Automatic Seed Placement in Region Growing Image Segmentation

Prince Pal Singh, Computer Science and Engineering Department, Guru Nanak Dev University, Amritsar
Jaswinder Singh, Computer Science and Engineering Department, Guru Nanak Dev University, Amritsar

ABSTRACT
In this paper an automatic technique for the initial seed placement in region growing image segmentation is proposed. This method uses the centroid calculation of the different regions appeared in an image. The proposed method can withstand for almost each and every shape appear in the image. We have optimum results for the symmetric shapes as well as close to optimum results for the non symmetric lamina shapes. Proposed work is divided into two stages. In first stage we calculate the region of interest and then place the seed at the centroid of that region. In second stage our region start to grow from the initial seed until the homogeneity criteria satisfied.

Keywords: Seed Placement, Segmentation, Region Growing, Area of Interest, Centroid.

I. INTRODUCTION
In present scenario researchers are interested in specific parts of an image. These parts are known as area of interest. To explore these areas different image processing techniques are used known as image segmentation. Image segmentation is a process in which regions or features sharing similar characteristics are identified and grouped together [1]. It is a process of extracting and representing information from an image by grouping pixels together into regions of similarity. Most segmentation techniques are either region-based or edge-based:

Edge Based Segmentation
Edge based segmentation [5] [7] [4] is the location of pixels in the image that correspond to the boundaries of the objects seen in the image. As boundary of a region or an object then it is closed and that the number of objects of interest is equal to the number of boundaries in an image. An edge or a linear feature is manifested as an abrupt change or a discontinuity in digital number of pixels along a certain direction in an image. It is calculated by using gradient or first and second order derivatives. Sobel, Canny, Prewitt and Roberts are the famous edge detection methods.

Region Based Segmentation:
The region based segmentation [5] [7] [4] is partitioning of an image into similar/homogenous areas of connected pixels through the application of homogeneity or similarity criteria among candidate sets of pixels. Each of the pixels in a region is similar with respect to some characteristics or computed property such as color, intensity and/or texture. To start a region growing initial position known as “seed” must be selected based on certain criteria.

Seed Selection: In previous work [5] [6] automatic seed is selected based on the following three criteria:
1. The seed pixel must have high similarity to its neighbors.
2. For an expected region, at least one seed must be generated in order to produce the region.
3. Seeds for different regions must be disconnected

Related Work
The basic idea of region growing method [5] is a collection of pixels with similar properties to form a region. The steps are as follows:
First, we need to find a seed pixel as a started point for each of needed segmentation. And then join the other pixels based on similarity of neighbors with the initial seed pixel. These new pixels as a new seed pixel to continue the above process until no more pixels that satisfy the condition can be included.

In the practical application of this method we need to address three questions:
1. Chose or determined a group of seed pixel which can correctly represent the required region;
2. Fixed the formula which can contain the adjacent pixels in the growth;
3. Made rules or conditions to stop the growth process.

Three popular seeded image segmentation algorithms are Manual seed placement [3], Random Walk [2] and the Histogram Approach [1].
In manual approach of seed placement [3] initial seed is placed by using mouse clicks on the specific area of interest in an image. From that position region start to grow until the region is homogeneous.

The Random Walk method [2] computes for each unseeded pixel the probability that a random walker starting at that pixel first reaches the foreground or background seeds and then classifies each pixel into the corresponding group according to the maximal probability.

In histogram [1] approach initial seed placement is done on the basis of maximum peak found in the histogram. From that initial position region start growing based on homogeneity criteria.

**Problem In Existing Methods**

In all previous methods we cannot find the initial seed position automatically which is required for region growing. Also these methods take considerable calculations to grow the required region.

**Proposed Method**

Our method is divided into two stages:

**Stage I:** In this we calculate the area of interest based on background and object properties of a grayscale image. The area or region generated is used to find the centroid in order to place the seed automatically.

**Stage II:** This stage is known as region growing stage. Here our region start to grow from the initial seed placed in Stage I. Growth of region depends upon the intensity value of the neighboring pixels as well as threshold value. If the intensity value of neighboring eight pixels i.e (left, right, up, down, top-right, bottom right, top-left, bottom-left) is same and it lies in the given threshold value our region will start to grow. It also checks that previously visited pixels. If a pixel is already grown i.e part of our region it will not be visited again no matter if it comes as a neighboring pixel. This will reduce our computational overhead. When our region start to grow in stage II there is need of some stopping gradient which limits the growth of region up to the area of interest. This happens by calculating the intensity values of the neighbors. If the intensity values of the neighboring pixels changes abruptly then our region stop to grow at that point. So finally our grown region will be the required segmented region.

**Results And Discussion**

Proposed Method is applied on different grayscale images. A grayscale image passed from previously discussed stages in order to generate those final outputs. These stages predict the area of interest, automatically place the initial seed, start region growing and finally generate the output. Different outputs at different stages are shown as below:

![Input Image](image1)

Fig.1 Input Image

![Operations](image2)

Fig.2: Operations
Figure 3 shows the various operations carried out in order to find the region of interest as well as seed position. Finally, Figure 3 shows the final segmented image of a coin. Similar is the case for Figure 5, which shows the real importance of region growing. In this figure, the area of interest found is of multiple objects which is refined when it is grown. Finally, we get our segmented region of the desired object after region growing in Figure 6.

Conclusion And Future Work

Our proposed method has the potential to work with different images obtained from multiple fields. Also, it is able to overcome the shortcomings [3] of previous seed growing methods. Also, we found our area of interest as well as its boundary using few commands with slight modifications. This helps in automating the seed placement and finally, to grow the region with proper segmentation. It allows us to reduce the level of noise as well as stand well in front of the regular as well as irregular shapes appearing in the image.

Looking for the future, our proposed work relies heavily on the area of interest found in stage I. If the background and the object with a connected boundary are distinguishable from each other, we get our area of interest but problems arise when the background and foreground objects are merged together. In the future, some more efficient technique to obtain the area of interest needs to be explored.
References