FLOWER COUNTING IN YIELD APPROXIMATION USING DIGITAL IMAGE PROCESSING TECHNIQUES

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ABSTRACT

Floriculture is a discipline of horticulture concerned with the cultivation of flowers and ornamental plants for floral industry and for garden. In Floriculture the accurate forecasting of the yield and their estimation from the raw data are playing the important role in the planning of various aspects of Horticulture production. In most cases, such counting procedure is performed manually, which is often lengthy and tedious in Floriculture fields. A growing number of routine and research activities in a wide variety of fields, have the certain types of objects (people, flowers, cells, etc.) as one of their main components. Flower counting is used in yield estimation of the particular crop using Precision Agriculture (PA). Precision agriculture is defined as the management of crops production. Flower counting is more challenging in digital image processing. This paper presents complete and fully automatic method for flower counting from floriculture field images. The proposed work has been developed in MATLAB Environment.

Keywords: Circular Hough Transform, Flower Counting, K-Mean Clustering.

I INTRODUCTION

India is one of the largest producers of flowers, fruits, etc. But the economic contribution of agriculture to India's Gross Domestic Product (GDP) is steadily declining. For this reason different issues are emerging in the aspects of agriculture production and marketing. These issues have therefore led to new methods in the agricultural research. In manual count, results are erroneous due to greater amount of exhaustion of a continuous and repetitive work.

Counting is an important step in yield estimation so that it should be accurate and precise. If yield is overestimated, the money will be lost in pre-orders of ships and trucks and a large investment may be blocked because of excessive packaging. If underestimated, problem of insufficient packing material, collectors and lack of time to arrange vehicles has to be faced.

In this proposed work a series of image processing techniques have been applied to count the flowers in an image precisely thereby estimate the yield. This work focused on estimating the number of flowers in the field under the natural daylight condition.

The rest of this paper is organized as follows: Literature Review is discussed in Section 2, proposed system with block diagram is discussed in Section 3,Results and Discussion is discussed in Section 4,and Conclusionin Section 5.

II LITERATURE REVIEW

NeetikaBairwa[1] addressed issues in flower counting. 15 Gerbera flower images are processed and applied image processing techniques to achieve 95.01% of accuracy over manual counting. SuvarnaNandyal,Jagadeesha [4]presented a Crop Growth Prediction based on Fruit Recognition using Machine Vision in which the fruit region is located and segmented using edge detection and circular fitting algorithm. Morphological operations are adapted for segmented regions to get proper boundaries. The color and shape features and extracted for the fruit region. The recognition accuracy of only 90% is observed. Segmentation and feature extraction were not up to mark.Wijethunga et al. [8] developed automated counting approach with application to kiwifruit counting system. Three simple counting methods followed by a minimum distance classifier based segmentation techniques in L*a*b* color space is discussed. The recognition accuracy is above 90%. Bewes et al.[16] implemented the complete version of generalized Hough transform to detect round objects. According to the authors, the computational burden had prevented its until that moment(2008) but, with more computational resources available, this option became viable, resulting in the algorithm called Circular Hough transform (CHT).

Sarkate, et al. [17] counted Gerbera flowers using Hue Saturation Value (HSV) color space and histogram analysis. Proposed algorithm given less accurate result due to overlapped flowers.Harmsen et al. [20] did flower counting using a multi- target tracking algorithm that accurately identifies the relevant characteristics of flower. The plant rotates in front of a camera, and a series of consecutive pictures are taken. Tracking algorithm detects, predicts and count flowers in number of plants.Dorj et al. [19] estimated tangerine yield by counting of tangerine flower using machine vision. Flowers are counted with help of Gaussian filter and RGB color detection method.Salvo et al. [18] predicated blueberry based on counting of number of flowers buds. Bud counting relates the number of enough of fruit for the harvest and also relates weather variable.Asif ur Rahman Shaik[11] has proposed to marking the timber truck for using image processing techniques enhanced technics for using preprocessing mannered. Object segmentation and edge detection to connected components labeling under to identify the marking circle around the timber logs and he has achieved an accuracy of 92%.

III PROPOSED ALGORITHM

Flower counting is used to yield approximation or estimation of a particular crop in floriculture field. The manual counting is erroneous and time consuming. In this work to develop an algorithm for computer vision- based system for automated, fast and precise counting of flowers.

In this proposed work is todetect and count the flowers using image processing techniques. Firstly, we starts with acquired images and thento convert RGB to Lab color space. Second stage applied segmentation techniques for extract the flowers using k-means clustering and then to convert binary image with help of Thresholding techniques (Otsu's Method) for identify the region of flowers. Finally count the flowers using Circular Hough Transform.

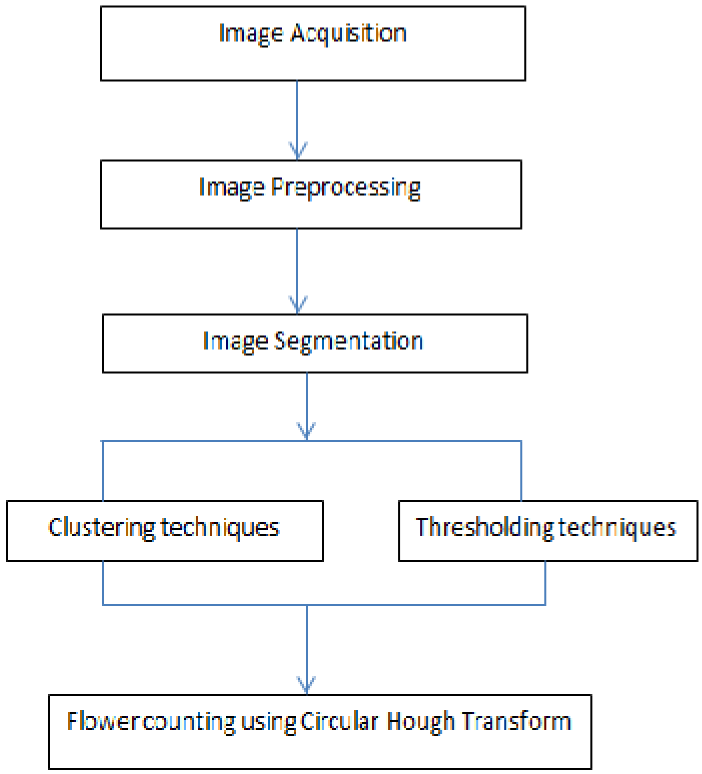

Fig 3.1 Block Diagram

3.1 Image Acquisition

The steps intend to capture image through camera. The quality of image depends on camera parameters. Such as lighting condition, size of objectsanddistance from which image. For better results, cameras with higher resolution are preferred.70 images have been acquired from Floriculture field in Yercaud, Salem district.

Fig 3.2 Originalimage

3.2 Image Preprocessing

The images taken from outfield may have some problems such as dull light, high light, shaking etc. and such images might lead to false detection of flowers. The main objective of preprocessing techniques to enhance the color of the flowers. Color images can be explained by the various color space like RGB, Lab, HSV etc. Lab color space L-represent the luminosity (brightness), a-represent the red, green color, b- represent the blue, yellow color. Lab color space is an efficient and device independent color space image. Achieving consistency and high quality color imaging system requires the understanding and characterization of every color device in the system. In a controlled environment, it is possible to "tune" the various components of the system to achieve satisfactory results for most cases.

Lab color is clearly separates gray-scale information represented as color information's. So, that to convert RGB to Lab color space. Fig 3.3 shows the conversion of Lab color space enhanced by the original image.

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Fig.3.3 Lab Color Image

3.3 Image Segmentation

After pre-processing, image segmentationtechnique is applied.Image segmentation approach helps to extract the flower regions with the help of clustering and thresholding techniques.

3.3.1 Clustering Techniques

Clustering is the classification of objects into different groups, the partitioning of data set into subset, so that the data in each subset share some common trait-often according to some defined distance measure. In this workcolor based segmentation using K-mean clustering algorithm is used. K-means clustering treats each object as having a location in space. It finds partitions such that objects within each cluster are as close to each other as possible, and as far from objects in other clusters as possible. Using K-means clustering, to cluster the objects into three clusters with the Euclidean distance metric is used.Euclidean distance metric can separate objects by color, which result in three images. The three segmented images are shown Fig 3.4only Segmented in flower regions, Fig 3.5Segmented in buds in an image and Fig 3.6Segmented in background using Clustering techniques.

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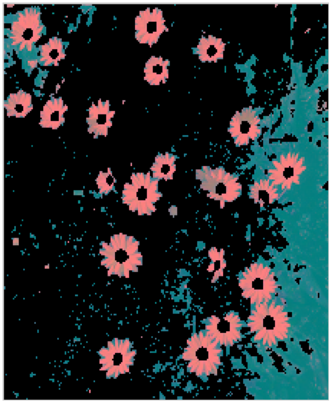

Fig 3.4Segmentedcluster1 image

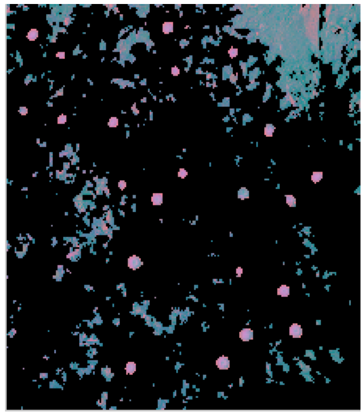

Fig 3.5 Segmented cluster2 image

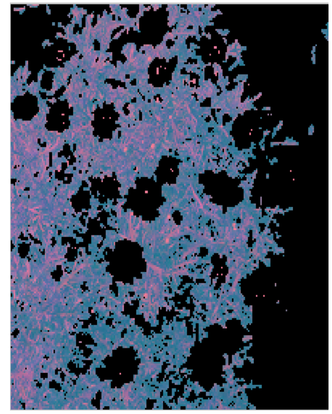

Fig 3.6 Segment cluster3 image

3.3.2 Thresholding Techniques

The next step is thresholding techniques. The main objective of thresholding technique is to separate the background from the segmented image. The optimum global thresholding techniqueis used to separate the flowers in the image from the background. So the segmentedcluster1image is converted into binary image as represented in Fig. 3.7.

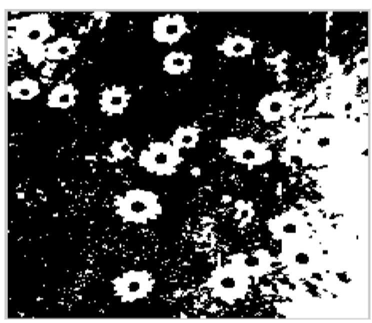

Fig 3.7Binary Image

3.3 Circular Hough transformation

The circle Hough Transform (CHT) is a feature extraction to detect shapes such as circles straight line as well as the parametric curve. Unlike the linear HT, the CHT relies on equations for circles. The equation of the a circle is,

$$r^2 = (x - a)^2 + (y - b)^2 \quad (1)$$

Here 'a' and 'b' represent the coordinates for the center, and 'r' is the radius of the circle. The parametric representation of this circle is

$$x = a + r*\cos(\theta) \; y = b + r*\sin(\theta) \quad (2)$$

In contrast to a linear HT, a CHT relies on 3 parameters, which requires a larger computation time and memory for storage, increasing the complexity of extracting information from our image. For simplicity, most CHT programs set the radius to a constant value (hard coded) or provide the user with the option of setting a range (maximum and minimum) prior to running the application. For each edge point, a circle is drawn with that point as origin and radius ‘r’.

Here R_{min} value is 5, and R_{max} value is 30.

The CHT also uses an array (3D) with the first two dimensions representing the coordinates of the circle and the last third specifying the radii. The values in the accumulator (array) are increased every time a circle is drawn with the desired radii over every edge point. The accumulator, which kept counts of how many circles pass through coordinates of each edge point, proceeds to a vote to find the highest count. The coordinates of the center of the circles in the images are the coordinates with the highest count. In this proposed work to estimate the number of flowers in the floriculture image the resulted image has been used asa Circular Hough transform to counted the flowers for yield approximation. Circular Fitting algorithm based on circular Hough transform is applied so that separated flower regions fit in the circles marked by red color and also counted the flower regions to identify the circles.

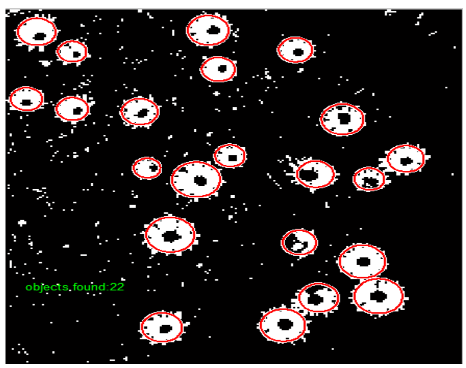

Fig 3.8 counting flowers

Fig 3.8 shows the image are done to detect shapes such as circle, usingcircle fitting algorithm and also counted.

IV RESULTS AND DISCUSSION

The accuracy is measured based on final results produced by the algorithm versus the manual counting process. Here, 6 images were tested with this algorithm. Table 4.1 showing the accuracy of counting of flowers in developed algorithm.

Table 4.1 comparison number of flowers

Tested Image No	Manual Counting	Developed algorithm count
1	11	11
2	96	96
3	20	20
4	17	17
5	5	5
6	7	7

The accuracy is measures based on final results produces by the algorithm to refer the manual counting process. Fig 4.1[a-f] shows the results of 6 samples of flower images.

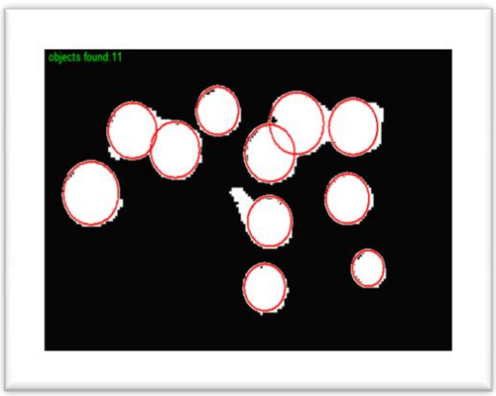

Fig 4.1(a) Flower count of image 1

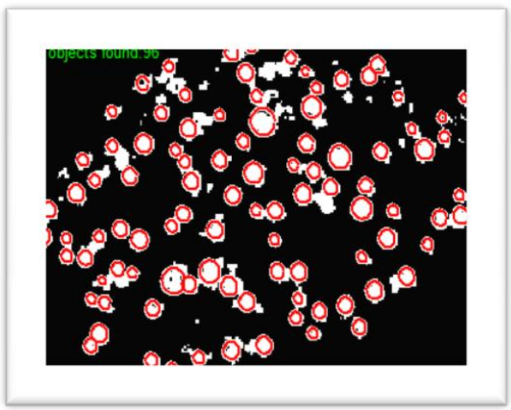

Fig 4.1(b) Flower count of image 2

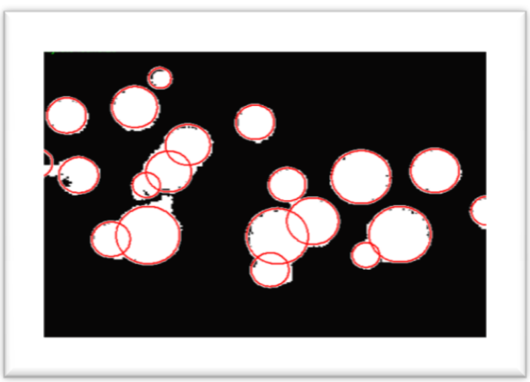

Fig4.1(c) Flower count of Image 3

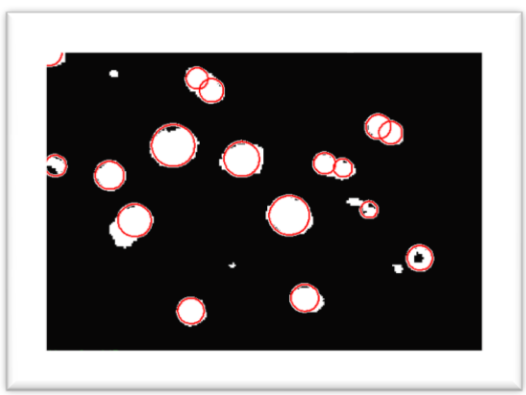

Fig 4.1(d) Flower count of Image 4

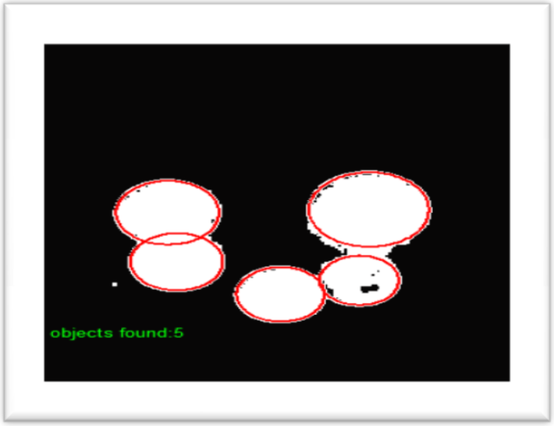

Fig 4.1(e) Flower count of Image 5

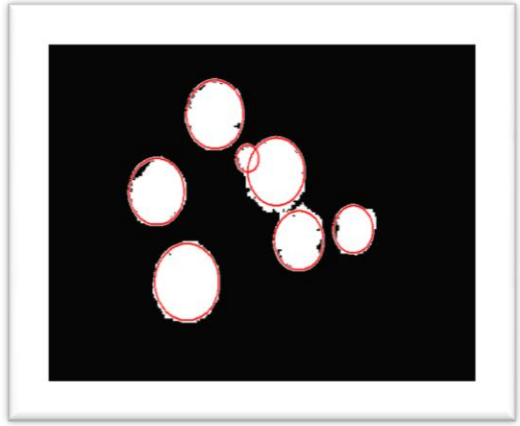

Fig 4.1(f)Flower count of Image 6

V CONCLUSION

This paper deals with automatic detection and counting number of flowerssuperior to the manual count which is often lengthy and tedious. This paper aimed to provides automatically counting of flowers with greater accuracy and precision in floriculture fields.It can help decision support system that could generate results for counting of flowers and which will be useful in yield information and serve as base formanagement and planning of flower marketing.

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