

Image Segmentation Techniques

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Abstract: Image segmentation is the process of division of a digital image into multiple segments sets of pixels, also known as super pixels. The aim of segmentation is to simplify and change the representation of an image into something that is more meaningful, easier to analyze and easy to understand. Image segmentation is used to give the values of objects and boundaries of an selected image like lines, curves. Image segmentation is the most important field of image analysis and its processing which is mostly used in medical field to analyse the disease. It is also used in many scientific fields including, engineering and technology, face recognition and object. The major challenge of image segmentation is to remove the noise from image by using various methods and give the clear view of image. The main goal of this article is to propose methods improving image segmentation and give the clear object about image by using different techniques. This paper presents a brief outline on some of the most commonly used segmentation techniques like thresholding, Region based, Edge detection, fuzzy based and ANN based segmentation.

Index Terms--- Segmentation, Edge Detection, Region Based, threshold, fuzzy based and ANN based segmentation techniques.

1. INTRODUCTION:

The main aim of image processing is to retrieve required information from the given image in a way that it will not effects the other features of that image and provide the image that can be easy to understand. De-noising of an image by using filter is the most important step required to fulfill this requirement [1]-[2]. The task of image segmentation is to divide an image into a number of non-overlapping regions. Which give same characteristics like gray level, color, tone, texture Famous techniques of image segmentation which are still being used by the researchers are Edge Detection, Threshold, Histogram, Region based methods, and Watershed Transformation. Since images are divided into two types on the basis of their color, i.e. gray scale and color images. Some of the most famous image segmentation methodologies including Edge based segmentation, Fuzzy theory based segmentation, Partial Differential Equation (PDE) based segmentation, Artificial Neural Network (ANN) bases segmentation, threshold based image segmentation, and Region based image segmentation[3].

1.1 Image segmentation Techniques: Many image segmentation techniques have been developed by researchers and scientists, some of the most important and widely used image segmentation techniques are shown in Fig. 1. Image segmentation is also used to differentiate different objects in the image, since our image is divided into foreground and background, whereas foreground of image is related to the area of interest, and background is the rest of the image. Hence, image segmentation will separate these two parts from one another. Region-based, edge based, fuzzy theory, threshold and ANN based segmentation like technique are explained following like region based segmentation, edge based segmentation,

fuzzy based segmentation ,threshold based segmentation and ANN segmentation .

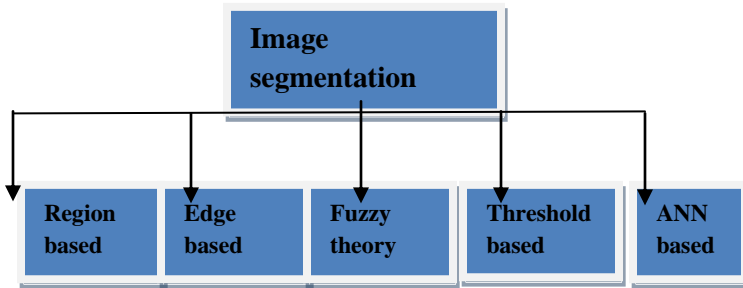


Fig.1 Various Image Segmentation Techniques

(a) Region based method :It is used the threshold in order to separate the background from an image, whereas neural network based techniques used the learning algorithm to train the image segmentation process [4]. In this technique pixels that are related to an object are grouped for segmentation [18].The thresholding technique is bound with region based. segmentation. The area that is detected for segmentation should be closed. Region based segmentation is also termed as “Similarity Based Segmentation” [4]. There won’t be any gap due to missing edge pixels in this region based segmentation[16] Region based segmentation methods are categorized into three main categories, i.e., region growing, region splitting, and region merging [19]. In this section several new approaches regarding Region based image segmentation is discussed from last five years.

Karoui [17] proposed a new unsupervised image segmentation method using level set methods and texture statistics. They claim that their method is different from other methods since it doesn’t assume independent variable, and it doesn’t restrict to first order grey features. Yong-mei Zhou [20] has introduced new region-based image segmentation technique with the help of mean-shift clustering algorithm. Firstly, their method extract color, texture, and location features of each pixel of an image, secondly, make the clusters on the basis of those features using mean-shift clustering approach, label the each region, and finally make segments of image on the basis of these labels. They used Mat lab 7.0 to implement their algorithm. Experiment shows that their method present better results in term of speed and segmentation.

Civahir Cigla [23] presented a new graph theoretic color image segmentation method, and tries to improve the normalized cut image segmentation method.

(b) Edge-based techniques: it is used the most common method of detecting boundaries and discontinuities in an image. An edge is a set of connected pixels, i.e., same intensity level, between two adjacent pixels and can be distinguished by estimating the intensity gradient[8]. Edge detection is a basic step for image segmentation process [12]. It divides an image into object and its background. Edge detection divides the image by observing the change in intensity or pixels of an image. Gray histogram and Gradient are two main methods for edge detection for image segmentation [13].

Yu Xiaohan [14] proposed a new image segmentation technique based on region growing and edge detection methods. Their hybrid method helps the segmentation process to avoid from errors when both techniques used in a separate manner. Region growing is used to find the edge pixels in the image, while 2nd order derivative is used for edge detection. Experiments are conducted on 3D MRI image data.

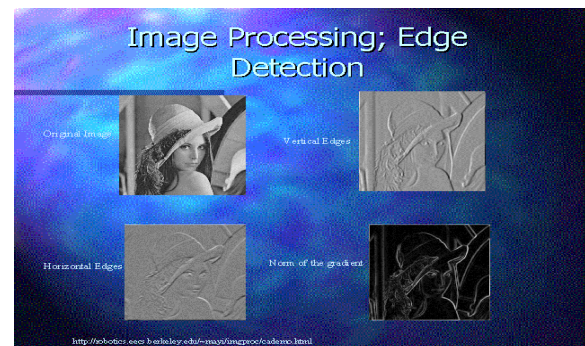


Fig: Edge Detection

(c) Fuzzy set theory based segmentation: it 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 [9]. A gray-scale image can be easily transformed into a fuzzy image by using a fuzzification function.

Gour Chandra Karmakar [10] 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.

Amol S. Pednekar [11] proposed a new image segmentation technique based on fuzzy connectedness using dynamic weights. Author has found that traditional **segmentation schemes can't solve the problems of fuzzy medical images**. They introduce DyW algorithm which dynamically adjusts the linear weights in fuzzy connectedness.

(d) The threshold technique :it is the most intuitive of them all. It is based on local pixel intensity levels. The current image is compared to the background image and a threshold value decides if the pixel differs enough to belong to the foreground. Clearly, additional filtering and clustering has to be considered since the background can also vary, i.e., possible noise, especially in outdoor environments.. Thresholding[7] 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 as global 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 corrupts the histogram of the image, making separation more difficult.

(e)ANN based image segmentation : it is neural net is an artificial representation of human brain that tries to simulate its learning strategies and can be used for decision making process. An artificial neural network is often called a neural network or simply neural net. In recent years, artificial neural networks have been widely used to solve the problem of medical image segmentation. Neural network that simulate life, especially the human brain's learning procedures, constitutes a large number of parallel nodes. Each node can perform some basic computing. The learning process can be achieved through the transferring the connections among nodes and connection weights [15]. Its main advantage is not dependent on the probability density distribution function.It can also prove the segmentation results when the data deviation from the normal situation. Neural network can also reduce the requirements of expert intervention during the image segmentation process

4 .CONCLUSION

In this paper, Image segmentation has a promising future as the universal segmentation algorithm and has become the focus of contemporary research. The Five important segmentation techniques are discussed. There are different types of techniques available for segmentation process. But the paper focused on top five techniques used for segmentation. The paper shows the detailed explanation about how the segmentation is done by using each technique separately. Thus there is no single method which can be considered good for all type of images but all methods are equally good for particular type of images. Due to all above factors, Image Segmentation faces a challenging problem in image processing and computer vision.

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