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A Survey on Image Segmentation Methods

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Abstract: *Image Segmentation is a technique, which is use to get a particular region or object recognition of an image, even recognize a particular part of an object. It is often an essential phase, if we want to analyze images, object detection, visualization, and many other images processing tasks. Different type of segmentation methods has been developed in the past two decades. This survey explains various image segmentation techniques and evaluates them.*

1. Introduction

In Image, it is essential that we have to distinguish between the objects of interest and others. The word "others" is referred to as the background of an image. The techniques are used to find the objects of interest are indicated to as segmentation. Segmentation should be considered the first and important task to do analysis an image. Image segmentation denotes that the particular block of an image into a set of regions, with the aim of detect the interest object from an noising image or information extraction which corresponds to image data through image segmentation, measurement of feature, or represents the meaningful areas of the image, such as the crops detection. Three features of image are mainly considerable for segmentation, i.e., color, shape, texture. The main objective of segmentation is to remove other noise portion from an image for easy analysis.

2. Classification of image segmentation technique:

Last few decades, a variety of techniques or algorithms have been proposed for segmenting images by identifying regions of particular common features. These can be classified into two main classes:

1. Merging Algorithm
2. Splitting Algorithm

There are several segmentation techniques or methods already developed by researchers, which are splitting, merging or a combination both of classes (Figure-1) such as:

- Threshold
- Region Based
- Edge Based
- Fuzzy Theory based
- Mean Shift Segmentation

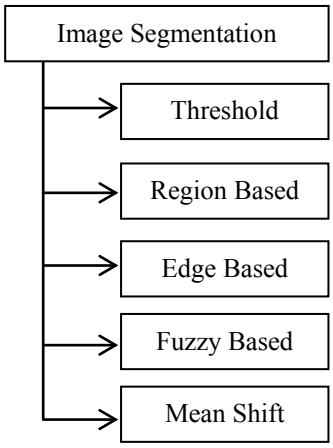

Figure: 1 Image Segmentation Technique

2.1 Threshold Technique

Thresholding, a common and simplest technique is widely used for image segmentation. Histogram thresholding and slicing techniques are used to segment an image. They may be applied directly to an image, but can also be combined with pre- and post-processing techniques. This technique is based upon a simple concept. A parameter θ called the brightness threshold is chosen and applied to the image a[x, y] as follows:

If $a[x, y] \geq \theta$ then a[x, y]=object=1
Else a[x, y] = background = 0

This technique is appropriate and powerful, when we are interested in light object on a dark background [1]. What is happens, when we are interested in dark object on a light background. We would use

If $a[x, y] < \theta$ then a[x, y] = object = 1
Else a[x, y] = background = 0

2.2 Region Based Technique

Region based methods are based on continuity. Region growing is the modest region-based segmentation algorithm (Figure-2). Like any other types of image segmentation, its main aim is to partition an image into different regions that are analogous according to a set of pre-specified feature. Unlike edge-based segmentation, which returns boundaries between regions, region-based segmentation is a technique that allows us to determine the regions directly. Region growing needs a set of starting pixels called seeds. First phase in region growing is to select a fixed the seed points based on some specific features. The preliminary region creates the exact position of these seeds [14]. Compute the pixel value of the initial seed point and its neighboring points for clustering. Repeat until all pixels in image have been allocated to an appropriate cluster. These techniques are generally better in noisy images where edges are difficult to detect, but its time consuming because SRG requires lots of computation time [2].

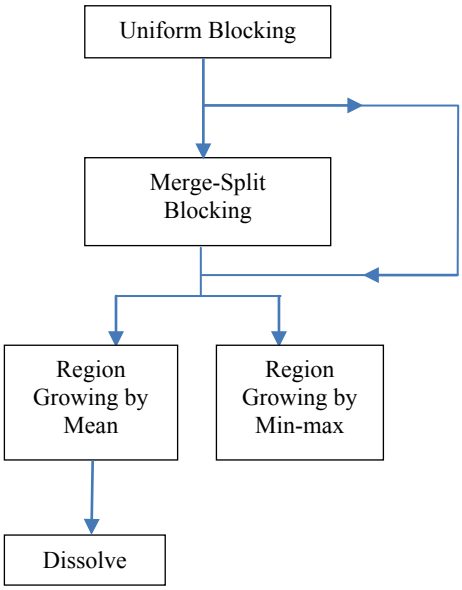

Figure: 2 Region-based Algorithm

2.3 Edge Based Technique

Edge based technique, detected edges in an image are assumed to represent object boundaries, and used to identify these objects [3]. This method can be preferable for two major reasons are: algorithms are usually less complex then others and edges are more important features in an image to distinguish their regions. In image processing especially in computer vision, the edge detection is the most familiar approach for detecting significant discontinuities in intensity values. There are three different types of discontinuities in the grey level like point, line and edges. Spatial masks can be used to detect all the three types of discontinuities in an image. There are many techniques are proposed in last few decades, those are:

- Roberts Edge Detection
- Sobel Edge Detection
- Prewitt Edge Detection
- Kirsh Edge Detection
- Robinson Edge Detection
- Marr-Hildreth Edge Detection
- LoG Edge Detection
- Canny Edge Detection

Edge detection contain three steps as follows: Filtering, Enhancement and Detection. The most common problems of edge-based segmentation are: Edge presence in locations where there is no border and no edge presence where a real border exists.

2.4 Fuzzy Based Technique

Fuzzy-based segmentation is highly power full technique. This method has been widely studied and successfully applied in image segmentation. The processing of natural images that have ambiguity and vagueness[12]. To reducing, new techniques has been developed. For example, Fuzzy rule-based non-linear thresholds and using a fuzzy-based hierarchical algorithm [4], which based on the fuzzy theory (Zadeh 1968) [6]. Amol S. Pednekar [7] proposed a new image segmentation technique based on fuzzy connectedness using dynamic weights. The improved- FCM (IFCM) algorithm is based on the concept of data compression where the dimensionality of the input is highly reduced [8]. Fuzzy based clustering approaches are used for improvement in density that effectively reduces the limitation of fragmentation. FCM is give better result than k-means [5, 9]. Fuzzy image processing has three stages as given in (Figure – 3)

1. Image fuzzification
2. Modification
3. Defuzzification

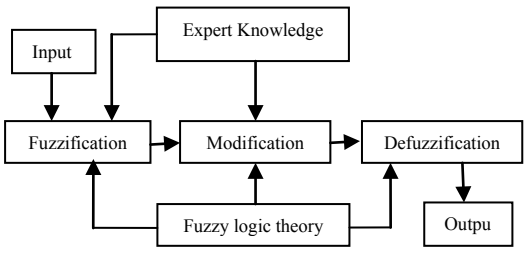

Figure: 3 Fuzzy based image processing

This segmentation technique is sensitive to noise, computationally expensive and determination of fuzzy membership is not very easy.

2.5 Mean Shift Segmentation Technique

The mean shift based technique was proposed in [10]. It is most powerful segmentation algorithm which has become widely-used in the image processing application. The mean shift technique is comprised of two basic steps: a mean shift filtering of the original image data (in feature space), and clustering of the filtered data points that is filtering and clustering.

In this step, the mean shift segmentation algorithm consists of analyzing the probability density underlying the image data in feature space. The data in this space will correspond to the locations with highest data density. The mean shift filtering step consists of finding the modes and associated with each data point helps to smooth the image while preserving discontinuities. Unlike other techniques, the mean shift is an iterative non-parametric algorithm or a nonparametric density gradient estimation using a generalized kernel approach [13]. After filtering, each data point in the feature space has been replaced by its corresponding mode. This suggests using single linkage clustering, which effective converts the filtered points into segmentation.

3. Conclusion

In this paper, we have explained the different type of techniques for image segmentation with key objectives and limitations. These segmentation methods discussed are most important for detecting a object in image. We chose only five segmentation technique, which are most commonly used in image processing application.

4. Reference

[1] Rafael C. Gonzalez, RichardE. Woods, "Digital Image Processing", 2nd Edition, Beijing: Publishing House of Electronics Industry, 2007.

[2] Wang, Y. H. (2010). Tutorial: Image Segmentation. National Taiwan University, Taipei, 1-36.

[3] Muthukrishnan, R., &Radha, M. (2011). Edge detection techniques for image segmentation. International Journal of Computer Science & Information Technology, 3(6), 259.

[4] Maeda, J., Kawano, A., Yamauchi, S., Suzuki, Y., Marçal, A. R. S., & Mendonça, T. (2008, June). Perceptual image segmentation using fuzzy-based hierarchical algorithm and its application to dermoscopy images. In *Soft Computing in Industrial Applications, 2008. SMCia'08. IEEE Conference on* (pp. 66-71). IEEE.

[5] Tolias, Y. A.—Panas, S. M.: On Applying Spatial Constraints in Fuzzy Image Clustering Using a Fuzzy Rule-Based System. IEEE Signal Processing Letters, Vol. 5,1998, pp. 245–247.

[6] Zadeh, L. A. : Fuzzy Sets. Inform. and Control., Vol. 8, 1965, pp. 338–353.

[7] Pednekar, A. S., & Kakadiaris, I. A. (2006). Image segmentation based on fuzzy connectedness using dynamic weights. *IEEE Transactions on Image Processing*, *15*(6), 1555-1562.

[8] Mondal, K., Dutta, P., & Bhattacharyya, S. (2012). Feature Based Fuzzy Rule Base Design for Image Extraction. *arXiv preprint arXiv:1206.3633*.

[9] Ravindraiah, R., & Tejaswini, K. (2013). A Survey of Image Segmentation Algorithms Based On Fuzzy Clustering. *International Journal of Computer Science and Mobile Computing*, *2*(7), 200-206.

[10] D. Comaniciu, P. Meer, "Mean shift: A robust approach toward feature space analysis", IEEE Trans. on Pattern Analysis and Machine Intelligence, 2002, 24, pp. 603-619

[11] Rastgarpour M., and Shanbehzadeh J., Application of AI Techniques in Medical Image Segmentation and Novel Categorization of Available Methods and Tools, Proceedings of the International Multi-Conference of Engineers and Computer Scientists 2011 Vol I, IMECS 2011, March 16-18, 2011, Hong Kong.

[12] Hamed Shamsi And Hadi Seyedarabi, "A Modified Fuzzy C-Means Clustering With Spatial Information For Image Segmentation", International Journal Of Computer Theory And Engineering, Vol. 4, No. 5, October 2012.

[13] Comaniciu, D., & Meer, P. (2002). Mean shift: A robust approach toward feature space analysis. *IEEE Transactions on pattern analysis and machine intelligence*, *24*(5), 603-619.

[14] Freixenet, J., Muñoz, X., Raba, D., Martí, J., & Cufí, X. (2002, May). Yet another survey on image segmentation: Region and boundary information integration. In *European Conference on Computer Vision* (pp. 408-422). Springer Berlin Heidelberg.