A REVIEW ON SEGMENTATION TECHNIQUES OF IMAGE PROCESSING

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ABSTRACT

The various image segmentation techniques are used for partitioning an image into multiple parts, so that each part has its valuable representation. There are now a wide assortment of image segmentation techniques, some considered general purpose and some deliberate for specific classes of images. These practices are separated on the basis of various properties such as detecting discontinuities and similarities. It is a great challenge for image analysis to have an accurate partitioning of the image so that the reliability of segmentation maintained.

KEYWORDS: Image Segmentation, Thresholding, Feature Based Clustering, Region Based Segmentation, Model Based Segmentation, Graph Based Segmentation.

The image segmentation technique is used to divide pixels into significant image surfaces, objects, or natural parts of objects. Segmentation is used in various areas such as object recognition, finger print recognition, medical imaging and computer guided survey. A challenging problem is to region with boundaries insufficiencies just like missing edges or lack of texture contrast between regions of interest and background. This review paper attempts to include all these points to a limited scope.

SEGMENTATION TECHNIQUES

Based on the following two properties of image, different techniques are classified.

- Detecting Discontinuities
- Detecting Similarities

Detecting Discontinuities

The Detecting Discontinuities are based upon a difference of their gray levels in an image as illustrate an edge detection [1]. Signal rises with rapid evolution such as transient signal in dynamic systems may undergo abrupt changes such as sharp change in first or second derivative. However, Fourier analysis is usually not able to detect the events. The purpose of this example is to show how analysis by wavelets can detect the exact instant when a signal changes and also the type and amplitude of the change.

Detecting Similarities

The Detecting Similarities are based upon the predefined criteria, that divides the proposed image into a segments whose pixel values on grouping gives the same results correspondence to the original image[1], followed by image segmentation algorithms that point up different techniques.

Classifications of these techniques are as follows:

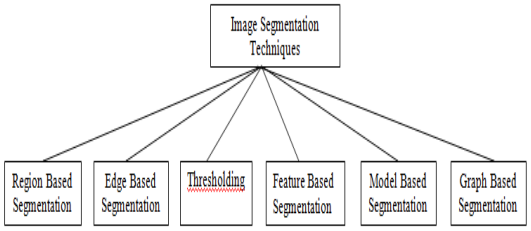

Figure 1: Classification of Segmentation Techniques

REGION BASED SEGMENTATION

A set of connected pixels with similar properties is known as Region. Partitioning an image into regions conveys useful information about objects or parts of an object consisting in an image. The partitioning into regions is done with the help of gray values of the image pixels [6,4]. As following two techniques are very supportive in region based segmentation:

- Region Growing
- Region Splitting and Merging

Region Growing

Region growing is a technique that combines pixels based upon predefined criteria into sub regions or larger regions [7]. It can be processed in four steps:-

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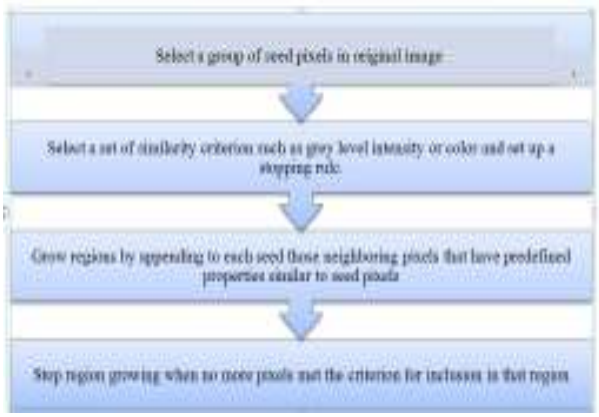

Figure 2: Steps of Region Growing

Region Splitting and Merging

As for choosing a seed points, image can be divided into a set of random independent regions which then merged into a single region. Region splitting and merging is generally implemented with the help of quad tree representation.

Edge Based Segmentation

A different gray level property between two regions is known as Edge. With the help of Edge based segmentation, objects are easily detected in an image. Using this technique, object boundaries are represented, and helpful in identifying the objects. Robert's edge detection, Sobel Edge Detection, Prewitt edge detection, Kirsh edge detection, Robinson edge detection, Marr-Hildreth edge detection, LoG edge detection and Canny Edge Detection are the common discontinuity based operators which are used in this technique. [9].

Thresholding

Naturally, region can be segmented through thresholding by the separation of light and dark regions [10]. To separate the interested region from its background, thresholding is beneficiary technique [11, 12]. In this technique, object is detected by transforming a gray scale image to binary image.

Threshold techniques can be divided into two classes:

- Global Threshold
- Local Threshold

Feature based clustering

In this technique, given image is transformed its equivalent histogram and then further apply some clustering technique. With the help of some unsupervised technique, pixels are clustered for segmentation. Clustering, techniques can be classified into following two categories:

- Supervised Clustering
- Unsupervised Clustering

1. Supervised clustering: In this clustering, clustering criterion is decided with the help of human interaction. It includes hierarchical approaches such as Relevance feedback techniques, Log-Based Clustering, Hierarchical Clustering, Retrieval Dictionary Based Clustering, K-Means Algorithm. These clustering techniques are:

i. Relevance feedback: A relevance feedback approach allows a user to work together with the retrieval algorithm by providing the information of which images in relevance to the query.

ii. Log–Based Clustering: Information retrieval process is maintained that is based on retrieval system logs [13].

iii. Hierarchical Clustering: It is the procedure of cluster is built by amalgamate the different images in the form of a tree and then developing gradually in order to form a small cluster.

iv. Retrieval Dictionary Based Clustering: In this clustering, retrieval dictionary is maintained which is used to classify learned patterns into plural clusters. Based upon distance between two clusters, image is retrieved [13].

v. K-Means Algorithm: In K-means algorithm data sets are classified into given number of clusters and then find the k centres, one for each cluster. Results may vary when the location of centres vary [14].

2. Unsupervised clustering: This type of clustering decides the clustering criteria by itself.

Model Based Segmentation

Markov Random Field (MRF) based segmentation is well-known as Model based segmentation. MRF has an inbuilt region smoothness constraint which is used for colour 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 [15]. MRF has spatial region smoothness constraint and there are correlations amongst the colour components [16].

Graph Based Segmentation

With the usage of various supervised learning algorithms, graph is constructed from the given image and features are extracted from this graph. After building a graph, apply state-of-the-art graph-cut algorithms to solve the problem efficiently [19]. This segmentation algorithm uses graph-cut approach to extract objects from given image.

CONCLUSIONS AND FUTURE SCOPE

As paper, signifies the classification techniques of image segmentation that shows potential to future as the universal procedurals and has become the focus of contemporary research. Homogeneity of images, spatial characteristics of the image continuity, texture, image content are the various factors for segmenting an input image. Thus, there is no single method which gives effective results for all type of images. After the analysis of different techniques of image segmentation, it is observed that a hybrid solution for image segmentation consists of two or more techniques is being the best approach to solve the problem of image segmentation.

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