A review Image Segmentation based on Various Retina Vessel Segmentation Feature Extracted Methods

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Abstract: Image segmentation can be defined as in which we divide the images into various parts in the form of pixels. In segmentation, we simply represent the image into more understandable form. Segmentation essentially used to detect the objects, boundaries & other relevant data in the digital images. Retinal vessel segmentation algorithms are the critical components of circulatory blood vessel Analysis systems. We present a review of vessel segmentation techniques & algorithms. We put the various vessel segmentation approaches and techniques in perspective by means of a classification of the existing study. While we have essentially targeted the segmentation of blood vessels, neurovascular structure in particular. We have divided vessel segmentation algorithms & techniques into 6 main categories: (1) Parallel Multiscale Feature Extraction and Region Growing, (2) a hybrid filtering, (3) Ridge-Based Vessel Segmentation, (4) artificial intelligence- based approaches, (5) neural network-based approaches, & (6) miscellaneous tubelike object detection approaches.

Keywords: Image segmentation, method of image segmentation, Parallel Multi-scale Feature Extraction and Region Growing, a hybrid filtering, Ridge-Based Vessel Segmentation, artificial intelligence- based approaches.

I. INTRODUCTION

Computer vision applications require an image segmentation to extract the meaningful regions of the image. Segmentation is the most [1] vital part in image processing. Boundary off an entire image into several parts which is something more expressive and easier for further process. These numerous parts that are re-joined will cover the entire image. Segmentation may also depend on various features that are contained in the image. It may be either colour or surface. Before de-noising an image, it is segmented to recover the original image. The main motto of segmentation is to reduce the [2] material for easy analysis. Segmentation is also useful in Image Analysis and Image Compression. Image Segmentation is the process of unscrambling an image into multiple disjoint, non-overlapping regions such that pixels that belongs to the same region will be same based on some image property like grey scale value, colour, texture etc. of the pixels.

Image segmentation is considered to be a medium level activity in an image processing system. When an image is segmented mainly five conditions should be satisfied. First, the segmentation process must be complete that means each pixel belongs to at least any one of the region [3]. Second, the pixels in a region must be connected i.e. each region is a connected set of pixels. Third, two regions cannot intersect with each other. This condition may be violated in case of fuzzy segmentation.

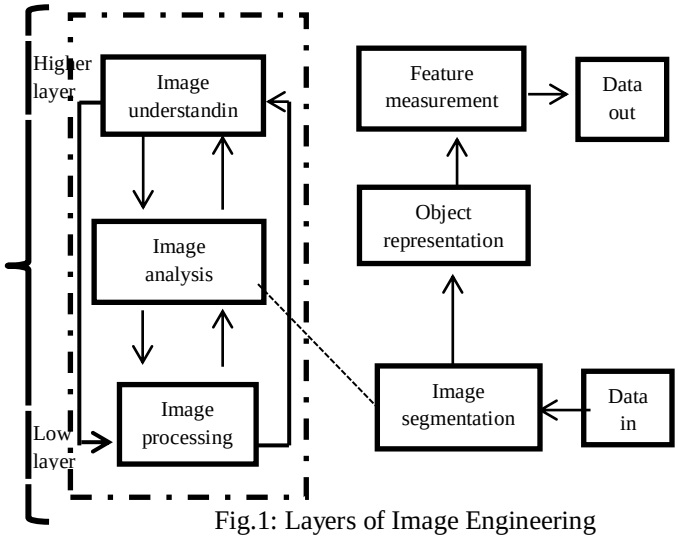

Fig.1: Layers of Image Engineering

Fourth, each region of the segmented image must gratify a predicate based on the grey scale value, texture etc.

II. RELATED WORK

Hui Zhang et al., 2012 [4] efforts on the research of image segmentation accuracy problematic because out dated Sobel operator image segmentation is easy to cause the imprecision of image segmentation , difference is not apparent, segmentation accuracy is low . Absorbed against these defects, this paper puts forward an enhanced Sobel operator 2-d maximum entropy digital image segmentation method. This algorithm primarily carries out image segmentation, rendering to digital image features, and then finds its real edge through the threshold of Sobel edge detection algorithm. Chuan Long Li et al., 2012 [5] propose a novel fuzzy c-means image

segmentation algorithm. Its effectiveness is due to two apparatuses. The first mechanism is the replacement of the Euclidean distance conventionally used to measure similarity of the image pixels by a novel resemblance measure which is considered spatial neighbourhoods using Gaussian kernel, and thus technique becomes less sensitive to the noise of the image. The second mechanism is not necessity of any similarity penalty term in FCM's objective function as some FCM's variations to reduce the inspiration of noise on the result of image segmentation; in addition, our method needs no condition of setting parameter according to the image. Syoji Kobashi et al., 2013 [6] In command to abbreviate the processing time and to decrease the effort of users, this paper presents two methods of interactive image segmentation method based on fuzzy connectedness image segmentation. The first method interactively updates object sympathy of FCIS according to users' extra seed voxels. The second method models the profile of the object affinity using radial-basis function network, and applies online training for users' extra seed voxels. Trupti S. Bodhe et al.,2013 [7] In contemporary crop status organisation in greenhouse, instead of doing physically, crop status is monitored using cameras with some automation. One of the major difficulties in the greenhouse crop production is the presence of pests. An accurate and timely monitoring of pests populace is the basic requirement. In the pest uncovering, image analysis is very important and image segmentation is one of the wanted steps to distinguish the pest from rest of part of an image. Colour image segmentation is desirable than grey scale image segmentation.

III. CLASSIFICATION METHODS OF IMAGE SEGMENTATION

Segmentation can be classified as follows:

- Region Based [4]
- Model Based

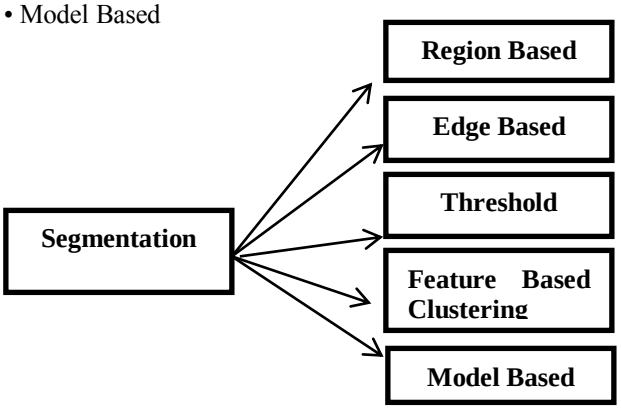

Figure 2.Various types of segmentation

- Edge Based
- Threshold
- Classification

A. Region Based

In this technique pixels that are related to an object are congregated for segmentation .The thresholding system 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". There won't [5] be any opening due to absent edge pixels in this region based segmentation .The boundaries are identified for subdivision. In each and every step at smallest one pixel is related to the region and is taken into consideration. After identifying the change in the colour and texture, the edge flow is converted into a vector. From this the edges are detected for further segmentation.

B. Edge Based

Segmentation can also be done by using edge detection techniques. There are various techniques. In this method the boundary is identified to segment. Edges are detected to identify the breaks in the image. Edges on the region are traced by recognizing the pixel value and it is compared with the neighbouring pixels.

C. Threshold

Thresholding is the easiest way of segmentation. It is done through that threshold values which are achieved from the histogram of those edges of the original picture [8]. The threshold values are obtained from the edge detected image. So, if the edge detections are correct then the threshold too. Segmentation through thresholding has fewer calculations compared to other techniques. [9]Segmentation is based on "his ton". For a particular segment there may be set of pixels which is named as "his ton". Roughness quantity is followed by a thresholding method for image segmentation. Segmentation is done through adaptive thresholding. The grey level points where the gradient is high, is then additional to thresholding surface for segmentation. The drawback of this segmentation technique is that it is not suitable for complex pictures.

D. Feature Based Clustering

Segmentation is as well done through Clustering. They followed a different procedure, where most of them apply the technique directly to the image but here the image is converted into histogram & then clustering is complete on it [26]. Pixels of the color image are clustered for segmentation using an unsupervised technique Fuzzy C. This is applied for ordinary pictures. If it is a noisy image, it results to disintegration. A basic clustering algorithm i.e., K-means is used for segmentation in textured images. It clusters the related pixels to segment the image Segmentation is complete through feature clustering & there it will be changed according to the color components [10]. Segmentation is also purely depending on the features of the image. Features are

taken into account for segmentation. Modification in the intensity and color values are used for segmentation [11].

E. Model Based

Markov Random Field (MRF) based segmentation is known as Model based segmentation [12]. An inbuilt region smoothness constraint is presented in MRF which is used for color segmentation. Components of the colour pixel tuples are measured as independent random variables for further processing. MRF is combined with edge detection for identifying the edges accurately [13].

IV. VESSEL SEGMENTATION ALGORITHMS

Depending on the image quality and the general image artifacts such as noise, some segmentation methods may Require image pre-processing prior to the segmentation algorithm [14], [15]. On the other hand, some methods apply post-processing to overcome the problems arising from over segmentation we divide vessel segmentation algorithms and techniques into six main types: (1) Parallel Multiscale Feature Extraction & Region Growing, (2) a hybrid filtering, (3)Ridge-Based Vessel Segmentation,(4)artificial intelligencebased approaches, (5) neural network-based approaches, and (6) miscellaneous tubelike object detection approaches.

1. Parallel Multi-scale Feature Extraction and Region Growing

The purpose of parallelizing the segmentation algorithm described earlier is to procedure larger data sets of images, whose resolution differs from low to high, in an acceptable time. The main problem for processing such images (particularly high-resolution ones) is the accessible local memory. Even though the trivial solution may be growing the amount of memory per processor, the essential problem is not truly solved. Parallelism is applied so the answer is developed by partitioning the images, so all sub images can be partially processed within the available memory per processor.

2. A Hybrid Filter

Hessian-based filters can enhance vessels of many size & estimate their directions at the same time. However, Hessian based filters cannot distinguish step edges from vessels effectively. Matched filters can differentiate step edges from vessels more efficiently. Matched filters are normally applied at multiple scales, whereas at each scale multiple kernels are used to enhance vessels in different ways. Consequently, the computational cost of matched filters is advanced than that of Hessian-based filters. To solve the problem of false detection of edges, Sofka [16] proposed using the edge info at the boundary of vessels. A vessel should have two edges on every side of it which can be used to effectively distinguish between vessels and edges in the image. The proposed improvement filter combines the benefits of Hessian based filters, matched filters, and edge information.

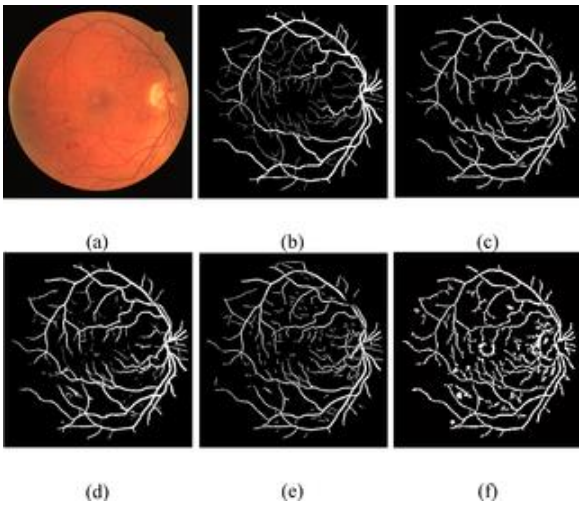

Figure Hessian based filters [17]

3. Ridge-Based Vessel Segmentation

A method is presented for automated segmentation of vessels in two-dimensional color images of the retina. This method can be used in computer analyses of retinal images, e.g., in automatic screening for diabetic retinopathy since image edges are natural indicators of vessels, we start our analysis with a short overview of ridge detection for 2-dimensional gray value images. For a extra extensive discussion on this subject, see [18]. The ridge detection method used in this paper is described in full detail in [19]. Because the green channel of colour fundus images formatted as an RGB image gives the maximum contrast between vessel and background [20], this channel is used for extraction of the image ridges The next step in initial primitives for the vessels is a grouping of ridge pixels which belong to the same ridge. The aim is to obtain primitives which represent approximately straight line elements The grouping technique is a simple region growing algorithm which relates an already grouped ridge pixel with ungrouped pixels in a neighbourhood of radius , where the subscript " " stands for connectivity. If no grouped pixel is obtainable, a novel one is selected randomly as seed from the remaining ungrouped ridge pixels. The comparison between the grouped and a candidate pixel within the neighbourhood is based on two conditions: 1) The eigenvector directions of the ridge pixels should be similar and 2) If condition 1) is met, the pixels should be on the same ridge (& not on parallel ridges). The first situation can be checked by taking the scalar product of the eigenvectors at the location of the pixels. If the pixels have similar orientation the scalar produce will be close to 1. The second situation can be checked by computing the unit-length normalized vector between the locations of the two

pixels under consideration & taking the vector product between & of the grouped pixel. If the pixels are on the same segment, the vector product will be close to 1. The goal of this work is to classify every pixel in an image as vessel or non-vessel. [21]

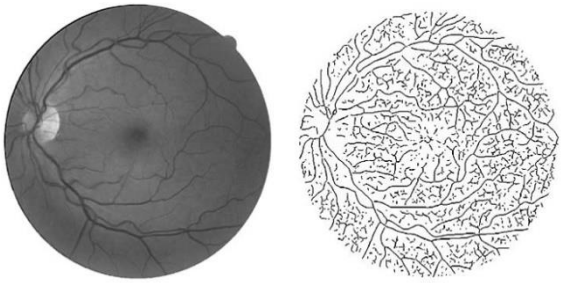

Figure Ridge-Based Vessel Segmentation [23]

4. Methods Based on Artificial Intelligence

Artificial Intelligence-based approaches utilize knowledge to guide the segmentation process & to delineate vessel structures. Different kinds of knowledge are employed in different systems from various sources. One knowledge source is the properties of the image acquisition technique, such as cine-angiography, digital subtraction angiography (DSA), computed tomography (CT), magnetic resonance imaging (MRI), and magnetic resonance angiography (MRA). Particular applications utilize a overall blood vessel model as a knowledge source. Smets et al [22] encode general knowledge about appearance of blood vessels in the form of 11 rules (e.g. that vessels have high intensity centre lines, comprise high intensity regions bordered by parallel edges etc.). The work of Stansfield applies a domain-dependent information of anatomy to understand cardiac angiograms in the high-level stages. According to Stansfield, "Anatomical knowledge is embodied within the system in the form of spatial relations between objects & the expected characteristics of the substances themselves Knowledge-based systems exploit a priori knowledge of the anatomical structure. These systems employ some low-level image processing processes, such as thresholding, thinning, & linking, while guiding the segmentation process using high-level knowledge. Artificial Intelligence-based methods perform well in term of accuracy, but the computational complexity is much bigger than some other approaches. Rost et al [22] describe their knowledge-based system, called SOLUTION (Solution for a Learning Configuration System for Image Processing), and designed to automatically accept low-level image processing algorithms to the needs of the application. It aims to overcome the problem of extensive change requirement in the existing system to perform in a different environment.

V. CONCLUSION

In this paper, we have discussed about the image segmentation, the various techniques of it and image engineering. These techniques are applicable in dissimilar fields alike medical imaging, object recognition, pattern recognition etc. by studying this topic in depth, we got to know that, image segmentation is having vital use and challenging future in image processing.

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