

Whitefly detection on Cotton crops using Image Processing

Sonali Dhiman, Prashant Bhardwaj

Academic Consultancy Service Division, Centre for Advance Computing, Mohali, India

ABSTRACT- In India, the agriculture is an important sector and about 70% people depend on it. There are wide range of diversity to select vegetable and fruit crops. Among all crops, cotton is the most cultivated cash crop that give more income to the Indian farmers. But, due to diseases caused by insects like whitefly can cause severe losses in the yield and affects the quality of the product. But, it becomes difficult to detect the insect with the naked eyes because size of insect is very small for which it requires close monitoring of the crops. The research is based on the whitefly detection, which affects the cotton crop.

We are developing a system for the effective detection of whitefly by using image processing on MATLAB. Various key steps like image acquisition, image processing, image segmentation, background subtraction algorithm, and then to extract whitefly are involved. In addition to this, a buzzer is connected to Arduino board and give an alarming signal for insect detection

Keywords- Cotton, Whitefly detection, Image Processing

I. INTRODUCTION

Cotton is a soft, feathery, mushy, staple strand that grows in a boll, or in a protective case, around the cotton seeds. The main use of the cotton crop is in the clothing and household items, but industrial products contributes from many thousands of package. Diseases caused by the insects like whitefly causes severe damage to the crops which leads to the decrease in the productivity of cotton and affects the quality of the product. The ability of whiteflies to carry and spread disease is the widest impact they have had on cotton crop production. The management of the perennial cotton crops requires close monitoring especially for the insects that can be a strenuous way in large farms and time consuming too. There are various methods that have been suggested in the last two decades which are not efficient. So, the main objective of this research work is efficient detection of whitefly. This Research work involves various steps like image acquisition in which color images of cotton leaves are captured using digital camera then the image preprocessing is done to improve the image that enhances some image features like color space conversion, image segmentation is process used to make image more comprehensible and easier to analyze and background subtraction algorithm for detection of insects. In addition to this, an Arduino board is connected through USB

to serial port convertor which is further connected to the buzzer to give an alarming signal when an insect is detected.



Fig 1: Cotton

II. LITERATURE REVIEW

Naikdurgesh Manikaro et al. showed that In this paper there is explanation of detection of various disease caused by insects, bacterial diseases, fungi diseases and viral diseases occurred on the cotton crop. Different kind of algorithms are merged in the application. Image processing is one of the salient techniques that will convert the segment image into objects and background image. One of the essential steps in image analysis is feature extraction by the image processing toolbox and also the determination by using MATLAB helps us to recommend required remedy for that disease emerges on the leaves of cotton plant.

Sanjay B. Dhyagude et al. explained that this paper work is similar to the previous one as it also detect the various disease caused by the fungi, bacteria and viruses on the plant. Automatic detection of plant diseases in an important research topic as it may prove advantageous in observing substantial fields of cotton crops, and thus instinctively detect the diseases from the evidences that emerges on the plant leaves. Segmentation is the technique that is categorized by calculating the quotient of disease spot on the leaves of agricultural plant areas. The most favourable threshold value for segmentation can be obtained using weighted Parzen-window.

Zulkifli bin husin et al. showed that this paper discusses the effective way used in early detection of chilli disease through leaf feature inspection. Numerous farmers declined to grow chili in the rainy season because of the increase of chilli disease which has nowadays become a high risk for the control in the quality and productivity. Normally, there are two types of aspects which can kill and destroy the leaves of the chili plants; living known as biotic a Living agent's which generally include insects, bacteria, fungi and viruses. Nonliving agents that include are the supreme of temperature, excessive moisture in the atmosphere, poor sunlight,

insufficient amounts of nutrients, and poor soil pH and air pollutants.

P. Revathi *et al.* explained that it is a more developed computing technology that has been introduced to help the farmers to take superior decision about many aspects of crop development process. Appropriate evaluation and recognition of crop disease in the field is very critical for the increased production and the quality of the product.

III. PROPOSED APPROACH

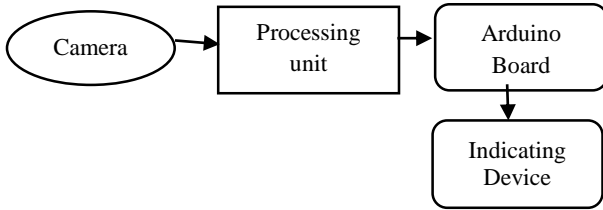


Fig 2: Block diagram of proposed approach

The given block diagram is shown in Fig 2 which represents the proposed approach.



Fig 3

A. Image Acquisition

The images of the plant leaves are apprehended through the digital camera. This image is in RGB (Red, Green and Blue) form. Then for the RGB leaf image color transformation structure is created, and then, color transformation structure is applied through a device-independent color space transformation. Image acquisition in image processing which is performed is always the first key step in the workflow sequence because no processing is possible without an image.

B. Image Pre Processing

Image preprocessing is a technique which is known for image clipping i.e. cropping of the leaf image to get the required image region. In addition to this Image enhancement is carried out for increasing the contrast. Further, the RGB images are converted into the grey images using color conversion using equation (1).

$$f(x) = 0.2989 * R + 0.5870 * G + 0.114 * B \text{ ----- (1)}$$

Then the histogram equalization which disperse the intensities of the images that is applied on the image to upgrade the images of the insects on the cotton crop.

C. Image Segmentation

Image Segmentation separates an image into well-defined regions containing each pixels with similar parameters. Basically, image segmentation make image to be meaningful and useful for analysis and interpretation of image, the distinct regions should definitely relate to depicted objects or features of interest. Meaningful image segmentation is the first key to transform from low-level image processing like a greyscale or color image into images of one or more other high level image description in terms of features, objects, and locations. There are various techniques used in the Image segmentation, but the proposed work has some of the techniques used which is given below

(a) Bwareaopen method

In Image segmentation, bwareaopen technique of segmentation is mainly used in the proposed work which generally used to separate small objects from the binary image.

Syntax

$$BW2 = bwareaopen (BW,P)$$

$$BW2 = bwareaopen (BW,P,conn)$$

Description

BW2 = bwareaopen(BW, P) removes all connected components that is objects that have lesser than P pixels from the binary image BW, generating another binary image, BW2.

(b) Threshold technique

The straightforward technique of image segmentation is called the threshold method. This technique is normally based on a threshold value to convert a gray-scale image into a binary image. There are numerous method using threshold technique like Otsu’s method and k-clustering algorithm. But we are using Otsu’s method for image segmentation.

Syntax

$$Level = graythresh(I)$$

$$[level EM] = graythresh(I)$$

Description

$$Level = graythresh(I)$$

It evaluates a global threshold (level) which can be used to transform an intensity image to a binary image by im2bw. The normalized intensity value of level lies in the range [0,1].

D. Background Subtraction Algorithm

Background subtraction that is also known as Foreground detection, is a method in the fields of image processing and computer vision whereas an image’s foreground is extracted for further processing like object recognition etc. Whenever, his current frame is simply subtracted from the previous

frame, the difference in the pixel values for a given pixel should be greater than a threshold T_h and then the pixel is considered part of foreground.

$$| \text{frame} - \text{frame} - 1 | > T_h$$

E. Extraction of Insect

In this process, the important and useful features of whitefly are extracted by applying the loop. The image below is shown in which whitefly is separated in multiple segments.

F. Hardware Involved

(a) Arduino Board

The proposed project also includes Arduino, which is a combination of both hardware and Software Company, project, and microcontroller-based kits for framing digital devices and interactive objects that can observe and control physical devices. Some of the common examples of such devices proposed for beginner hobbyists include simple robots, thermostats, and motion detectors. Further, it has two parts (1) Hardware (2) Software

(b) Buzzer

A buzzer or beeper is an audio signalling device which can be of different types, it can be mechanical, electromechanical, or piezoelectric.

IV. RESULTS

In the end, there is explanations of results and discussions over it. As concluded by the pictures given below of the proposed approach, there are number of stages according to which there can be classification due to which the whitefly is detected and the performance improved is measured and can be seen according to the research work. The following various figures are given below

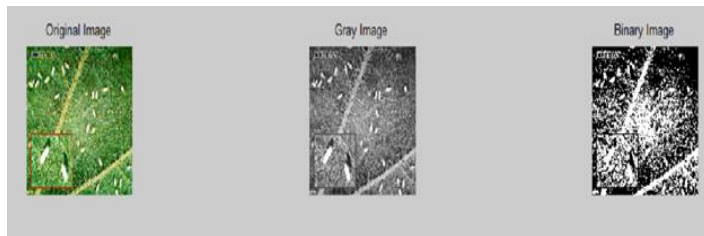


Fig 4: Preprocessed Image

The preprocessed Image is known to eliminate noise in image or other object removal, there are different pre-processing techniques that is considered.

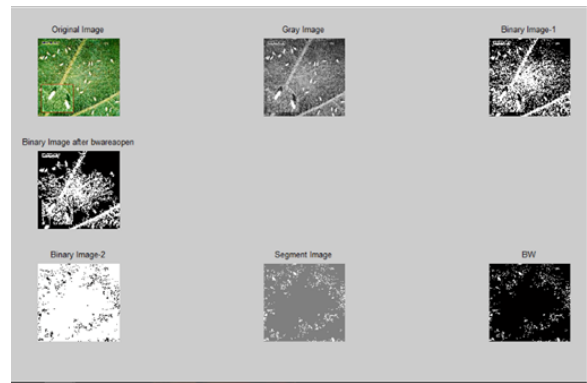


Fig 5: Segmented Image

Meaningful image segmentation is the first key to transform from low-level image processing like a greyscale or color image into images of one or more other high level image description in terms of features, objects, and locations.



Fig 6: Image after Background Subtraction algorithm

Background subtraction algorithm is mainly used for detection of moving objects in videos from static camera. The reasoning in the method is that of locating the moving objects after the subtraction between the current frame and the reference frame that is often known as background image or background model.



Fig 7: Extraction of Insects

The Extracted Image the important and useful features of whitefly are extracted by applying the loop. The image above is shown in which whitefly is separated in multiple segments.

V. CONCLUSION

In this thesis work, study on the detection of whitefly on the cotton crop addressed how the insect like whitefly is effectively detected on the cotton leaves in the early stage

before it will damage the whole plant using image processing toolbox, and also the diagnosis of the whitefly present on the cotton leaves by using MATLAB. As we know that such small insects cannot be monitored by naked eyes and it can be costly process as farmers may have to travel long distance to consult the experts.

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