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Review On Image Segmentation Techniques

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ABSTRACT
This paper is discussing on the subject of Image segmentation method, techniques Segmentation is the phase where a noteworthy commitment is made during automated study by delineating structures of interest and discerning them from background tissue. Image segmentation is useful in Image Compression, Image Extracting and Image Display Segmentation algorithms are based on two properties of intensity values-discontinuity and similarity. First category is to partition an image based on the abrupt changes in the intensity and the second method is to partition the image into regions that are similar according to a set of predefined criteria.

Keywords- segmentation, Region based, Fuzzy theory based, Edge detection, Thresholding, ANN based, Model based.

I. INTRODUCTION

Image Segmentation [1] is a process in which we can divide or partitioning the digital image into different region. For example when we divide the whole text into different paragraph, word, character is called segmentation. Commonly we can divide the segmentation into two broad categories i.e. Region based segmentation and Edge based Segmentation.

Segmentation is a challenging field of image analysis. In particular, medical image segmentation has become very important with development of complex medical imaging modalities which are capable of producing a large quantity of high-resolution two-dimensional (2-D) and three-dimensional (3-D) images. The problem of image segmentation has been studied extensively and there are a large number of methods described in the literature [6].

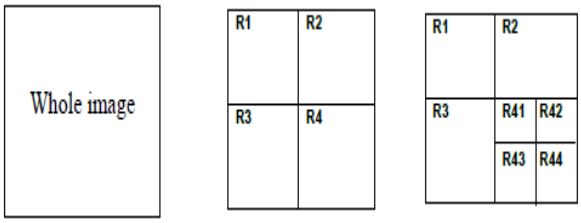
II. VARIOUS SEGMENTATION TECHNIQUES

1.Region based segmentation
2. Thresholding based segmentation
3. Fuzzy theory based image segmentation
4. Model based segmentation
5. Edge based segmentation
6 .ANN based image segmentation
7. Morphological Watersheds based segmentation
8. Manual, Semi-automatic and Automatic Segmentation

1. REGION-BASED SEGMENTATION-

1.1 Region Based segmentation includes: Region splitting, Region merging and Region growing

. **1.1 Region splitting** In region splitting, image is broken into a set of disjoint regions, which are coherent within themselves. Here a whole image is taken as an area of interest. Now check that all the pixels in the region of area of the interest fulfil the similarity constraint. The area of interest will corresponds to the entire region of image if it is true otherwise it will split the area of interest. This process of region splitting will proceed until no further splitting will occur.



(a)Whole image (b) First split (c) Second split

1.2 Region Merging In region merging, firstly the image is segmented using 2x2, 4x4, and 8 x 8 pixels. After those region descriptions is done on the basis of statistical gray level properties. Adjacent region's description is compared with region description. If they match, they are merged into a larger region and a new region description is computed. But if

they don't match then the region will marked as non-matched.

1.3 Region Growing

In region growing segmentation [1], regions are determined directly. Region growing method is easy to complete and compute. Firstly we start with a single seed and then select set of seed points. Seed is also called pixel. Seed points are selected with the help of some criteria. For e.g. we select seed by checking the neighbouring pixels and if the pixels are similar then add them to region.

2. Thresholding based segmentation-

Thresholding is based on the hypothesis that the histogram is has two dominant modes, like for example light objects and an dark background. The method to extract the objects will be to select a threshold F(x, y)= T such that it separates the two modes. Depending on the kind of problem to be solved we could also have multilevel thresholding [8].

Threshold segmentation is classified into following categories:

• Global Thresholding • Adaptive Thresholding • Local Thresholding

2.1 Global Thresholding It is based on the histogram of an image. Using a single global threshold, image histogram is partitioned. The success of this technique very strongly depends on how well the histogram can be partitioned.

2.2 Adaptive Thresholding An approach to handling situations in which single value thresholding will not work is to divide an image into sub images and threshold these individually .In view of the fact that the threshold for each pixel depends on its location within an image this technique is said to adaptive

. **2.3 Local Thresholding** Thresholding may be viewed as an procedure that involves tests in opposition to a function T of the form: $T = T[x,y,p(x, y),f(x, y)]$ Where $f(x, y)$ is the gray level , and $p(x, y)$ is some local property. If T depends on mutually f(x, y) and p(x ,y) in that case this is referred to a Local Thresholding.

3. Fuzzy theory based image segmentation-

Fuzzy set theory is used in order to analyze images, and provide accurate information from any image. Fuzzification function can be used to remove noise from image as well [2]. A gray-scale image can be easily transformed into a fuzzy image by using a fuzzification function. Different morphological operations can be combined with fuzzy method to get better results [3]. Fuzzy k-Means and Fuzzy C-means (FCM) are widely used methods in image processing [4]. In this section several new approaches of image segmentation using Fuzzy theory is presented. Gour Chandra Karmakar [5] introduced a new fuzzy rule based image segmentation technique which can integrate the spatial relationship of the pixels. Three types of membership functions are used, i.e., Membership function for Region pixel distribution, to measure the closeness of the region, and to find the spatial relationship among pixels. There is no need to define parameters in their technique, like FCM algorithm. Fuzzy rules uses above three membership functions and then performs segmentation of an image. FCM and proposed technique is implemented on Matlab X-ray images. Results have shown that GFRIS outperform FCM and isolate the object from background accurately.

4.Model based segmentation-The human vision system has the capability to identify objects even if they are not entirely represented. It is apparent that the information that can be gathered from local region operators is not adequate to achieve this task. Instead precise knowledge with reference to the geometrical form of the objects is requisite, which can after that be compared with the local information. This instruct of consideration leads to model-based segmentation. In manual segmentation, the structure of organs or interest has monotonous form of geometry. It involves (i) registration of the training examples to a common pretense, (ii) probabilistic depiction of the variation of the registered samples, and (iii) statistical inference flanked by the model and the image.

5. Edge based segmentation-Edge detection plays prominent role in image analysis. In edge detection process, identification of sharp edges is done and then locating the sharp discontinuous in an image. Detecting edges is very useful in a amount. of contexts. Edge detection is difficult in noisy images, seeing as together the noise along with the edges enclose high frequency content. For instance in a distinctive image perceptive job such as object recognition, an vital step is to segment an image into diverse regions corresponded to dissimilar items in the scene. Edge detection is the first tread

in image segmentation. The main generally used edge detection techniques are Gradient-based and Laplacian based Edge Detection. In order to achieve edge detection we follow these steps below:

1) Filtering – Filter image to improve performance of the Edge Detector with respect to noise.

2) Enhancement – Emphasize pixels having significant change in local intensity

3) Detection – Identify edges - thresholding

4) Localization – Locate the edge accurately and estimate edge orientation.

Edge detection has been applied in enhancement of noisy images – satellite images, x-rays, medical images like cat scans, text detection, mapping of roads, video surveillance, etc.

6. ANN based image segmentation-

In Artificial Neural Network, every neuron is corresponding to the pixel of an image. Image is mapped to the neural network. Image in the form of neural network is trained using training samples, and then connection between neurons, i.e., pixels is found. Then the new images are segmented from the trained image [6]. Some of the mostly used neural networks for image segmentation are Hopfield, BPNN, FFNN, MLFF, MLP, SOM, and PCNN. Segmentation of image using neural network is perform in two steps, i.e., pixel classification and edge detection [7]. In this section several new approaches of ANN used for image segmentation is discussed from last five years. Xuejie Zhang [8] proposed a new Fast learning Artificial Neural Network (FLANN) based colour image segmentation approach for R-G-B-S-V (i.e., RGB and HSV) cluster space. In first step, noise is removed using 3*3 averaging filter to reduce the disparity in colour distribution. In second step, pixels are converted to RGBSV space using HSV conversions. FLANN clustering is performed to produce a cluster result of image. Next, pixels with same color are being separated. Segment number is assigned to each segment of image. Effect of tolerance and neighborhood size is observed. Results have shown that proposed algorithm produced perfect segments for colours in the image. Farhad Mohamad Kazemi [9] proposed a fast C-means based training of Fuzzy Hopfield Neural network

7. Morphological Watersheds based segmentation-

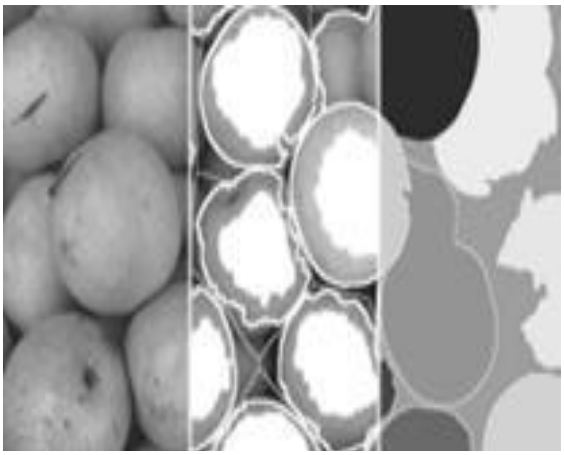


Fig 1.Segmentation by morphological watersheds [11]

This method combines the positive aspects of many of the methods discussed earlier. The basic idea to embody the objects in "watersheds" [10] and the objects are segmented. Below only the basics of this method is illustrated without going into superior details. The concept of watersheds is the idea of visualizing an image in 3D, 2 spatial versus gray levels. All points in such a topology are either belonging to regional minimum. All with assured to a single minimum, equal to two points where more than one minimum. A particular region is called watershed if it is a region minimum satisfying certain conditions.

8. Manual, Semi-automatic and Automatic Segmentation-

8.1 Manual Segmentation Manual segmentation refers to the process whereby expert transcribers segments and labels a speech file by hand over, referring only to the spectrogram as well as waveform. The manual method is assumed to be more accurate. Also, the employ of a human transcribers ensures that the segment boundaries and labels are perceptually legitimate.

8.2 Automatic Segmentation

Automatic segmentation refers to the course of action whereby segment boundaries are assigned without human intervention by a program. This will almost certainly be an HMM-based speech recognizer that has been given the correct symbol string as input. The output boundaries may not be entirely precise, especially if the training data was sparse.

8.3 Semi-Automatic Segmentation Techniques like Livewire or Intelligent Scissors are worn in

this category of segmentation. **Livewire**, also acknowledged as **Intelligent Scissors**, is a segmentation method which allows a user to opt for regions of interest to be extracted swiftly and perfectly, using simple mouse clicks. The user sets the starting point clicking on an image's pixel, recognized as an anchor. Then, as he starts to alter the mouse over other points, the smallest cost path is haggard from the anchor to the pixel where the mouse is in excess of, changing itself if the person moves the mouse. If he needs to pick the path that is being displayed, he simply clicks the image again. One can effortlessly see in the right image, that the spaces where the client clicked to outline the desired region of interest are marked with a small square. It is also clear-cut to see that the livewire has snapped on the image's borders.

III. CONCLUSION

In this paper, different types of image segmentation techniques have been discussed. In image classification tasks, the algorithm has to be gone through number of steps to get the final results which includes pre-processing of the image. In this step image has been enhanced for further processing i.e. edge detection, blurring, and contrast adjustment etc. comes under this section. The next section of the image processing involves mid level segmentation, in which image has been divided or segmented into number of segments for future classification and finally the high level vision which involves classification of the image segments according to application needs. Therefore in last two sections of computer vision image processing, segmentation algorithms play important role to segment the image into number of fragments and for extracting the features of the dataset according to application requirements. We have surveyed different types of techniques in this paper. In future, we will used one of these algorithms to carry out our work in image retrieval systems.

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