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A Survey on Various Techniques for Image Segmentation

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ABSTRACT: Image segmentation is the process through which an image is divided into multiple segments. The aim of segmentation is to change the features and representation of an image according to our need or into something that is more meaningful and easy to analyse. Using image segmentation we can classify an image into different group. Till now many research has been done using clustering in the area of image segmentation. There are different methods of clustering e.g. k-means clustering, c-means clustering, fuzzy c-means and many more but k-means is one of the most popular methods of clustering. K-means is an unsupervised clustering algorithm. There are many features of an image with which we can improve image and two of them are PSNR (peak signal to noise ratio) and RMSE (root mean square error). To improve image, PSNR rate must be increased and RMSE rate must be decreased. When the mean square error is decreased the quality of image will automatically increased. Varieties of clustering algorithm are used to improve these features. Different clustering algorithm will give different values for PSNR and RMSE rate. In this paper, we are doing a survey of different clustering algorithm in various application of image segmentation. Mainly image segmentation is used in medical science to locate disease, tumour, cancer and many other problems. Some of their shortcomings are also mentioned for further development.

KEYWORDS: image segmentation, k-means clustering, PSNR rate, RMSE rate.

I. INTRODUCTION

Because of research and various application of image processing people often interested in only some parts of an image. These parts are the target of image processing, with specific features and unique nature in image. Hence image segmentation is used to divide or partition an image into different region according to their characteristics and then extract the region in which we are interested [10]. Visualization, image compression, medical image diagnosis, etc these are different image processing technique which use image segmentation as their basic work [2]. Principle of image segmentation is to represent the image in form of physically connected regions. Image segmentation aim is often get by analysing different features of an image e.g. colour, brightness, edge, texture. Image segmentation is used to differentiate the different regions of an image based on their intensity, colour and other geometric properties [11].

As we know segmentation is a process in which in which digital image is divided into multiple segments. Image segmentation is used for edge detection, locate objects, line detection and boundaries in images. Results of image segmentation are different regions and each region is a set of pixels. Each pixel of a region is similar to the other pixels and these pixels share some characteristics e.g. colour, intensity and texture [4].

II. LEVELS OF IMAGE ENGINEERING

Image engineering is divided into three levels:

- A. Image processing:- image processing is a low level operation, and it mainly work on pixel-level. [12]
- B. Image analysis:- image analysis comes above image processing and it is the middle level. At this level, the segment (target) is expressed and described. [12]
- C. Image understanding:- this level is comes above image analysis and a high level operation. It operates on data symbol that comes from description.[1] [12]

Image segmentation is an important tool in medical area, it extract the region from background that is of interest. Medical image are represented by the array of number in their raw form. [23] [24]

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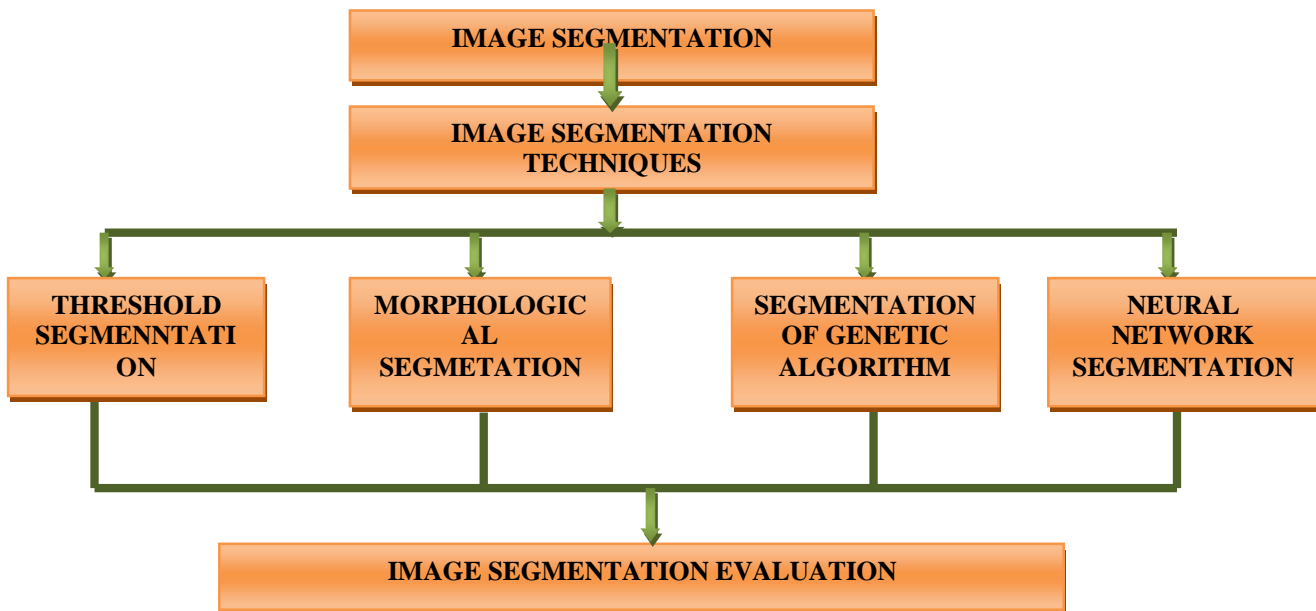


Figure1. Image segmentation architecture

III. TYPES OF IMAGE SEGMENTATION

Image segmentation process is categorized as follow:

A. Pixel based direct classification

In this method, segmentation is done on the basis of pixels. It is similar to the processing of language, where a single word may have multiple meaning, unless the context is not given. The principle is same for image. If very small portion of image is shown, it became difficult to tell about image. If contextual portion of image is increase, then it will become easy to recognize image.

B. Global knowledge based segmentation

This segmentation identifies a threshold value from a grayscale or color histogram that represent an image. This threshold behaves like a splitting boundary that segment image into foreground and background part. If image is of low contrast then obtaining optimal threshold become difficult. [5]

C. Edge based segmentation

It is used for line detection application such as text recognition. Various popular edge detectors are: canny edge detector, prewitt and sobel operator. Edge detector alone is not good for segmentation because it does not form the closing boundary which is important to form a separate segment. [15]

D. Region based segmentation

Graph partitioning is a region based method, used for complex image segmentation. It can't be applied in the real time system, because of the algorithm complexity. [16]. In this technique, there is a newly developed mathematical morphology segmentation method which is called watershed transform. Watershed transform does not require any parameter for the termination condition. [9]

E. Cluster based segmentation

In cluster based segmentation a given set of data is divided into groups. This is the most popular method that used in segmentation for making cluster. We can define the number of cluster that we want to form. In each cluster there is a center and according to that center values from data set are assigned to the clusters. [23]

Segmentation is also used for detecting interstitial lung disease [ILD][6]. ILD is a group of lung diseases, it effects the tissue of lungs and stop the transferring of oxygen in to blood stream[17]. Watershed segmentation is one of the segmentation techniques. It is an edge based segmentation and used to find out the interested region. Its advantage is that in region growing algorithm edge information used from the gradient surface [18]. Its disadvantage is that the



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image is that over segmented. Image segmentation is also used in horticulture where pest detection is a major challenge. Traditionally, manual counting done and it is very time consuming and costly process. Hence, image segmentation is used in analysis of image required for pest detection [7]. Whitefly is the major cause for damage of crop. Image segmentation is the mainly used for pest detection in which machine count the number of pest and for this purpose different segmentation algorithm can be used [7]. In biomedical image processing, for red blood cell counting image segmentation is used effectively. An image divides into sub-images and help doctors to verify results according to their requirement [8]. Method of extracting life cell from image area is used by King Wu [22]. By counting the red blood cell, pathologist gets information for diagnosis of different type of anemia.

IV. LITERATURE SURVEY

NameirakpamDhanachandra, Khumanthem Manglem et al. [23] proposed a clustering algorithm that is the combination of two algorithms. There are different methods and of the most popular method is k-means clustering algorithm. K-means is an unsupervised clustering algorithm and is used to segment the interest area from the background. Subtractive clustering method used to generate the initial centers and those centers are used in k-means algorithm for the segmentation of image. Then finally median filter is applied to the segmented image to remove any unwanted region from the image. **Keh-Shih Chuang, Hong-long Tzeng, Sharon Chen et al. [24]** proposed a conventional FCM algorithm. A fuzzy c-mean (FCM) algorithm that contains spatial information into the relationship function for clustering. The spatial function is the summing up of membership function in the locality of each pixel under consideration. The advantages of new method are: (1) it reduces the spurious blobs, (2) it removes noisy spot, (3) it is less sensitive to noise than any other techniques.

Daniel Gomez, Javier Yanez, Carely Guada [14] et al. introduces the concept of Fuzzy image segmentation, providing an algorithm to build boundaries that are difficult to build based on the existing relations between the fuzzy boundary set problem and the hierarchical image segmentation problem. A fuzzy set on set of edges is given, using these sets each fuzzy image segmentation is characterized, that can be easily understood as the unclear boundary of the image. **Shan Zeng, Rui Huang, Zhen Kang [25] et al.** introduces a new method of image segmentation that combine spectral clustering and Gaussian mixture model. The new method contain three phases. (1) Image is partitioned into small segments given by a Gaussian mixture model (GMM), and the GMM is resolved by an Expectation Maximization (EM) algorithm with a very new projected Image Reconstruction Criterion, named EM-IRC. (2) distance among GMM components are measured using Kullback-Leibler (KL) divergence, (3) lastly, spectral clustering is applied to this enhanced similarity matrix to merge the GMM components. **Zhensong Chen, Zhiquan Qi, Fan Meng [20] et al.** introduces that image segmentation problem is a primary task and process in computer visualization and various application of image processing. It is well known that the performance of image segmentation is mainly inclined by two factors: the segmentation approaches and the feature presentation. As for image segmentation techniques, clustering is one of the most popular approaches. In this paper, a novel image segmentation approach is presented based on Dirichlet Process clustering algorithm. Compared with the current methods, our method has several improved advantages as follows: 1) The given algorithm could directly give the cluster number of the image based on the decision graph; 2) The center of cluster could be correctly recognized; 3) We could simply achieve the hierarchical segmentation according to the requirement of our application. Various experiments express the validity of this novel segmentation algorithm.

V. Kalist, Canesan P, J. Merlin Mary Jenitha [19] et al. proposed Possibilistic-fuzzy c-means based segmentation of satellite image. Possibilistic fuzzy c-means (PFCM) clustering is a mixed version of fuzzy c-means (FCM) clustering and possibilistic c-means (PCM) clustering. The PFCM clustering stay away from various limitations of both PCM and FCM. PFCM removes the problem of noise sensitivity in FCM. Moreover PFCM gives answer to the coincident clusters problem in Possibilistic c-mean clustering and the row sum constraint problem in Fuzzy PCM clustering. In the proposed approach, before segmentation, the images of satellite are altered from RGB color space into HSL space. The polar coordinate, user oriented HSL color space estimate the human vision and represents the colors in more perceptually and intuitive way than the RGB representation. The segmentation of images of satellite in RGB and HSL color space is compared and the experimental result shows that capability of the proposed approach. **Mei Yeen Choong, Wei Yeang Kow, Lorita Angeline et al. [5]** proposed that segmentation on synthetic and natural images are enclosed to study the performance and effect of different image complexity. Because of its cost expensive and it become unfavorable in performing image segmentation on high resolution image. Thus, a graph-based image segmentation



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method done in multistage approach. Two-stage image segmentation can be implemented that help reducing unnecessary image segmentation in specific region instead of performing segmentation on whole image.

V. CONCLUSION

This paper define the segmentation technique in various fields like in medical images detect Cancer, to brain MRI, to count blood cells, in Horticulture for pest detection and many more. With the help of various clustering methods, segmentation became very effective.Cluster based segmentation can give effective result so further study can be conducted regarding improving clustering technique in segmentation. Issues in image segmentation are image quality and number of errors. We have to improve these errors.

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