e-ISSN: 2349-9745
p-ISSN: 2393-8161

Scientific Journal Impact Factor (SJIF): 1.711

International Journal of Modern Trends in Engineering and Research

www.ijmter.com

Review of Image Segmentation Techniques based on Region Merging Approach

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Abstract - Image segmentation is an important task in computer vision and object recognition. Since fully automatic image segmentation is usually very hard for natural images, interactive schemes with a few simple user inputs are good solutions. In image segmentation the image is dividing into various segments for processing images. The complexity of image content is a bigger challenge for carrying out automatic image segmentation. On regions based scheme, the images are merged based on the similarity criteria depending upon comparing the mean values of both the regions to be merged. So, the similar regions are then merged and the dissimilar regions are merged together.

Keywords - image segmentation, region-based methods, seeded region growing, clustering, region splitting.

I. INTRODUCTION

Image segmentation refers to the partition of an image into a set of regions that cover it. Main goal is to represent regions of meaningful areas of the image, such as the crops, urban areas, and forests of a satellite image. In other analysis, the regions of images might be set of border pixels and grouped into such structures as line segments and circular arc segments of 3D industrial objects. In image segmentation, an image is divided into a number of discrete regions such that the pixels have high similarity in each region and high contrast between regions; and regions may be depending as groups of pixels having both a border and a particular shape such as a circle or ellipse or polygon.

Properties like gray-level, color, intensity, texture, depth or motion help to recognize similar regions and similarity of such properties, is used to construct groups of regions having a specific meaning. Segmentation is a valuable tool in many fields including industry, health care, image processing, remote sensing, traffic image, content based image, pattern recognition, video and computer vision etc. A particular type of image segmentation method can be found in application involving the detection, recognition, and measurement of objects in an image [1].

By understanding images, the information extracted from them can be used for other tasks for example, navigation of robots, extracting malign tissues from the body scans, detection of cancerous cells and identification of an airport from remote sensing data. Now there is need of a method. With the help of which, we can understand images and extract information or objects [3,5].

Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Other type of segmentation is color-based segmentation, which this paper interested in. Image segmentation has many application for example in

medical imaging, to locate tumors, pathologies, measure tissue volumes, computer-guided surgery, diagnosis, treatment planning and study of anatomical structure or for locating objects in satellite images and it can be used for face and fingerprint recognition, traffic control systems and brake light detection and machine vision. Several general-purpose algorithms and techniques have been developed for image segmentation [6].

II. LITERATURE REVIEW

Jifeng Ning [12] described the Efficient and effective image segmentation is an important task in computer vision and object recognition. Since fully automatic image segmentation is usually very hard for natural images, interactive schemes with a few simple user inputs are good solutions. A novel maximal-similarity based region merging mechanism is proposed to guide the merging process with the help of markers.

An approach for color image segmentation is described Vijay Jumb [2]. In this method foreground objects are distinguished clearly from the background. As the HSV color space is similar to the way human eyes perceive color, hence in this method, first RGB image is converted to HSV (Hue, Saturation, Value) color model and V (Value) channel is extracted, as Value corresponds directly to the concept of intensity/brightness in the color basics section. Next an Otsu's multi-thresholding is applied on V channel to get the best thresholds from the image. The result of Otsu's multi-thresholding may consist of over segmented regions, hence K-means clustering is applied to merge the over segmented regions.

Faten Abu Shmmala [6] described the color based image segmentation is done in two spaces. First in LAB color space and second in RGB space all that done using three versions of K-Means: K-Means, Weighted K-Means and Inverse Weighted K-Means clustering algorithms for different types of images: biological images (tissues and blood cells) and ordinary full colored images.

One of the important technologies for image processing is image segmentation is described by Hydin John [7]. The complexity of image content is still a big challenge for carrying out automatic image segmentation. The user guidance can help to define the desired content to be extracted and thus reduce the ambiguities produced by the automatic methods. On this paper It discusses the various segmentation techniques for pixel based image segmentation, region based image segmentation, edge based image segmentation, and graph based image segmentation.

The conceptual details discussed V Dey [9] of the techniques are explained and mathematical details are avoided for simplicity. Both broad and detailed categorizations of reviewed segmentation techniques are provided. The state of art research on each category is provided with emphasis on developed technologies and image properties used by them.

Chen Jian, Yan Bin, Jiang Hua, Zeng Lei, Tong Li [14], proposed an improved maximal similarity based region merging technique. An improved algorithm of maximal similarity based region are used SLIC superpixels segmentation to obtain presegmented regions, using SLIC superpixles, it is easy to control the number of resegmentation regions. It also introduce the texture features differeces while rigion merging, so they can obtain the accuracy of similarity measurement.

III. REGION-BASED SEGMENTATION METHODS

It divides the entire image into sub regions depending on some rules like all the pixels in one region must have the same gray level. Region-based methods mainly rely on the assumption that is made clusters on their similarities. If the neighboring pixels within one region have similar value, then compare one pixel with its neighbors. If a similarity criterion is satisfied, the pixel can be set belong to the cluster as one or more of its neighbors. The selection of the similarity criterion is significant and the results are influenced by noise in all instances. In this section discussing the different region based segmentation methods.

3.1. Seeded Region Growing Method

The seeded region growing method is one of the simplest region-based segmentation methods. It performs a segmentation of an image on the following steps:

Step1: We start with a number of seed points, which have been clustered into n clusters and add new pixels slowly.
Step2: Select the seed pixel and the selection depends on:

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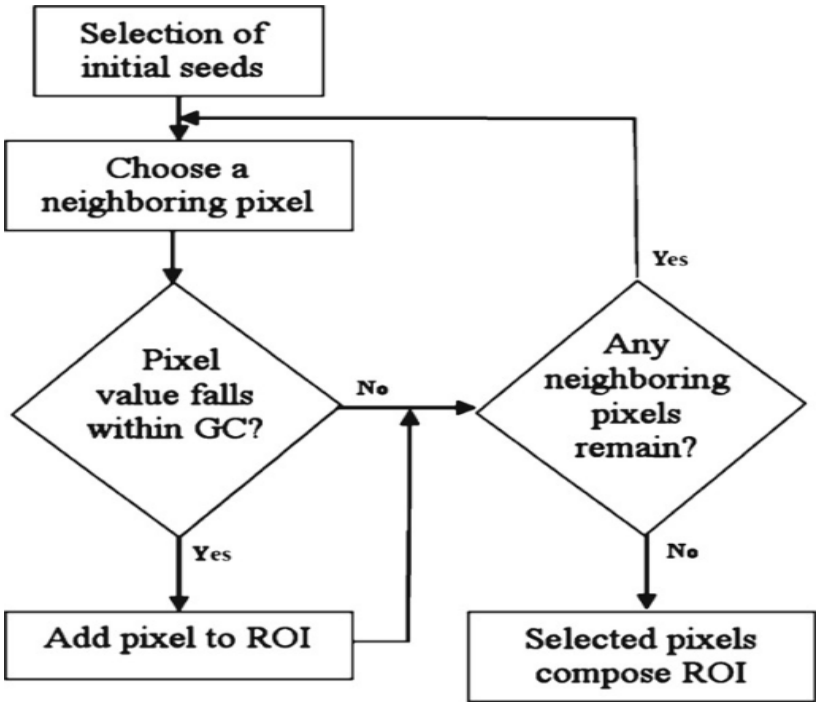
- The nature of the problem.
- If targets need to be detected using infrared images for example, choose the brightest pixel.

Step3: Check the neighboring pixels and add them to the region if they are similar to the seed.
Step4: Repeat Step3 until all pixels in image have been allocated to a suitable cluster. for each of the newly added pixels;
Step5: Stop if no more pixels can be added.

Drawbacks:

- The initial seed-points problem means the different sets of initial seed points cause different segmentation results. And it reduces the stability of segmentation results from the same image.
- It is time-consuming because SRG requires lots of computation time.



3.2. Unseed Region Growing Method

Their distinction is that no explicit seed selection is necessary. In the segmentation procedure, the seeds could be generated automatically. So this method can perform fully automatic segmentation with the added benefit of robustness from being a region-based segmentation. The steps of unseed region growing method are as below.

Step1: We start with a number of seed points, which have been clustered into n clusters and add new pixels slowly.
Step2: Initializes the first cluster with a single image pixel and each image pixel classify into different clusters.
Step3: Select a pixel from image and check it.
Step4: Each pixel value assign to a cluster.
Step5: After each pixel has been allocated to the cluster, the mean pixel value of the cluster must be updated.
Step6: Iterate Step2 to 5 until all pixels have been assigned to a cluster.

3.3. Region Splitting and Merging

The main issue of region splitting and merging is to distinguish the homogeneity of the image, Its work on two steps: first the image is split depending on some criterion and then it is merged. The whole image is initially considered as a single region then some measure of internal similarity is computed using standard deviation. If too much variety occurs then the image is split into regions using thresholding. This is repeated until no more splits are further possible. Quad tree is a common data structure used for splitting. Then comes the merging phase, where two regions are merged if they are adjacent and similar. Merging is repeated until no more further merging is possible. The major advantage of this technique is guaranteed connected regions. Quad trees are widely used in Geographic information system.

Merits:

a. Images can be split continuously according to required resolution.
b. We can split the images also on the basis of classification.
c. The merging approach is different from splitting approach.

Demerits:

a. It may produce the blocky segments.

3.4 Maximal Similarity based Region Merging:

The image is to classify into homogeneous regions for merging. A region can be described in many aspects, such as the color, edge, texture, shape and size of the region. The region merging based segmentation, color histogram is more robust than the other feature descriptors. Maximal similarity based region merging approach work on following steps.

Step1: Select an image, and classify on the basis of their features such as the color, edge, texture, shape and size of the region.
Step2: Find the homogeneous regions from selected image.
Step3: Mark the regions as object and background regions.
Step4: Determine the similarity between the unmarked regions with the help of marked regions.
Step5: Each similar region group put into different clusters.
Step6: Repeat step 2 to 5, until scan the each pixel of an image.
Step7: stop.

IV.CONCLUSION

There have been many image segmentation methods created and being created using many distinct approaches and algorithms but still it is very difficult to assess and compare the performance of these segmentation techniques. The initial seed points cause different segmentation results. And it reduces the stability of segmentation results from the same image. Seed point method is a time consuming process.

With the Maximal Similarity based Region Merging rule, a two stage iterative merging algorithm was presented to gradually label each non-marker region as either object or background. The proposed scheme efficiently exploits the color similarity of the target object so that it is robust to the variations of input markers. In the context of region merging based segmentation, color histogram is more robust than the other feature descriptors. This is because the initially segmented small regions of the desired object often vary a lot in size and shape, while the colors of different regions from the same object will have high similarity.

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