A study on Segmentation Techniques

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KEYWORD

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ABSTRACT

Segmentation is required to appropriately partition any picture into multiple tiny pieces, as well as to locate various image elements and extract relevant information. The digital image is segmented into numerous smaller segments (sets of pixels), each with its own set of opposing attributes such as texture, color, intensity, and a variety of other statistical properties. This work seeks to illustrate various typical pixel-based segmentation techniques used in image processing, such as thresholding, k-mean clustering, histogram, split & merge, and watershed transformation, as well as their benefits and drawbacks.

1. Introduction

A digital image consists of different picture elements, set in form of pixels representing a two-dimensional structure. Each pixel has a digital value of one or more bit known as bit depth. The pixels represent brightness, contrast, color, energy, intensity, sound, elevation or a classified value extracted by image processing. Images are said to be a reliable source of transmitting information. Since, there is no such image segmentation technique accepted universally which has potential to implement all image related information such as extraction of harmful tissues from body scan, exploring cancerous cells, airport detection from available remote sensing data, robot navigation etc Singh P, Chadha S.R. (2013).

Segmentation is a necessary step in image processing and also for interpretation and analysis of object specific knowledge required for image interpretation. In short, segmentation is needed in image visualization, analysis, and representation. Segmentation is used for detecting, recognizing and calculating the image objects. The segmentation can be used for differentiating low- and high-level image processing. Although it is very difficult to obtain a reliable and correct image by

automatic segmentation means. Image segmentation can be implemented in many practical areas TJTHS-0101_001 such as in medical imaging, satellite for classifying terrains, watermarking, brake light detection optical character recognition (OCR), machine vision, image compression, traffic control and industrial inspection etc (Singh P, Chadha S.R. (2013), B. Poornima, Y. Ramadevi, T. Sridevi. (2011))

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2. Segmentation Techniques

Segmentation of images can be broadly categorized into 3 different categories: pixel based, continuity approach (edge- based) and similarity approach (region- based). The selection for the desired segmentation techniques is dependent on the nature of the given image and problem to be solved. There are different types of images such as MRI images, color images, radiographic images, grayscale images etc. that are needed to be processed and analyzed including Image segmentation techniques can be broadly classified as following image.

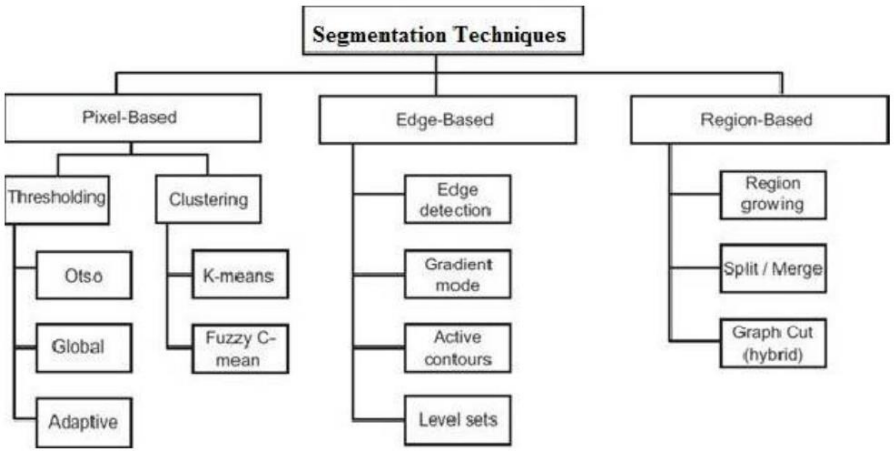
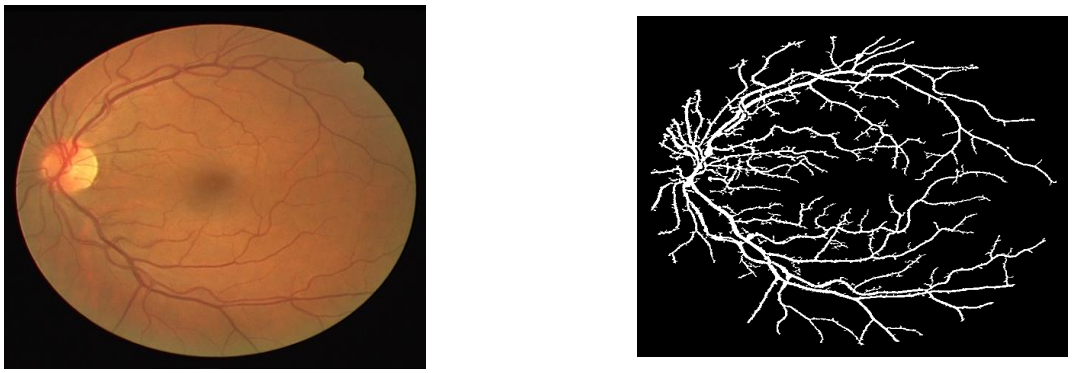


Figure 1: Types of Segmentation Techniques Basavaprasad B, Ravi M. A (2014),

2.1 Thresholding

One of the simplest segmentation approaches for exudates detection is thresholding. It is needed to differentiate and separate light objects from dark background based on given image feature such as texture, color, contract and intensity [Abubakar F. M. (2013), Chandrakala M, Devi P. D. (2016), Jamil A. M. Saif, Al-Kubati A. A. M, Hazaa A. S, Al-Moraish M. (2012)]. Thresholding separates the given image into two different parts, background in black and foreground in white. Using a suitable threshold value T images can be converted easily in binary form. Binarization simplifies the recognition and classification process because it contains all the primary information regarding the shape and position of object Chandrakala M, Devi P. D. (2016), The major drawback of thresholding is that it only considers the intensity of the pixels and not the spatial information so it is not suitable in images having blur boundaries. For solve these problems we use region growing based segmentation. [P. Daniel Ratna Raju, G. Neelima. (2012), Banchpalliwar R. A, Salankar S. S. (2016),]



(A) (B)

Figure 1: (A) Regular fundus image (B) Segmented image

2.2 K-means Clustering Based Segmentation

K-means is the simple unsupervised algorithm used for solving clustering problems. The idea followed is to define k centroids for k clusters. The centroids should be placed as far away possible, but it dependent on the purpose and goal for which this algorithm is implemented. Then take each point in the given data set (pixels) and associate them to the nearest centroid, the entire process is called early grouping.

2.3 Histogram Based Segmentation

The simplest method for image segmentation is thresholding technique. The threshold value can also be termed as the clip-level. This approach assumes that the image is predefined into background and foreground. It weighs the histogram to check for balance and removes weight from the appropriate side for making it balanced.

2.4 Split and Merge Algorithm Based Segmentation

Split and merge algorithm is also called multilevel thresholding, since it divides the image into sub images and perform thresholding on each sub image. The basic representational structure of split and merge algorithm is a pyramidal that is equal sized squares. Thus, this method attempts at dividing the image into uniform regions. This method too plays a vital role in image processing in identification of hard exudates. The algorithm starts with an assumption that the image is a single region to be processed. Then, the partitioning and merging process begins.

In this type of segmentation, the image is first partitioned into square sub regions until homogeneity is verified. After the splitting process is done, merging process is implemented with the neighboring sub-regions that satisfy the uniformity criterion. This method proposed in Amel F. Mohammed M, Hafid BA (2012), traces the distribution of illumination to detect bright lesions. Hence histogram-based approach was found to give imprecise results, especially when the amount of overlap of feature distribution is high.

2.5 Watershed Transformation Based Segmentation

Watershed transformation is something similar to a water droplet following the gradient of given image flowing to the local minimum. Watershed transformation has been used in segmentation of image processing. The term watershed refers that the areas drained by different river systems are divided by a ridge. Image analysis starts with the pixel's identification belonging to the different object and separating them from background

2.6 Fuzzy c Means Based Segmentation

Fuzzy C-Means algorithm assigns membership to each and every data point corresponding to each cluster center. The points are assigned based on the distance between the cluster center and the data point. In Fuzzy C-Means segmentation, the membership summation of each data point should be unity.

FCM is a clustering method which permits one piece of data to be part of two or more clusters. Clusters are differentiated based on similarity criteria. These similarities include connectivity, distance and intensity of clusters.

Conclusions

Image segmentation is needed for enhancing the images quality as it is adversely affected by the pressure, temperature and noise. Segmentation is done to ensure correction of different factors such as pixel color, texture, intensity, image content, similarity of images, and problem domain. The above-mentioned segmented techniques have few advantages & disadvantages. All segmentation algorithms do not ensure similar kind of result for all type of images so we choose the segmented technique based on the problem area and type of image for obtaining efficient and accurate performance. Further research is needed for providing an adaptive segmentation technique applicable on all images in any area of applications.

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