

Abstract

This paper has presented a evaluation of some well-known image segmentation techniques. The segmentation process; divides a given image into distinct regions and objects. It has become more popular due to its various vision applications. The main objective of this study is to explore various algorithms of image segmentation. The short comings of earlier work on image segmentation algorithms have also been evaluated. The main focus of this paper is on the clustering based segmentation techniques.

Keywords: Image Segmentation, Clustering

Introduction

An image can be referred as a two-dimensional function, $f(x, y)$, where x and y represents are spatial coordinates, and the amplitude of at any pair of coordinates is called the intensity of the image at that point very particular point. When the intensity of f and the value of x, y are finite then the image is called digital image.[11]

Image Segmentation is an important process of image processing and understanding. Basically it is defined as the process of dividing the image into different parts of homogeneity. The aim of image segmentation is to simplify the representation of an image into something that is more meaningful and easier to understand.

It is basically used to find the location of objects, boundaries, lines etc. in the digital images. More precisely, image segmentation is the process of assigning a label to every pixel in the image such that pixels with the same label share certain visual characteristics or features.[7]

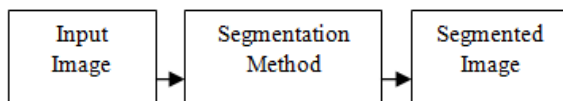


Fig 1.1 Process Of Image Segmentation

The result of image segmentation is a set of regions that together cover the entire image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, texture and intensity. Adjacent regions are significantly different with respect to the characteristics.

Image Segmentation Methods

Image segmentation is a process of dividing an image into different regions such that each region is nearly homogeneous. There are many methods available which are used for image segmentation to better understand the image processing. The following are some of the image processing methods that have been explained

Histogram Thresholding Based Methods

In histogram thresholding method operation of converting a multilevel image into a binary image is performed, where it assigns the value of 0 (background) or 1 (objects or foreground) to each pixel of a digital image based on a comparison with some threshold value T (intensity or color value). If the T is constant, the approach is called global thresholding otherwise, it is called local thresholding.

Global thresholding methods can fail when the background illumination is uneven so to compensate for this uneven illumination we can use multiple thresholds and the threshold selection is typically done interactively. These methods are popular because of their simplification and efficiency. The problems that arise in this kind of method is that basic histogram based thresholding algorithm do not process those images which have histograms that are unimodal when the target segment is much smaller than the background area.

Edge Detection Based Methods

Edge detection method is widely used in the field of medical image segmentation. This method helps to locate the pixels in the image that correspond to the edges of the objects seen in the image and the

result is a binary image with the detected edge pixels. The algorithms that are commonly used are Sobel, Prewitt and Laplacian operators. These algorithms are best applied to images that are simple and do not carry any noise. But this method does not work well when images have too many edges and noise so it will be unable to identify a closed boundary easily

Graph Partitioning Methods

Graph partitioning method is very useful method for image segmentation. In this method, the image is described as a undirected graph. The pixel or a group of pixels are related with nodes and edge weights which define the related similarity between the neighbourhood pixels. The graph or image is segmented according to a criteria designed to model clusters. The output is represented as an object segment in the image. The most common graph partition method is normalized cut.

Region Based Methods

The region-based segmentation is the technique that is used to find regions directly. It uses image characteristics to map individual pixels in an input image and change with the sets of pixels called regions that might correspond to an object or a meaningful part. There are various techniques through which this kind of segmentation is implemented such as region growing ,region splitting and merging. Region Growing is a procedure that collects the pixels or sub regions into larger regions based upon some predefined criteria. The basic way is to start with the set of seed points and from these grow the regions by appending to each seed those neighbouring pixels that have predefined properties similar to the seed. There is also another technique for region based segmentation that is region splitting and merging in which there is parameter R which represents whole image region and a predicate Q which further subdivide the image into small regions.[3]

Clustering methods

Clustering method is a process in which a data set or say pixels are replaced by cluster, pixels may belong together because of the same color, texture etc. The famous clustering techniques are log-based clustering and hierarchical clustering. In log based clustering, the cluster which is obtained are based on the retrieval system. The log based technique failed in the case of multidimensional images. So to overcome the disadvantages of this technique hierarchical clustering come into existence .[7] It is a process in which different images are

integrated and build as cluster in the form of tree. The following are some of the types of clustering method

K-means Clustering Methods

The k-means clustering method is of two types one is non-adaptive version proposed by Lloyd and an adaptive version introduced by MacQueen. Adaptive version is most commonly used which further based on the Euclidean distance. [3] K – means clustering is an iterative technique that is used to partition an image into clusters in which there is choice of k cluster centres, randomly or heuristic then each pixel in the image is assigned to the cluster. The cluster centres is recomputed by averaging all of the pixels in the centre. The quality of solution obtained from this method depends upon the initial set of clusters and the value of k.

C-means Clustering Method

The segmentation needs partitioning of images into different cluster with similarity. [6] It is fuzzy clustering method where every point has a degree of belonging of clustering as in fuzzy logic, rather than belongs to just one cluster. In this centroid of a cluster is the mean of all points, weighted by then degree of belonging to the cluster. It is also called soft k-means clustering method.

FELICM

It stands for Fuzzy C-Means with Edge and Local Information, which introduce the weights of pixels within local neighbours windows to reduce the edge degradation. [1] Basically this method has somehow tried to overcome the isolated distribution of pixels inside segments of image. The basic process of FELICM is that in this method firstly the original image is being converted into gray image and then the principal components analysis is taken. Then in the next step edges are obtained by adjusting two threshold values that is a high threshold value and low threshold value in canny edge detection algorithm. After analyzing the edges ,different weights are set to the neighbours within the local windows. Then the clustering is done with the FELICM method by using the spatial and spectral information

Mean Shift

It is an advanced technique for clustering based segmentation. It is a non-parametric iterative algorithm. It is implemented through kernel density estimation which is a non-parametric way to estimate the density of a random variable. It is somehow

popular method for estimating probability. For each data point, mean shift defines a window around it and computes the mean of data point. Then it shifts the centre of window to the mean and repeats the algorithm till it converges.

Related work

FELICM [1] decreases the edge degradation by adding the weights of pixels within local neighbour windows. The canny edge detection is used for edge extraction, adaptive threshold values. The FELICM based method could be directly applied without using the filters. The FELICM approach has delivered the better results with respect to fuzzy c means clustering method and mean shift approach. The benefits of Spatial Fuzzy C-means (SFCM) [2] is that it overcomes the limitation of conventional FCM towards noisy image have been discussed. Thresholding by Fuzzy C-means (THFCM) [2] approach has solved the problem of existing method to determine a threshold for excellent segmentation.

The k-means clustering [3] method is an iterative technique that is used to partition an image into clusters in which there is choice of k clusters along with the types of clustering that is hierarchical clustering and partitioned clustering. The region growing segmentation [4] is partitioning of an image into homogeneous connected pixels. Each pixel in the region is similar due to some property such as color and texture.

FCM [5] based method basically sensitive to noise. A new modified fuzzy c-means clustering [6] with spatial information for image segmentation is used for the better results as compared to FCM [5]. The fuzzy local information C-means (FLICM) [7] can remove the shortcomings of the already known fuzzy c-means algorithms [5], [6]. FLICM [7] has used fuzzy local information like spatial and gray level which guarantee noise sensitiveness and robustness to noisy images

Gaps In earlier work

The survey has shown that the most of image segmentation techniques based upon clustering has certain limitations and they are as follows.

1. Mixed regions: Most of the existing techniques have focused on the complex regions. Not much work done for the images with mixed regions.

2. Principal region extraction: The effect of the regions on the segmentation has been neglected by many researchers.

3. Effect of color: The effect of the color on the segmentation results has also been neglected by many

researchers during implementing the segmentation algorithms using various techniques.

Conclusion & future work

Image Segmentation is an important process of image processing and understanding. Basically it is defined as the process of dividing the image into different parts of homogeneity. The aim of image segmentation is to simplify the representation of an image into something that is more meaningful and easier to understand. Clustering based method is a process in which a data set or say pixels are replaced by cluster, pixels may belong together because of the same color, texture etc. The survey has shown that of the existing techniques have focused on the complex regions. Therefore not much work has been done for the images with mixed regions. The effect of the regions on the segmentation have been neglected by many researchers. The effect of the color on the segmentation results has also been neglected.

In near future an integrated approach can be used to get the better results with image segmentation methods which will help to overcome the disadvantages of previously existing methods.

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