Image Segmentation

1Jyoti Hazrati, 2Kavita Rawat, 3Khush Batra

Dronacharya College Of Engineering, Farrukhnagar, Haryana, India

Dronacharya College Of Engineering, Farrukhnagar, Haryana, India

Global Institute Of Technology And Management, Farrukhnagar, Haryana, India

KEYWORDS:

Segmentation,thresholding,intensity,pixel,detection,image.

ABSTRACT:

In computer vision, many techniques are used to simplify or change the representation of an image into something that is more meaningful and easier to analyse. **Image segmentation** is the process of subdividing a digital image into multiple segments known as super pixels. 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 aspect . Its result is a set of segments that collectively encompass the whole image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as colour, intensity. In this survey, we have discussed various applications of image segmentation as well as many techniques being used for this process. So, the work about image analysis becomes much better.

1 .INTRODUCTION:

Image segmentation is the process of partitioning a digital image into multiple segments known as super pixels. It encompasses a huge range of techniques being implemented for large range on applications.In segmentation, image is subdivided into its constituent regions or objects that have similar features according to a set of predefined criteria. These features may be colour, intensity, energy or texture. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. In image segmentation a label is assigned to every pixel in an image such that pixels with the same label share certain visual characteristics. In this process, pixels are clustered into salient image regions. The overall result of image segmentation is a collection of segments that altogether cover the entire image.

2. ALGORITHMS:

Algorithms for segmentation generally are based on:

- discontinuity : to partition an image based on sharp changes in intensity
- Similarity: It is used to partition an image into regions that is similar according to a set of predefined criteria.

3. Detection of discontinuities:

There are 3 basic types of gray-level discontinuities .These are:

1. Points
2. Edges
3. Lines

Image is segmented along these discontinuities.

4. SEGMENTATION TECHNIQUES :

We have reviewed the studies based on finding object regions in grey-level images. This process has been approached from a wide variety of perspectives in our survey; we have included many techniques for image segmentation. Some of these are :
Thresholding ,tree based segmentation, region based segmentation, edge based segmentation and Clustering,
Neutral networks for segmentation, and some other approaches.

A. THRESHOLDING :

The simplest method of image segmentation is called the thresholding method. It is the best approach to choose the best intensity thresholds to use by analysing the grey-level histogram. This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image. Ohlander proposed a constructing colour and hue histogram technique that is much useful for segmenting coloured images. The key of this method is to select the threshold value (or values when multiple-levels are selected.When the intensity distribution of objects and background pixels are clearly distinct it is desired to use a global (single) threshold over the entire image.

A.1 GLOBAL THRESHOLDING:

In global thresholding, the same threshold is applied to the whole image. It is successful in highly controlled environment.

A.2 LOCAL THRESHOLDING:

In local thresholding, threshold depends on local property such as local average.In this method, we divide images into regions and then perform thresholding effects individually in different regions.

A.3 ADAPTIVE THRESHOLDING:

In this type of thresholding, the threshold depends on the spatial coordinates.The image is first divided into sub-images and then these are threshold.

B. POINT DETECTION OR PIXEL DETECTION:

Point detection is the best approach for segmentation. An isolated point is detected at the location on which mask is centered if |R| > T, WHERE R: spatial filtering result, T: nonnegative threshold. This filter is a high pass spatial filter. The filter detects a point whose gray level is significantly different from its background.

C. EDGE BASED DETECTION:

[2]Pixel based segmentation result in measurement mistakes of the size of the segmented objects when objects show variations in their gray values. It is the major problem with pixel based segmentation that the darker objects will become too small and brighter images too large. So, edge based segmentation can be used to avoid a bias in size of the segmented image without using a complex thresholding scheme.

The size variations result from the fact that the gray values at the edge of an object change only gradually from the background to the object value. No bias in the size occurs if we take the mean of the object and the background gray values as the threshold. However, this approach is only possible if all objects show the same gray value or if we apply different thresholds for each object.
Edge-based segmentation is based on the fact that the position of an edge is given by an extreme of the first-order derivative or a zero crossing in the second-order derivative.

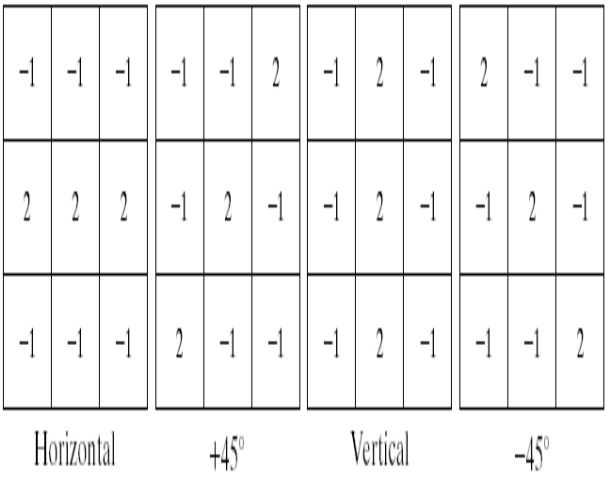
Edge detection is the approach basically used for segmenting images based on abrupt (sudden) changes in intensity.

We define a point in an image as an **edge point** if its two-dimensional first-order derivative is greater than a specified threshold.
A collection of the points which are connected according to a predefined criterion of connectedness is known as an edge**.** The phrase **edge segment** generally is used if the edge is short in relation to the dimensions of the image. Edge detection is most commonly used for detecting meaningful discontinuities.
According to the intensity profile, edge models are basically classified into three different types:

1. Step- edge
2. Ramp-edge
3. Roof edge

D. LINE BASED SEGMENTATION OR LINE DETECTION :

For line detections we can expect second derivative to result in a stronger response and to produce thinner line than first derivative. The double line effect of second derivative must be handled properly in lined detection.
It is sensitive to sudden changes and thin lines. Second derivative can have negative results and we need to scale the results. The Palladian is isotropic.It means that it is independent of direction.If we would like to detect lines on a certain direction only we might want to use masks that would emphasize certaindirection and be less sensitive to other directions.



E. REGION-BASED SEGMENTATION:

This method is yet another a good technique for image segmentation in this method a set of seeds is taken as input along the image.The purpose of the seed is to mark every ocject which is required to be segmented. These regions are then repeatedly grown by comparing all unallocated neighbouring pixels to the specified regions. The difference between intensity value of the pixel and the region's mean δ is used as a measure of analogy.[5] The pixel which is having the smallest difference by measuring this way is allocated to the respective region. This whole process is taken along until all pixels are allocated to a region.

a) Region- growing :

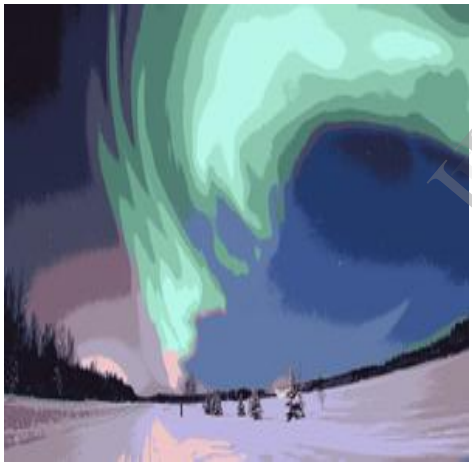
This category of segmentation techniques is based on the homogeneity of spatially localized features like intensity, texture values etching this algorithm, one or more pixels are taken called seeds and a region is then grown around them based upon a specific homogeneous criteria. The pixels similar to the seeds are merged within a single region.
This process is then applied to every group of pixels until all pixels get a specified region.

b) Clustering Method

In this method, each pixel in the image is assigned to the cluster that minimizes the distance between the pixel and the cluster centre. Cluster analysis show the partitioning of data into meaningful subgroups and can be applied for classification purposes.

It uses k-means algorithm. It is an interactive technique that is used to partition an image into k clusters. The algorithm being used for this technique is:[3]

1 Pick *K* cluster centres, may be random.
2 Each and every pixel of the image is assigned to the cluster that minimizes the distance between the pixel and the cluster centre.
3 Re-compute the cluster centre by averaging all of the pixels in the cluster.
4 Repeat steps 2 and 3 until convergence is attained (e.g. no pixels change clusters).



[3] IMAGE AFTER CLUSTERING

F. GRAPH-PARTITIONING METHOD:

Graph partitioning methods are generally good enough to be used for image segmentation. This approach was proposed by Cho and Meer derived from the consequence of different segmentation outputs on one output image. Generally a pixel or a group of pixels are associated with nodes and edge weights define the (dies) similarity between the neighbourhood pixels. The graph (image) is then partitioned according to a criterion designed to model "good" clusters. Each partition of the nodes (pixels) output from these algorithms are considered an object segment in the particular image. The most popular algorithms of this category are normalized cuts,

Minimum-cut, Random walker and isoperimetric partitioning.

G. MODEL-BASED SEGMENTATION:

The central assumption of such an approach is that structures of interest/organs have a repetitive form of geometry. So, one can find easily for a probabilistic model towards explaining the variation of the shape of the organ and then when segmenting an image impose constraints using this model as prior. Such a task involves (I) registration of the training examples to a general strength,(ii) a probabilistic explanation of the variation of the registered samples, and (iii) statistical inference between the model and the image..

H. COMPRESSION-BASED METHODS:

Compression based methods postulate that the optimal segmentation is the one that reduces the over all coding length of the given data. The link between these two concepts is that segmentation always focuses on finding patterns in an image and any regularity in the image that can be used to compress the given image. The method explains each segment by its texture and boundary shape. Each of these components is modelled by a probability distribution function and its coding length is computed as follows:

1.) The boundary encoding leverages the fact that regions in natural images tend to have a smooth delineation. This criteria is used by HUFFMAN CODING to encode the difference Chain Code.
2.) Texture is encoded by lossy compression technique just similar to MINIMUM DESCRIPTION LENGTH(MDL) principle, but in this case the length of the data given the model is approximately calculated by the number of samples times the

entropy of the model. An interesting property of this model is that the estimated entropy bounds the true entropy of the data from previous. This is because in all the distributions with a given mean and co-variance,the largest entropy is adapted by normal distribution.

I. SPLIT-AND-MERGE METHOD:

This method is based upon quad tree partition of an image. It is sometimes called 'QUADTREE SEGMENTATION OR METHOD'. As the name indicates, it is the quad tree partition; it applies in the root at the root of the tree that represents the whole image. If the image found to be non-homogeneous than the image splits into four non-squares. Further, if these squares are homogeneous then it combines. The nodes in the segments is called segment node.

J. MOTION SEGMENTATION :

In the simple methods of motion segmentation, the image is operated pixel by pixel and one frame is subtracted from the previous frame in the sequence of an image obtained as a running average. It also has a complex approach related to segmentation of moving images. In this complex approach, the patio-temporal gradient magnitude of the image is computed as a product of the individual gradients and applied to the boundaries of image.

Moving Segmentation techniques has been divided into commonly three categories:

a) static segmentation
b) Recovery of motion and segmentation simultaneously
c) Optical flow based segmentation

Among all these methods, the first one is a much better technique to apply on a moving image as it improve the segmentation performance by using static techniques which a better option to replace the dynamic segmentation based on the intensities of multiple images.

Optical flow has a difficult reliable estimation and errors are propagated from the first stage of segmentation.

5. SUMMARY AND FUTURE WORK:

From above all reviews, we came to a conclusion that image segmentation is a technique in which image is simplified or represented into something that is more meaningful and easier to analyze. In this manuscript, we have discussed various segmentation procedures and methods along with algorithms which are used for the process of image segmentation .The procedures can be roughly divided into 8 categories which include: (I) Thresholding techniques which are quiet easier to apply and work on simple grey-level images; (II) Point detection method which is used for segmentation and classification along an isolated point; (III) Edge based segmentation techniques which are implemented using first and second derivatives of intensity function but usually produce incomplete edges which require linking process when applied to real images;(IV) Region growing methods which merge different pixels in an image based on a specified criteria, good enough to work when the regions are homogeneous and assumptions are valid. We have explained how we can acquire the desired image after applying some techniques. This paper has a general overview about the image segmentation technique which we basically used to cluster images into small regions i.e. regions corresponding to any surfaces, individual objects, or any natural thing.

6. REFERENCES :

[1]. R.C. Gonzalez, R.E. Woods, Digital Image Processing, Prentice-Hall, Englewood Cliffs, NJ, 2002.
[2].wikipedia.com.
[3]. segmentation.pdf
[4]. CIS472.seminar03.slides1.
[5]Hollander, R., Price, Kandy Teddy D.R. "Picture segmentation using a recursive region splitting method", Comput.graphics and Image Proc., vol.8, 1978
[6].Ip12_segmentation.pdf
[7].gonzales_10.1_10.2.pdf
[8]. A.Rosenfeld and D.pfaltz, Sequential operations in Digital Picture Processing J.A.C.M. (1966) EN0 4
.