field, especially in pest detection, in this paper clearly discussed about the pre

processing steps such as image enhancement ;by gray conversion and ClAHE method foggy and blur image have been rectified next step is image restoration in which noise reducing and edge detection in leaf is processed, final step is cluttering process in this Improved fuzzy c mean clustering algorithm which provide high PSNR value and low MSE value. In this method pest can be detected as early as possible, so pesticides can be controlled.

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