Digital Image Processing Techniques for Object Detection From Complex Background Image*

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***Abstract*— This report discusses the methods and techniques involved in the detection of any object through a complex background. In this report we have focused on the detection of mango from the mango tree. The MATLAB code must detect the correct object and also count the total number of objects present in the image. So, for this we have used some techniques, one of them is color processing which is used to eliminate the unwanted colors and objects from the image by performing filtering. The second technique used in this report is Circular Hough Transformation (CHT), it is used for object detection. This technique will highlight the mangoes present in the image by circular pattern, the circular pattern will work on the given radius within an image by collecting the maximum voting. Now, at last after the detection of mangoes in the image the counter will count all the numbers of highlighted objects and output the total number of mangoes.**

I. INTRODUCTION

In industries and many work places in order to save time of users object detection has taken place. Object detection technique is used for detection and location. And this is the most common and widely used technique in image processing. But it still needs some advancements and improvements in detecting the current object and it's total count.

So, in this report we will be detecting and allocating round or circular objects for this we have considered a tree of mangos. We will be using methods and techniques like color image processing, grayscale filtering and CHT to detect the accurate image from the complex background and it's total number present in the image.

Here we will be using MATLAB software to write our program and to implement this project. MATLAB is a widely used software for image processing as it contains a large number of libraries that supports image processing and object detection.

One of the most challenging tasks is extraction in images, the object we want to extract can be of any shape or size.So,we have to use such an algorithm that can be able to detect all the images. Hough transform can be used to detect any shape. Later,it was extended to circular hough transform to detect low-contrast circular objects. As our goal is to detect circular objects, we will be using CHT in which within a predefined set of shapes the object will be detected.In the following implementation and process of algorithm will be explained.

The image with a resolution of 320x240 pixels was utilized in this research. The image containing RGB color content is fed into the color processing phase, but the image that has already been converted to grayscale is sent into a different preprocessing step where the CHT occurs.

II. DIP IMPLEMENTATION AND PROCESS

To implement object detection, several techniques are taken into account. In Figure 1 the Recognition Process is shown. First, the images are sent into the preprocessing stage in order to perform resizing of image where the image is set to 320x240 pixels after that, it will go to the RGB adjustment where it will readjust the lighter and darker the object color and background. Now, after this step the image is fed into the color processing block which will be discussed in detail in 3.1 and in the last CHT will be performed which will also be discussed in detail in 3.2. If we conclude the steps we can have Figure 1 as the recognition block diagram for reference.

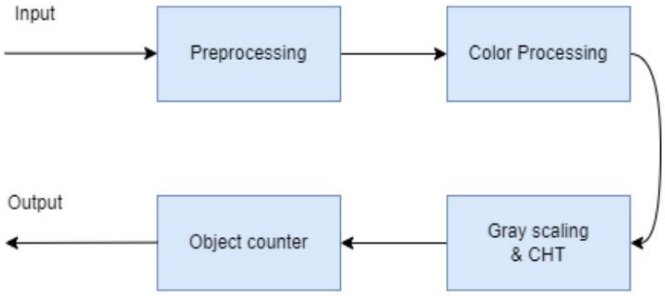

Fig. 1. Recognition Process

Two different images of mangoes on the tree were captured and adjusted in the pre-processing stage that will be used in the further processing.

Fig. 2. Result of Mango 1 Detection after RGB Adjustment.

Fig. 3. Result of Mango 2 Detection after RGB Adjustment.

Fig. 5. Result of Mango 1 Detection using RGB Filtering (Color Processing).

A. COLOR PROCESSING

The color processing stage is simply the color detection stage where only the RGB colors are detected and not every RGB is detected; only the specified RGB colors are detected, and the rest are eliminated.

After the color processing, the only left for the image is a clear mango and the leaves. Since it is a very smart technique to carry out the RGB colors that are needed and to neglect others but there is one drawback that the color intensities change as the light intensity falls on it. The color will fluctuate greatly depending on the intensity of light, the item's reflected rate, and the object's background, which may create the same RGB color as the object. Due to which, this project may involve detecting inconstant lighting conditions and a complicated background, the object detection approach may demand focusing on object detection utilizing CHT.

1) ALGORITHM: In this color processing, the algorithm will take each pixel and compare it with the default RGB value of the mangoes. If the detected pixel is relatable with the color of mango, the intensity of the pixel remains the same, else the pixel's intensity will be replaced by a black pixel.

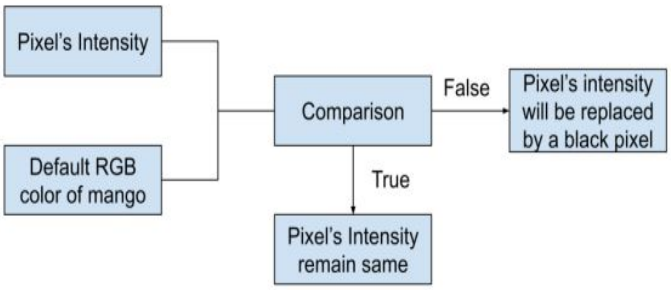

Fig. 4. Color Processing Algorithm

Both the images that were RGB adjusted previously in Fig: 2 3 are now passed through the color processing stage and the following results were noticed.

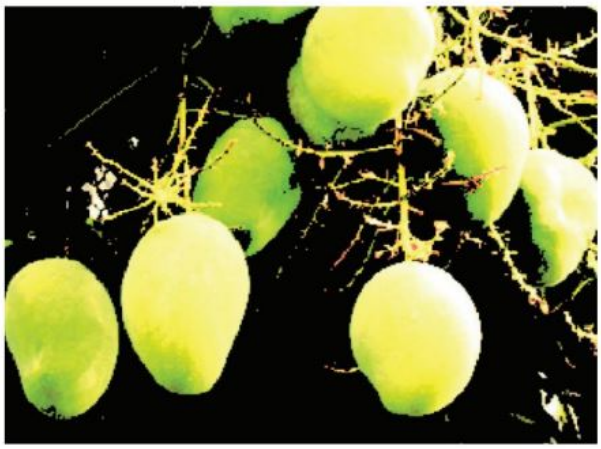

Fig. 6. Result of Mango 2 Detection using RGB Filtering (Color Processing).

B. CIRCULAR HOUGH TRANSFORM

The Circle Hough Transform (CHT) is a basic feature extraction technique used in digital image processing for detecting circles in complex background images. The circle candidates are produced by "voting" in the Hough parameter space and then selecting local maxima in an accumulator matrix. Circular Hough is used to transform a set of feature points in the image into a set of accumulated votes in the parameter space. Accumulated votes are in the form of an array and the highest number of arrays indicates the presence of the shape.

When compared to form detection, color processing may not be an effective approach for object recognition due to the uneven background visual and color intensity. The form of the unit, which nearly looks spherical, may be easily seen in the example mango picture Figure 2. The CHT may be used to exclude objects that aren't considered circles, such as leaves. Figure 5 illustrates the result of RGB filtering on Mango 1. Mangoes have a lighter natural color that makes it easy to distinguish.

A circular pattern can be described by the parametric equation of the circle and can be written as

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

As it can be seen the circle to get three parameter r, a and b, where a b are the center of the circle in the direction x y respectively and r is the radius. Gradient at each edge point is known. We know the line on which the center will lie

$$a = x - Rcos, b = y - Rsin \quad (2)$$

If the radius is also known, then the center of the circle can be located.

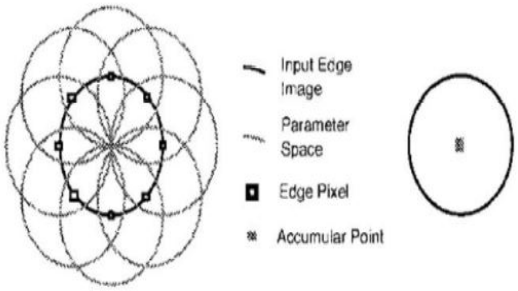

Fig. 7. Circular Hough Transform

1) ALGORITHM: 1) Load an image

2) Detect edges and generate a binary image

3) For every 'edge' pixel, generate a circle in the ab space

4) For every point on the circle in the ab space, cast 'votes' in the accumulator

5) The circles made at the edges are then noticed as the 3D accumulator cones

6) The accumulators with greater number of votes are the centers

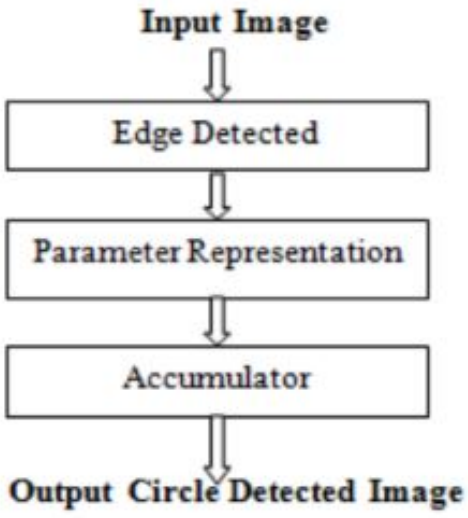

Fig. 8. Flowchart of CHT

Fig. 9. Result of Mango 1 Detection.

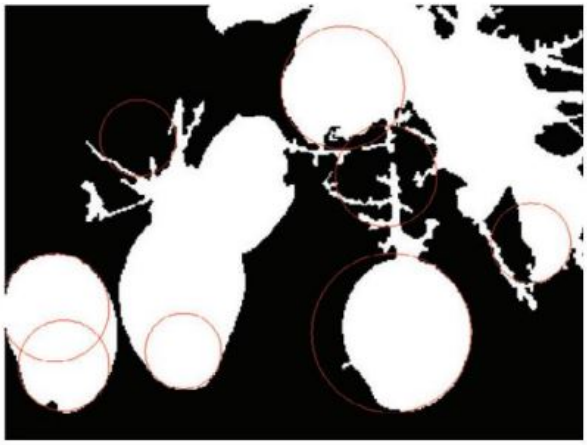

Fig. 10. Result of Mango 2 Detection.

III. CONCLUSIONS

In this project, the methods and techniques used are successful in detecting any object from a complex background using color processing and Circular Hough Transform. Color processing was used in order to filter out the background, second step by using grayscale filtering and lastly by binary filtering and Circular Hough Transform (CHT) for circular object detection. The color detection will just recognize the RGB color which is it will just identify the predetermined color that matches just and will eliminate others. While for the grayscale filtering, it filters the pixel and smoothens the image to make the edge clearer. Lastly, CHT takes place to detect the circular objects and display the total number of them.

During this process if the backlight condition takes place, it will affect the color processing and RGB color reflected will differ according to the light intensity. Backlight images are from an excessive reflection of light being opposite to a capturing device. The existing image enhancement methods cannot be directly applied to the backlight images because they are not designed to enhance both broad light and dark regions simultaneously. And we know that the grayscale

filtering cannot process the low intensity pixel, so there will be a large number of noises in the image. Due to all these reasons Circular Hough Transform will not detect the objects accurately and will result in inaccurate object detection or total count of objects

IV. FUTURE WORK

Object detection is a very vast field of improvements and enhancements are always needed in it in order to detect the accurate object and total numbers of that particular object detected. The principal reason for object identification is to distinguish and find at least one viable focus from still picture or video information. It completely incorporates an assortment of significant procedures, for example, image processing, pattern recognition and AI.

This paper specifically uses CHT as it detects circular objects only. In future we can use Hough Transform only in order to detect objects of any shape not particularly the round or circular shapes. It can also be used in crime scenes in order to detect if there was any object or person present during crime if the crime took place at night so in this way, we can do human detection as well.

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