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A Survey on Flower Detection Techniques based on Deep Neural Networking

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***Abstract*: Many researches have been done for automatic detection and yielding the flower crop but still there is lack of programmed flower reaping through automated machines. The major challenge in automated flower harvesting is the yield estimation itself. The important step towards flower detection is color detection and separation of flower from background. Firstly the images are captured and flower co-ordinates are calculated from image frame and background is removed from the image. After detection of all flowers from image, the coordinates of every flower are given to the automated harvesting machine for reaching to the flower**

INTRODUCTION

In late decades there has been expanding sought after of horticulture and its items. In India, horticulture is developing as a significant business crop. A great deal of significance has been given to this division because of its numerous utilizations, fulfilling the stylish needs of the general population, making greater work, guaranteeing higher rate of profits to rustic individuals and encouraging winning progressively remote trade. Indian horticulture industry involves flowers, for example, Rose, Tuberose, Glads, Anthurium, Carnations, and Marigold and so on. Development is attempted in both open ranch conditions just as best in class poly and nurseries. India's absolute fare of gardening was Rs. 507.31 crores/78.73 USD Millions of year 2017-18. Marigold is a standout amongst the most ordinarily developed flowers for greenery enclosure enrichment and widely utilized as free flowers for making festoons for religious and social capacities. It has picked up fame among the cultivators by virtue of its simple culture and wide versatility. Its propensity with the expectation of complimentary flowering, brief length to deliver attractive flowers, wide range of appealing hues, shape, size and great keeping quality has pulled in the consideration of flower cultivators. Marigolds are perfect for cut flowers, particularly for making garlands.

Table 1: Top 10 states in marigold flower production

Sr No.	State	Lose Value (in tonnes)
1	Madhya Pradesh	94
2	Karnataka	87.34
3	Gujarat	81.7
4	Andhra Pradesh	66.54
5	Haryana	61.83
6	West Bengal	58.1
7	Maharashtra	48.29
8	Chattisgarh	30.5
9	Tamil Nadu	18.08
10	Sikkim	16.5

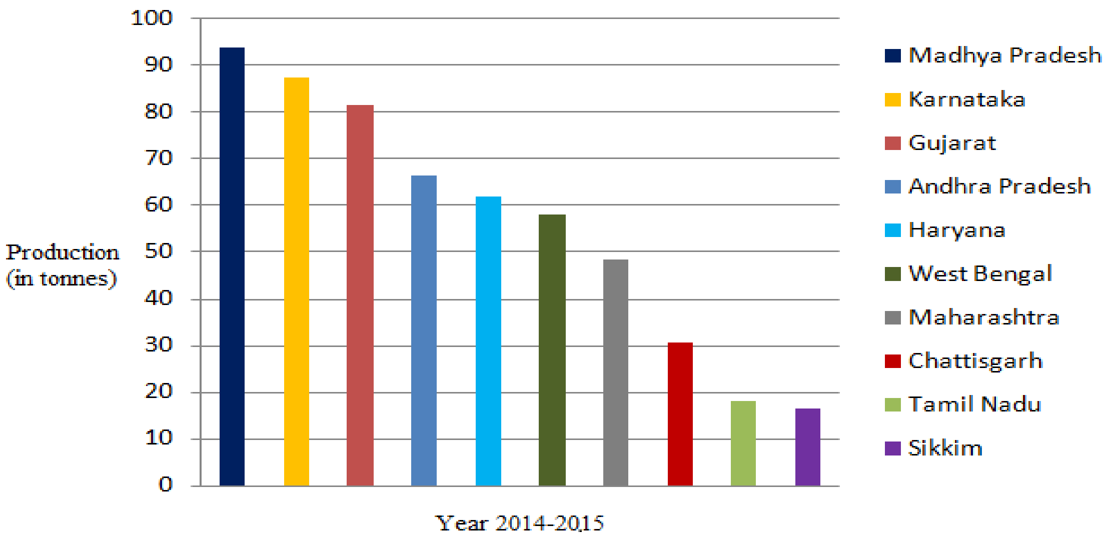

Figure 1: Top 10 states where marigold flower production is largest

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CLASSIFICATION OF FLOWER DETECTION TECHNIQUES:

Syed Inthiyaz et al. presented a framework for segmenting flower images captured with a digital camera. Here a color texture fusion as a prior parameter for level set evolution (FCTAC) [1] component is used. First the features are extracted are Color Gabor textures (CGT) and Color Level Covariance Matrix (CLCM). In this research PCA based fusion is applied on texture images of CLCM and CGT at multidimensional orientations. Here 4 pixel distances (d) in 4 different orientations (ϴ) is used:

$$(d,\theta) = \left[(\{1,2,3,4\},0\},(\{1,2,3,4\},\frac{\pi}{4}\},(\{1,2,3,4\},\frac{\pi}{2}\},(\{1,2,3,4\},3\frac{\pi}{2}\}\right]$$

In this paper the 5 parameters calculated for the image set chosen are: contrast, energy, entropy, homogeneity and correlation. This research can solve complex texture segmentation problems for un supervised flower image segmentation and can gives satisfactory results on a wide class of flower images compared to single gray texture features.

Syed Inthiyaz et al. proposed a pre-informed Chan vese based level sets algorithm. Objects colour, texture and shape fused features are included in pre information. The main motive to use this algorithm is to segment flower image and extract meaningful features which help in flower classification [2]. A mixed feature as pre information for the level set function is introduced which is made up of shape, texture and color [10]. RGB color planes are used for color feature, shapes are hand modeled from the original flower image and for texture Local Binary Patterns (LBP) is used. LBP compares each pixel in a pre-defined neighborhood to summarize the local structure of the image. For an image pixel $I(x, y) \in \Re^+$, where (x, y) gives the pixel position in the intensity image. The RGB image is $I(x, y, N) \in \Re^+$, where N represents RGB color planes. The neighborhoods of a pixel can vary from 3 pixels with radius r=1 or a neighborhood of 12 pixels with r=2.5. The value of pixels using LBP code for a centre pixel (x_c, y_c, N) is given by

$$LBP(x_c,y_c,N) = \sum_{i=1}^{N}\sum_{j=1}^{P} s(g_p - g_c)2^P$$

$$S(X) = \begin{cases} 1 & \forall \times \geq 0 \\ 0 & Otherwise \end{cases}$$

Where g_c is intensity gray value of centre pixel at (x_c, y_c) and g_p is gray value around the neighborhood of g_c.

The level set model based on a closed contour spreading in the image plane adhering to object edges. An implicitly defined contour of arbitrary shape ϴ in the image plane $O:\{o(x, y) \subset \mathbb{R}^2\}$ as the zero level set of an embedding function $\Phi: O \rightarrow \mathbb{R}$:

$$\Theta = \{x, y \in O | \Phi(x, y) = 0\}$$

in the image plane $I: \Theta \rightarrow \mathbb{R}^+$as

$$E^{Cv}(\phi) = \int_{\Theta} (I(X) - C^+)^2\, H(\phi(X))dx + \int_{\Theta} (I(X) - C^-)^2 \left(1 - H(\phi(X))\right) dx + \lambda \int_{\Theta} |\nabla H\phi(X)|dx$$

Lin Shi et al. proposes a flower auto-recognition system based on deep learning, by getting pictures by mobile smartphone and send the image to the CNN network. According to the system architecture images are captured by the mobile and converted to a Tfrecord [3] format, which is a standard format officially recommended by TensorFlow. It can store image data and labels together into binary files, and realize fast copy, move, read and store operations in TensorFlow. The flower image in Tfrecord format is sent to the pre-trained CNN system on FLOWERS32 dataset for identification and output the category label of the image. Images are sent to the cloud storage where the mobile phone receives the flower name automatically. For the FLOWERS32 dataset, here 1920 images are taken as training set and 640 images as testing set. The recognition rate and based on FLOWERS32 can reach about 95%.

Thi Thanh Nhan Nguyen et al. proposed an automatically identifying plant species from flower images through a deep Convolutional Neural Network (CNN) [4]. A comparatively study is evaluated on the CNNs architecture are AlexNet, CaffeNet, GoogLeNet. A saliency-segmentation-based approach to select the ROI (Region-Of-Interest) on flower images is also applied [11]. In this approach they fine-tuned the CNNs for optimizing the parameters. Firstly, pre-trained weights of CNNs are used on ImageNet and fine tuning the following parameters:

- Test iteration: 1666
- Initial learning rate: 0.001
- Step size: 10000 (update learning rate after 10000 iterations)
- Batch size: 5 (test set)
- Number of iterations: 50,000

The accuracy of the proposed method at Rank 1 is 67.45% and 90.82% at rank 10 for a flower dataset of 967 species extracted from PlantCLEF.

Mrudul Dighe et al. proposed a system to provide monitoring of flowers as an alternative for human inspection in a greenhouse [5] [12]. This proposed framework assembled with some devices is: camera (used for the purpose of image gathering by move around the greenhouse plant), image processing unit, database and user interface. At first the framework moves all around greenhouse plantation which consists of Raspberry Pi, DC motor, Raspberry Pi camera module and 16x2 display. The images are captured using a camera module which connects directly to Raspberry Pi to the CSI (Camera Serial Interface) port and the Image Processing is done in Raspberry Pi using Open Source Computer Vision (OpenCV) which is a library of programming functions. With the assistance of the image processing unit, the matured blossoms are recognized and counted [9]. Using the color transformation method the images are converted from RGB color model to HSV color model. Flowers from images are recognized by applying its specific hue, saturation and value range. The output of this methodology is stored in the SD card mounted on the Raspberry Pi. Further this information is utilized for investigation of the growth and yield of the flowers. The proposed system works more efficiently on a large scale and reduces the manual effort but this system cannot count the flowers grown in open air and blooming in bunches.

Prabira Kumar Sethy et al. proposed a methodology which can detect and count marigold flower successfully by using HSV color transform and circular Hough transform (CHT) [6] methodologies. In the proposed methodology marigold flower images are captured by the digital camera with the distance less than one meter. These images were processed using Dual Core processor with 2 GHz frequency and 2 GB RAM and the experiment was carried out on MATLAB R2016a. The CHT methodology used in this research can detect multiple numbers of circles with unknown radius. The accumulator metrics is produced by dividing parameter space into the bucket as per grid which denotes the number of circles. The steps used in this research for calculating the neighborhood pixels are:

Step 1: For each pixel (x, y) find the possible radius between 10 and 60.
Step 2: For each pixel (x, y) find the possible theta between 0 and 360.
Step 3: Update the polar coordinate for center using equation.
$a = x - r * \cos(t * PI/180);$
$b = y - r * \sin(t * PI/180);$
Step 4: Update voting by $A[a, b, r]+ = 1$

The proposed circular Hough transform for circle fitting algorithm successfully detects and counts the marigold flower of an open field with an error of 5% and is more robust and capable of counting the overlap flowers.
HONG An-xiange et al. has designed an efficient segmentation method based on ROI (Region of Interest) feature to remove background and detect flower body from flower images through the color clustering and domain knowledge methodology. Here in this research to define color feature; color histogram method is used and Centroid-Contour Distance (CCD) [15] and Angle Code Histogram (ACH) are used for extracting shape feature of flower. To extract the region of color clustering technique is used which is used to extract the background and pattern recognition. This research contains 80% accuracy with color and shape feature.
Jie Zou et al. introduced Computer Assisted Visual InterActive Recognition (CAVIAR) geometric model for flower recognition in the form of human-computer communication channe [14]l. Here an interactive flower recognition system is invented in which a domain specific model plays the main role to provide an interface between human and machine [13]. By adding pseudolabeled training samples (improves automatic recognition); CAVIAR system shows self-learning and helps in faster flower detection. For this research a database of 1078 flowers from 113 species with a digital camera is captured and provided to the system for further implementation.
Balvant V. Biradar et al. proposed a prominent and efficient method for detecting and counting the number of flowers from the flower images captured by digital camera by removing non flower region [7] [8]. The marigold flower images are captured manually using Sony Cybershot W810 20.1MP digital camera from the greenhouses with the distance of 1 to 2 meter. The system used segmentation of image using the thresholding technique through OTSU's algorithm. For counting of flowers in images firstly the bounding boxes are created for every connected edge in an image; after that the total number of bounding boxes are counted and stored. Two different databases of marigold flower images are used for experiment and the result have shown that the accuracy is over 92% to detect and count the number of flowers from flower images.

CONCLUSION

As we know manual flower harvesting is a time consuming process which take a lot of time in collecting and packaging the flower crop and may delay in deliver the harvest to the market. This unusual delay cause to spoiling the harvest and the farmer has to take a loss. So we can use the automated machines for monitoring the flower crop and machines can also identify the ripening flowers and can harvest the crop. In robotic harvesting we have to face less labor management problem and also production costs also reduced.
In this paper we have given a detailed review of the state-of-the-art techniques concerned with autonomous flower segmentation and detection. The grouping introduced in this paper is a good starting guide for those interested in this research area helping to choose, enhance or even develop a novel flower detection technique.

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