Review on different Techniques of Image Segmentation using MATLAB

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Abstract

Image segmentation denotes a process of partitioning an image into distinct regions. A large variety of different segmentation approaches for images have been developed. Segmentation is a process of extracting and representing information from an image is to group pixels together into regions of similarity. The segmentation is a very important stage in images and interpretation processing. There are two main approaches to segmentation: the frontier approach and the region approach.

Keywords: Image Segmentation, Segmentation Methods, Clustering, Image processing, Thresholding Methods, Edge based Methods

Introduction

Image processing covers various techniques that are applicable to a wide range of applications. Image processing can be viewed as a special form of two-dimensional signal processing used to uncover information about images. Among various image processing tasks, segmentation can be viewed as the first essential and important step of low level vision. Image segmentation is a process by which an image is partitioned into non-intersecting regions.

These regions have two properties:

1) Homogeneity within a region, i.e., the texture or color in a region should be as similar as possible, and

2) Heterogeneity between the regions, i.e., texture or color that in one region should be distinct from those in another region.

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation [1] is typically used to locate objects and boundaries in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image.

The goal of image segmentation is to cluster pixels into salient image regions, i.e., regions corresponding to individual surfaces, objects, or natural parts of objects. Segmentation could be used for object recognition, occlusion boundary estimation within motion or stereo systems, image compression, image editing, or image database look-up.

Segmentations of simple gray-level images can provide useful information about the surfaces in the scene.

Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic. According to segmentation method, we can approximately categorize them into region-based segmentation, data clustering and edge base segmentation. Image segmentation is useful in many applications. It can identify the regions of interest in scene or annotate the data. Region-based segmentation includes the seeded and unseeded region growing algorithms. The goal of segmentation is typically to locate certain objects of interest which may be depicted in the image, segmentation could therefore be seen as a computer vision problem.
Figure 1: The quality of the segmentation depends on the image.

Literature Survey

Narayan Subudhi et al., 2015 illustrates countless methods are obtainable into the literature. Based on several experiments among the most accepted methods is span growing. Research on period producing, though, has concentrated chiefly in the design of feature extraction as well as on creating and criterion that is merging. Most of these methods have dependence that is inherent the order in that the points and spans are examined. This flaw implies that segmented consequence is sensitive and painful to the selection of the early points that are producing prone to over-segmentation. This paper presents a framework that is novel circumventing anomalies like over-segmentation. In this article, we now have counseled frontier segmentation that is for maintaining the segmenting aerial images. This way implicates the preservation of boundaries ahead of segmentation of photos, thus noticing perhaps the discontinuities that are frail.

Christopher Herbon et al., 2014 There have currently been improvements in the span of fully detection that is automatic of objects in color images. State regarding the art that is fine joins detection alongside segmentation. In this paper we display why these methods can be significantly enhanced by familiarizing a new association that is iterative statistical modeling, and segmentation procedure. The technique that is counseled a detect-and-merge algorithm, that iteratively ands and validates new objects and later updates the statistical ideal, as meeting in extremely insufficient iterations.

R. Loganathan et al., 2013 addresses health image compression, as extra and wellness that is extra are digitized, frugal and competent information compression technologies are demanded to minimize the storage volume of wellness database in hospitals. The Expanse of Attention (ROI) – representing the diseased portion - in a health picture is segmented using alert contours in this paper. The ROI removed are next compressed employing compression that is lossless uphold the integrity. A novel Biorthogonal wavelet and Embedded Zero Tree (EZW) is counseled for compression technique. Experimental aftermath clarify that the technique that is counseled enhances the Top Gesture to Sound Ratio (PSNR) for the wellness image compression.

M. Lalitha et al., 2013 The aim of this survey on disparate clustering practices is to accomplish photo segmentation. Clustering can be termed here as a gathering of comparable images. The intention of clustering is to become consequence that is significant competent storage and quick retrieval in various areas. The goal is to furnish a report that is self-contained of thoughts and also the math underlying clustering techniques. Next the clustering methods are given, tear into: hierarchical, partitioning, density-based, model-based, grid-based, and methods that are soft-computing. The purpose of this study is to furnish a study that is comprehensive of clustering and picture segmentation techniques. As a result of significance of photo segmentation and clustering a true number of algorithms have been counseled but founded in the image that is inputted the algorithm ought to be selected to get to be the best results.

Hakeem Aejaz Aslam et al., 2013 presents a way that is new picture segmentation using Pillar K-means algorithm. This segmentation method includes a mechanism that is new gathering the agents of elevated resolution pictures in order to improve accuracy and cut the computation time. The arrangement uses K-means for picture segmentation optimized by the algorithm later Pillar. The Pillar algorithm considers the arrangement of pillars should really be placed as remote from every supplementary that is single challenge the stress allocation of a rooftop, as alike as the range centroids amid the data circulation. This algorithm is able to optimize the K-means clustering for picture segmentation within the aspects of computation and accuracy time. This algorithm distributes all early centroids based on the maximum distance that is cumulative. This paper evaluates in the way which counseled picture segmentation by contrasting alongside K-means clustering algorithm with level set method and Gaussian combination. Experimental after math elucidate the effectiveness of our way to enhance the segmentation accuracy and quality aspects of computing time.

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**Proposed Methodology**

**Thresholding Methods**

Makes decisions based on information from local pixels and is effective when the intensity levels of the objects fall squarely outside the range of background levels. Because spatial information is ignored, however, the boundaries blurred region can wreak havoc. Boundaries and borders region are closely linked, because there is a strong coordination on the edge of the area. Therefore, edge detection techniques have been used as the basis for the other segmentation technique. The edges identified by edge detection are often disconnected. Limits of a closed segment of the object regions are required to from an image. Discontinuities are bridged if the distance between the two edges is a predetermined threshold.

**Edge based Methods**

These Methods mainly centered around the edge detection. Weakness in connecting together broke contour lines which make it as prone to failure in the presence of blur.

**Region based Methods**

A method based on the region generally proceeds as follows: the image is divided into connected regions by grouping neighboring pixels of similar levels of intensity. Adjacent regions are then merged under some criterion involving perhaps homogeneity or sharpness of borders in the region. More stringent criteria result in fragmentation, given the blurred boundaries and light fusion.

**Split and Merge Methods**

Split-and-merge Segmentation is based on a partition of the quad tree of an image. Sometimes called quad tree segmentation. This process starts at the root of the tree representing the entire image. If it is non-uniform (homogeneous), and is divided into four square children (division process), and so on so forth. Conversely, if square four children are homogeneous, that can be combined in several connected components (melting process). The node of the tree node is a segmented. This process continues recursively until no splits or mergers are possible.

**Implementation**

1. Implement the methodology to segment the grey-level images.

2. Test on few images. Illustrate this results by showing the segmented images where the regions are displayed in different grey values.

3. Extent this algorithm to color images and test on few exemples.

4. Do initial centroid positions have an influence on the result?

5. How does the choice of the result?

6. How does the choice of the stopping threshold influence the result?

7. To improve the result, we propose to take into account the color of each pixel and its position. The color image is then represented in a 5D space (R,G,B,line, column). Implement and test the proposed method to segment the images with this new representation.

![Flow chart of the proposed method.](image-url)

**Figure 2.** The schematic flow chart of the proposed method.

![Color described image in RGB](image-url)

**Figure 3:** Color described image in RGB

To each pixel of an image is associated its color described in RGB. The image to be segmented can then be represented as a set of points in a 3D data space, as illustrated in the following figure. In case of a grey-level image, the procedure is the same apart from the fact that the image is represented as a set of points in a 1D space.
Conclusion

The proposed segmentation approach can automatically determine the proper number of regions. On the other hand, the representative gray levels of regions are also determined, and then a partitioning of the given image is done. The proposed approach can actually find the appropriate number of regions as well as proper segmenting of an image. The segmentation results are more continued and smoother than dynamic thresholding. These results are useful to doctors for recognizing organs and tissues correctly, thus enhancing their diagnostic efficiency and minimizing their workload in medical image analysis.

References


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