IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

A Review on Techniques of Image Segmentation

Ms. Kabade Mankarnika Manohar[1], Prof. Mrs. A. S. Patil[2]

Student, E&TC Department, PVPIT, Bavdhan, Pune, India

Asst. Professor, E&TC Department, PVPIT, Bavdhan, Pune, India

Abstract: Image segmentation is a classic & vital issue in image processing. It has been the hotspot for the researchers in the area of image processing. Segmentation is nothing but the process of dividing the image into multiple segments. The main aim is to make image more simple & meaningful. It also helps to find region of interest in a particular image. In this paper, we have covered a review on various segmentation techniques such as thresholding, edge based segmentation, region based segmentation, and clustering approach.

Keywords: Image segmentation, Image processing, thresholding, clustering.

1. INTRODUCTION

Segmentation is a one of the interesting area of research for image processing. Images are considered as most important medium of conveying information. To understand the image, to extract the information and use of that information for other tasks is an important aspect of machine learning. One of the important steps in direction of understanding the image is to segment them. It is the process of dividing the image into homogenous region with respect to certain features & which hopefully correspond to real objects in actual scene.

Image segmentation is the foundation process in which we divide the image into disjoint regions that are meaningful. The goal is to cluster pixels into regions corresponding to individual surfaces, objects/natural parts of object. We divide the whole image into multiple segments which are set of pixels, pixels in a region are similar to each other in some criteria, so as to locate & identify objects and corresponding boundaries in an image. In segmentation, value is assigned to every pixel in an image such that pixel with the same value share certain characteristics in a particular region. In general, segmentation is defined as the basic step in image processing that subdivides a digital image f(x, y) into its continuous, disconnect and non-empty subset f1, f2, f3….fn which provides convenience.

Example of segmentation:

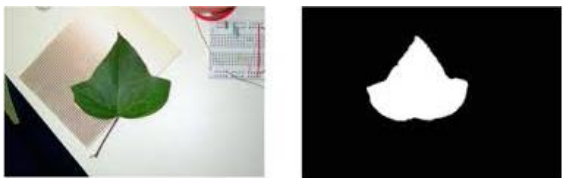

Figure1: I/P image with segmented image

2. IMAGE SEGMENTATION TECHNIQUES

There are some commonly used technique for image segmentation such as edge detection, Threshold, Histogram, Region based and clustering. We divide the image into two parts. One part is related to region of interest and other one is rest of the part of the image. So we use segmentation to separate these two parts. The result which we get from image segmentation is used for various applications such as filtering of noisy images, medical applications, locate objects in satellite images (roads, forests, etc), face recognition, fingerprint recognition, etc.

Different techniques of image segmentation are:

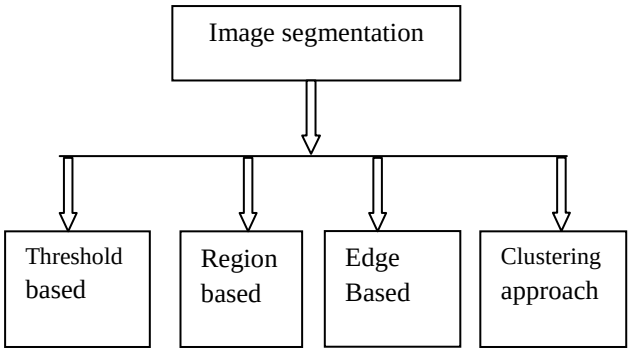

Figure2: different segmentation techniques

a. Threshold based

Thresholding is an old, simple and popular technique for image segmentation. Image segmentation by thresholding is a simple but powerful approach for segmenting images having light objects on dark background. Thresholding operation convert a multilevel image into a binary image i.e., it choose a proper threshold T, to divide image pixels into several regions and separate objects from background. Any pixel(x, y) is considered as a part of object if its intensity is greater than or equal to threshold value i.e., $f(x, y) \geq T$, else pixel belong to background. There are two types of thresholding methods. They are categorized asglobal and local thresholding. If T is constant then it is known as global thresholding otherwise it is local thresholding. Global thresholding methods can fail when the background illumination is uneven. In local thresholding, multiple thresholds are used to compensate for uneven illumination. There are certain disadvantages of thresholding method. Only two classes are generated, and it cannot be applied to multichannel images. Thresholding does not take into account the spatial characteristics of an image so it is sensitive to noise. This

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

corrupts the histogram of the image, making separation more difficult.

a. 1 Threshold selection

Segmentation using thresholding technique is the choice of selecting threshold value T. Automatically selected threshold value for each image by the system without human intervention is called an automatic threshold scheme. In case of automatic threshold selection method, the value of T can be chosen based on histogram, clustering, variance, means etc.

a. 2 Histogram Based Threshold selection

The histogram based technique is dependent on the success of the estimating the threshold value that separates the two homogenous region of the object and background of an image. Histogram based thresholding is applied to obtain all possible uniform regions in the image. Let P1 and P2 be the gray value of the peaks of the histogram. The threshold value T is given by eq. (1)

$$T = (P1+P2)/2 \quad (1)$$

a. 3 EMT Technique

The threshold image by using edge maximization technique (EMT) is used when there are more than one homogenous region in image or where there is a change on illumination between the objects and its background. In this case portion of the object may be merged with the background or portion of the background may as an object. For this reason any of the automatic threshold selection techniques performance becomes much better in images with large homogenous and well separated regions. This method depends on the research about the maximum edge threshold in the image to start segmentation that image with help the edge detection techniques operators.

b. Edge based

This type of segmentation represents a large group of methods based on information about edges in the images. This segmentation rely on edges found in an image by edge detecting operators –these edges mark image locations of discontinuities in gray level, color, texture, etc. Segmentation based on discontinuities find for abrupt changes in the intensity value. These methods are called as edge or boundary based methods. Edge detection is generally used for finding discontinuities in gray level images.

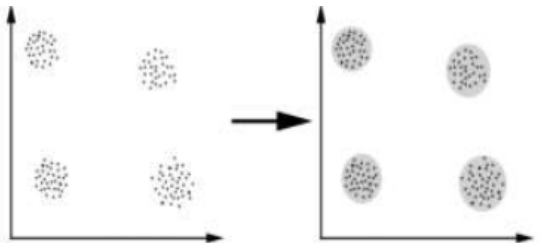

Fig2. Clustering

There are many methods for edge detection, but most of them can be grouped into two categories viz search based and zero-crossing based. The search based method detects edges by first computing a measure of edge strength, usually a first-order derivative expression. The zero-crossing based methods search for zero crossings in a second order derivative expression computed from the image in order to find edges.

b.1 1st Order Derivative

1) **Prewitt operator**-The Prewitt operator is used in image processing particularly within detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Prewitt operator is either the corresponding gradient vector or the norm of this vector.

The Prewitt operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation which it produces is relatively crude, in particular for high frequency variations in the image. The Prewitt operator was developed by Judith M. S. Prewitt.

2) **Sobel Operator**-It is discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the sobel operator is either the corresponding gradient vector or the norm of this vector. The sobel operator is based on convolving the image with a small separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations.

3) **Canny operator-** The canny edge detection is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It was developed by john in 1986.Canny also produced a computational theory of edge detection explaining why the technique works.

b.2. 2nd Order Derivative

1) **Laplacian operator**- There exist a point where there is a zero crossing. That point is the edge's location. Edge detectors that are based on this idea are called Laplacian edge detectors.

2) Zero-crossing- In the field of digital image processing, great emphasis is placed on operators which seek out areas of rapid change in pixel value. This point usually marks an edge or a boundary. A Laplace filter is a filter which seeks out points in the signal stream where digital signal of an image passes through a pre-set'0' value, and marks this out as a potential edge point. Because the signal has crossed through the point of zero, it is called a zero-crossing.

c) Region based segmentation

Region based segmentation is simple as compare to other methods and also noise resilient. It divides an image into different regions based on pre-defined criteria, i.e. color, intensity, or object. Region based image segmentation are categorized into three main categories, i.e. region growing, region splitting, and region merging.

d) Clustering

One natural view of segmentation is that we are attempting to determine which components of a data set naturally "belong together". This is a problem known as clustering. Clustering is an unsupervised learning task, where one needs to identify a finite set of categories known as clusters to classify pixels. Principle of clustering is maximizing the intra class similarity and minimizing the interclass similarity. Clustering is to get meaningful result, effective storage and fast retrieval in various areas.
Two popular methods of clustering are-

D.1. K-means clustering
K-means algorithm is an unsupervised clustering algorithm that classifies the input data points into multiple classes based on their inherent distance from each other. In k means algorithm data vectors are grouped into predefined number of clusters, at the beginning the centroids of the predefined clusters are initialized randomly. The dimensions of the centroids are same as the dimension of the data vectors. Each pixel is assigned to the cluster based on the closeness; the mean of each cluster is recalculated. This process is repeated until no significant changes result for each cluster mean or for some fixed number of iterations. [5]

D.2 Fuzzy clustering
Fuzzy c-means (fcm) is a clustering technique in which a data set is grouped into n clusters with every data point in the dataset belonging to every cluster to a certain degree. Fuzzy clustering method can be considered to be superior to those of their hard counterparts since they can represent the relationship between the input pattern data and cluster more naturally. Fuzzy c-means is a popular soft clustering method; its effectiveness is largely limited spherical clusters. Fuzzy c-means is one of the most promising fuzzy clustering methods. In most cases, it is more flexible than the corresponding hard-clustering algorithm.

3. CONCLUSION

In this review of image segmentation study, the overview of various segmentation methodologies applied for digital image processing is explained briefly. Though many techniques are developed, not all types are useful for all types of images. It is found
That there is no perfect method for image segmentation because the result of image segmentation is depends on many factors, i.e. pixel color, texture, intensity, similarity of images, image content and problem domain. Therefore, it is not possible to consider a single method for all types of images nor all methods can perform well for a particular type of image.

REFERENCES

[1] Jay Acharya1, Sohil Gadhiya2, Kapil Raviya3," Segmentation Techniques for image analysis: A Review", Vol 2 Issue, 1 January 2013
[2] Muhammad Waseem Khan, "A Survey: Image Segmentation Techniques", International Journal of Future Computer and Communication, Vol. 3, No. 2, April 2014
[3] H.P. Narkhede, "Review of Image Segmentation Techniques" Volume-1, Issue-8, July 2013, IJISME
[4] Punam Thakare, "A Study of Image Segmentation and Edge Detection Techniques", IJCSE
[5] Fari Muhammad Abubakar1, "Study of Image Segmentation using Thresholding Technique on a Noisy Image", IJSR