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# FLOWER IMAGE SEGMENTATION: A COMPARISON BETWEEN WATERSHED, MARKER CONTROLLED WATERSHED, AND WATERSHED EDGE WAVELET FUSION

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**ABSTRACT**

Watershed Transformation is one of the powerful tools for image segmentation. Watershed transformation based segmentation is generally referred to marker controlled segmentation. This paper proposes a new approach of image segmentation that includes histogram equalization and image smoothening techniques with the Prewitt or sobel edge detection operator. The results when compared with the previous method, shows that this can achieve more accurate segmented results and can reduce the over segmentation effect.

**Keywords:** histogram equalization, image segmentation, prewitt/sobel operator, watershed transform, marker controlled segmentation.

## 1. INTRODUCTION

Segmentation is a critical and settled exploration point in the field of image analysis and Computer vision. It is the most troublesome errand in image processing. Segmentation is the process of grouping the pixels that presents homogeneous characteristics, i.e. segmenting the image into various regions or objects. All consequent interpretation tasks, for instance, object recognition and classification depends vivaciously on the nature of the segmentation process.

We have a lot of transformation techniques present throughout, but watershed transform is the one that is broadly recycled in the segmentation process in order to achieve the accurate results. We can also call it as region based segmentation approach. The main idea of this method originates from geology: it is the landscape or topographic relief which is flooded by H2O. Watershed actually partition the lines present in the areas which attract more downpour dropping above the region. Another approach is to predict the scene being drenched in lake, with holes impaled into local minima. Catchment basins will top off with water beginning at the local minima. Midpoint where water from different catchment basins are meet there dams are brought together. Exactly, when the level of water has achieved the most astounding crest in an image, the procedure is halted. Subsequently the image is partitioned into areas is isolated by dams, called watershed lines or essentially watersheds. In practice, Watershed is connected to image gradient and the watershed lines isolate the homogeneous locales, giving the wanted segmentation result. The gradient image for the change is routinely found utilizing the morphological operations. Notwithstanding, noise in the gradient image results in over segmentation which can have a basic unfavorable impact on the nature of the segmentation results. The nature of the gradient gauge has the real effect on segmentation execution. So the result of various angles on watersheds has been found with the assistance of top sign to noise ratio.

Over segmentation is a critical issue for almost all of the watershed algorithms which were tended to in various literary works. Expectedly, watershed change is generally intended for the cause of image segmentation.

The dissection of image via watershed algorithm relies on the estimation of the inclinations. The low-contrast edges deliver an under segmentation and produce compact magnitude inclinations bringing about distinct regions to be wrongly merged. Here, we analyze the image segmentation done by watershed transformation in which the image enhancement techniques like histogram equalization etc. are used so as to avoid under segmentation and noise removal techniques to reduce over segmentation. These are pre-segmentation techniques applied to input image.

## 2. WATERSHED TRANSFORM

The gradient image is frequently utilized as a part of watershed transformation because the main theme of the segmentation is the uniformity of the grey values of the objects present in an image. But when other ideas are pertinent functions can be utilized. Specifically, when the segmentation relies on the appearance of the objects, the distance function is exceptionally useful. Let us imagine that the surface of the relief is being drenched in still water with openings (holes) generated in local minima. Water tops off the unlighted areas "the basins" beginning at these local minima. Where water originating from various basins meets, we will build dams. The process is ceased, when the water level has reached the towering landscape. In the interest of, the landscape is divided into regions or basins unconnected by dams, called watershed lines or simply watersheds.
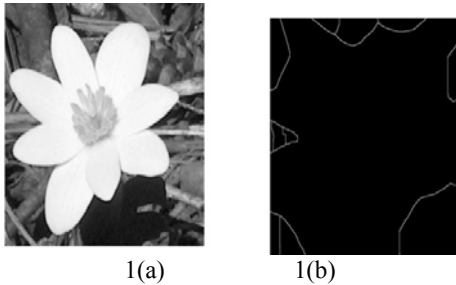
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1(a)                    1(b)

Figure-1(a) and 1(b) shows the grey scale image and the rigid lines for the grey scale image, respectively.

## 3. MARKER CONTROLLED WATERSHED

Isolating the touching items in flower image is the most problematic query in image processing techniques. The watershed change is often associated with this issue change discovers "catchment basins" and "watershed edge lines" in an image by regarding it as a surface where light pixels are high and dim pixels are low. Segmentation utilizing the watershed transforms works well in the event that you can distinguish, or "mark," forefront protests and background locations. Marker controlled watershed transformation follows the fundamental methodology.

a) Apply segmentation technique to an image whose dull locales are the objects, which we are trying to segment.

b) Process forefront markers. These are associated blobs of pixels inside the each object.

c) Process the markers of background and the pixels of these are not part of any object.

d) Change the segmentation work, so that it just has minima at the foreground and background marker locations.

e) Process the watershed transform of the altered segmentation functions.

## 4. WATERSHED FLOWCHART

In some flowers, selection and extraction of markers are bit difficult. We all are human beings, we can't get every picture without noise. This noise creates main disturbance in image processing and makes it more complex and makes detecting multifaceted. It also effects shape, size and grey level and makes us hard to find appropriate algorithms for extraction. Thus we have to go beyond the segmentation. We know that applying initial watershed transformation give us exceptionally unacceptable results. Numerous homogenous areas are fragmented into small regions. The watershed transform itself applied on another level will help us to combine the fragmented regions. If we look at the weight of boundaries after segmentation, we can't find same weight. Those weights which are inside the homogenous are weaker. In order to compare these boundaries, we have to present neighborhood relations between them. There are some advantages in watershed transformation.

a) The watershed lines always match up to the most appropriate edges between markers. So this technique is not influenced by lower contrast edges, Because of noise, that could produce local minima and thus produces inappropriate results.

b) Even though there are weaker edges between markers, our technique watershed always detects a contour in the area. We can find this type of contour on the pixels having higher contrast.

Mainly this approach is divided into four primary steps the initial step is to apply pre-processing techniques that includes removal of noise and adjust image intensity by preserving image information in it. The noisy images lead us to over segmentation and displays us inaccurate segmented image. So, we first remove noise and then adjust the pixel values so that we'll get well segmented image.

The following step is pre-segmentation process of an image that includes morphological operations, for example finding out regional maxima and mark the foreground objects that helps us in segmentation process. After marking foreground objects we have to reconstruct the image.

In third step we did the important task in our process that is segmentation. Subsequent to reconstructing image we superimpose it with original image. After doing that we will clean the edges of segmented image and compute background markers.

The final step of our algorithm is to apply watershed transformation to the distance of image and afterward see the outcome of segmented image.

The purpose of using marker controlled watershed transform is to overcome the pitfall of watershed transform. By using this algorithm, we can get rid of various problems like erasing the default noise present in the image. This technique can also make the image more clearly visible compared with other algorithms.

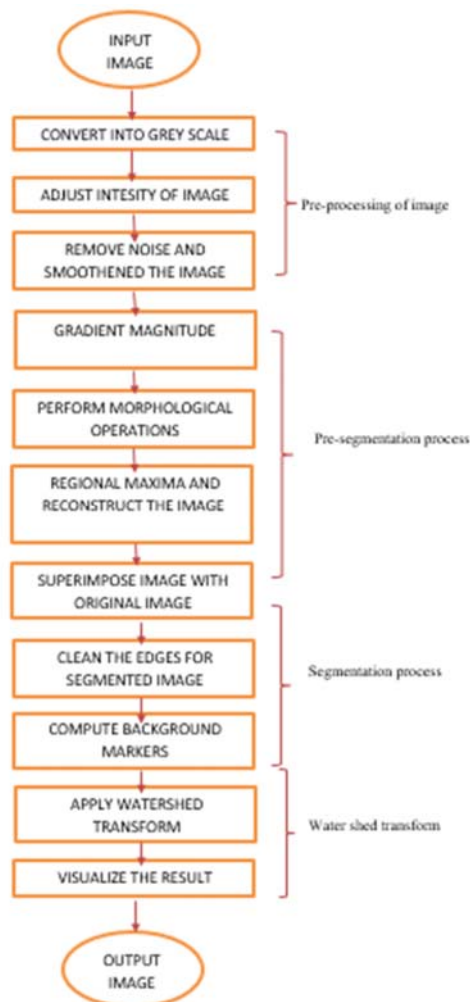The below Figure-2 shows the flowchart for watershed algorithm:

**Figure-2.**

## 5. EDGE BASED DETECTION

Edges can be defined as the unexpected changes of interruptions in an image. Edges can be classified into three types as horizontal edges, vertical edges and diagonal edges.

Most of the shape information of an image is surrounded in edges. So first we detect these edges in a flower image and by using these filters and then supplement those areas which contains edges, intensity of image will increase and thus, image becomes clearer.

We can define masks for edge detection as Prewitt operator, Sobel operator, Robinson compass masks, Robinsons mask. These filters are also called as linear filters or smoothing filters. In this paper, we used all operators for comparing with watershed transform.

### A. Prewitt operator

This operator detects two types of edges i.e., horizontal edges and vertical edges. These edges are calculated using the difference between equivalent pixel intensity of an image. This operator is also called as derivate operators or derivative masks. We have to follow

the following properties, those properties are, in image there should be an opposite value, summation of values in mask must be equal to zero and if there is more weight means there will be more edge detection.



**Figure-3(a).**          **Figure-3(b).**

The above Figure-3(a) and Figure-3(b) shows the information about grey scale image and prewitt operator output.

### B. Sobel operator

This operator is maximum similar to prewitt operator. This technique is also called as derivative mask and it's also used for edge detection. Similar to prewitt operator, sobel also have horizontal and vertical detection in an image. The main difference between sobel and prewitt operator is the coefficients are not fixed and can be adjusted according to our needs, but they should not exceed or violate any properties of derivative mask. For more edge detection we can put on weights to it, because there is no constant weight in sobel operator.

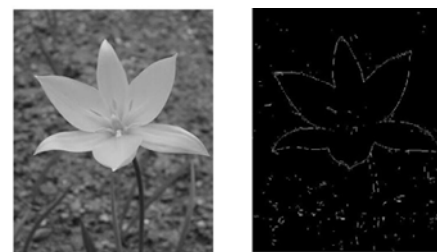The below Figure-4a and Figure-4b shows the information about grey scale image and sobel operator output.



**Figure-4(a).**          **Figure-4(b).**

### C. Roberts operator

This technique is simple, easy to perform and 2-D spatial gradient measurement on an input grey flower image. It highlights the regions having high spatial gradient, which repeatedly correspond to edges.

Figure-5(a).                Figure-5(b).

The above Figure-5(a) and Figure-5(b) shows the information about grey scale image and robberts operator output.

### D. Canny operator
This operator was designed to be a most favorable or optimal edge detection technique. There are many other techniques to be optimal with respect to different criteria. Is takes grey scale image as input and displays output image by showing tracked intensity discontinues.
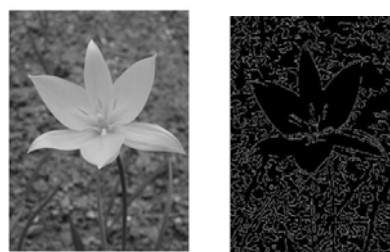


Figure-6(a).                Figure-6(b).

The above Figure-6(a) and Figure-6(b) shows the information about grey scale image and canny operator output.

### E. Zero crossing operator
This operator is also caller as laplacian operator, marr edge detector, and log edge detector. Zero crossing operators are also used to detect the edges. The difference between Robert, prewitt, sobel, canny and zero crossing operators is that these all operators are first order derivative mask and this is second order mask.
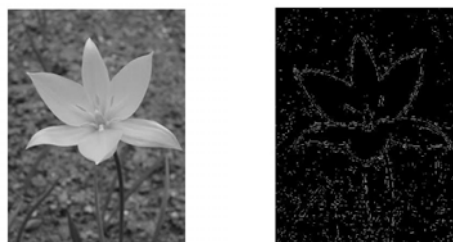


Figure-7(a).                Figure-7(b).

The above Figure-7(a) and Figure-7(b) shows the information about grey scale image and zero crossing operator output.

## 6. FUSION TECHNIQUES
These techniques are used to combine the relevant data from one or more flower images to a single image. So that it gives us more informative image. There are many fusion techniques, but we use only few (average method, minimum method, maximum method, wavelet transform method). To get more valid information we used fusion techniques and we will compare it with edge and watershed techniques. These techniques mainly depend on basic operations like addition, subtraction, averaging, it's not useful for higher level applications like thermal imaging, remote sensing. But for our flower images it produced a better result for different methods.

### a) Averaging method
This method calculates the pixel intensity of both images. In this, we can expect good pixel intensity and bad pixel intensity. It now combines them and apply average for these both pixel intensity of images. The result will be the minimized image. This method cannot generate exact value and fusion also not done perfectly.



Figure-8(a).                Figure-8(b).

The above Figure-8(a) and Figure-8(b) shows the information about grey scale image and averaging method fusion technique output

### b) Minimum method
In this method, the selection of pixel having minimum intensity value is considered. The pixel of fused flower image will be the pixel of equivalent position from input image having least intensity value. There are no operations performed here. It mostly works well on dark images.



Figure-9(a).                Figure-9(b).

The above Figure-9a and Figure-9b shows the information about grey scale image and minimum method fusion technique output.

### c) Maximum method

In this method, the selection of pixel having maximum intensity value is considered. The pixel of fused flower image will be the pixel of equivalent position from input image having maximum intensity value. There are no operations performed here. It mostly works well on dark images.
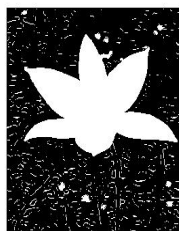


**Figure-10(a).**                **Figure-10(b).**

The above Figure-10(a) and Figure-10(b) shows the information about grey scale image and maximum method fusion technique output.

### d) Wavelet Transform:

The guide line of image fusion using wavelet transform is to consolidate the wave disintegrations of two unique images using fusion techniques connected to approximate coefficients and point of interest coefficients. The two images must be same size and should be connected with indexed image in a typical color map.



**Figure-11(a).**                **Figure-11(b).**
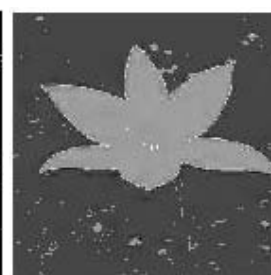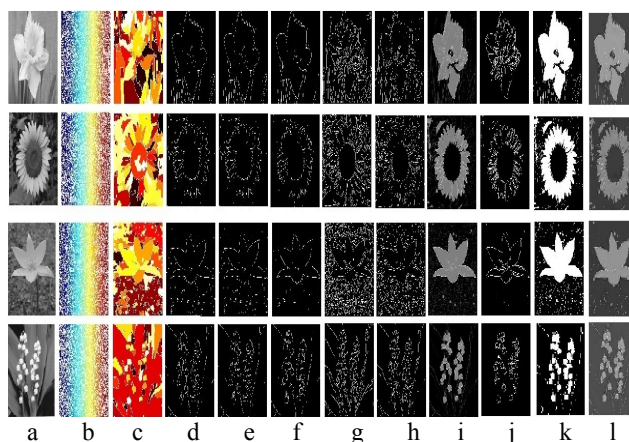


**Figure-11(c).**                **Figure-11(d).**

The above Figure-11(a) and Figure-11(b) shows the information about output of edge detection techniques and threshold image of marker controlled watershed. The Figure-11c and Figure-11d shows the information about output of wavelet transform method fusion technique output.

### 7. RESULTS



a   b   c   d   e   f   g   h   i   j   k   l

The above figure shows the information about the different images. Figure (a) image is grey scale image and Figure (b) is about the output of watershed segmentation. Figure(c) is output of marker controlled watershed. Figure (d) is the output of prewitt operator. Figure (e) is the output of sobel operator. Figure (f) is the output of robberts operator. Figure (g) is the output of canny operator. Figure (h) is the output of zero crossing operator.

Figure (d) to Figure (h) is the outputs of edge detection techniques. From Figure (i) to Figure (l) is the outputs of fusion techniques. Figure (i) is the output of averaging method fusion techniques. Figure (j) is the output of minimum method fusion technique. Figure (k) is the output of maximum method fusion technique. Figure (l) is the output of wavelet transform fusion technique.

## 8. CONCLUSIONS

We had a lot of segmentation techniques present throughout. But most of the techniques are failing to detect the flower images precisely. Our project deals with this ambiguity in order to overcome the problems that occur in watershed, marker controlled watershed, edge detection techniques. We also used some of the fusion techniques between the threshold of marker controlled watershed and edge detection techniques in order to achieve better results.

## FUTURE SCOPE

In this paper, we mainly concentrated on the detection of the shape of a flower. Furthermore, we would like to extend this paper for other specifications like colour, physical properties and so on. In future, we would like to extend this project for the recognition of flower images and later go for video processing techniques.

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