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REVIEW ON IMAGE SEGMENTATION TECHNIQUES

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ABSTRACT

Digital image processing supports strong research program in areas of image enhancement and image based pattern recognition.Among the various image processing techniques image segmentation plays a vital role in step to analyze the given image. Image segmentation is the fundamental step to analyze images and extract data from them. This work deals on the basic principles on the methods used to segment an image. Segmentation has become a prominent objective in image analysis and computer vision. To segment the images, from segmentation techniques edge detection, thresholding, region growing and clustering are taken for this study. Segmentation algorithms are based on two properties similarity and discontinuity. This paper focuses on the various methods that are widely used to segment the image.

Keywords*: Segmentation, Edge detection, Thresholding, Clustering, Region Growing.*

I. INTRODUCTION

Digital image processing is having many recent applications in the fields of remote sensing, medicine, photography, film and video production, security monitoring. New innovative technologies are emerging in the fields of image processing, especially in image segmentation domain.

II. IMAGE SEGMENTATION

Image segmentation is initial or front stage processing of image compression. The efficiency of segmentation process is its speed, good shape matching and better shape connectivity with its segmenting result.Segmentation refers to the process of identifying and isolating the surface and regions of the digital image which corresponds to the structural units. Segmentation may also depend on various features that are contained in the image. It may be either color or texture.

III. SEGMENTATION ALGORITHMS

Segmentation Algorithms have been developed to segment the images; they are based on the two basic properties, discontinuity and similarity. In discontinuity based partition and subdivision is carried out based on abrupt changes in intensity levels or grey levels of an image. In this method our interest

mainly focuses on identification of isolated points, lines and edges. In similarity based group those pixels which are similar in some sense, it includes approaches like thresholding, region growing, and region splitting and merging.

IV. CLASSIFICATION OF SEGMENTATION TECHNIQUES

Segmentation can be classified into the following categories.

- Segmentation by Edge Detection
- Segmentation by Thresholding
- Segmentation by Region based
- Segmentation by Feature based Clustering

4.1 Segmentation by Edge Detection

In image segmentation process, the basic step is edge detection. It divides an image into object and its background. Edge detection divides the image by observing the change in intensity or pixels of an image. Gray histogram and Gradient are two main methods for detecting edge detections in image segmentation. Edge detection operators are divided into two categories as first order derivative operators and second order derivative operators. Second order operators give reliable results. The canny edge detector is a second derivative operator.

a) Canny edge detector

Initially an image is taken and it is to segment using canny edge detection technique. For this, first the image is converted from rgb to gray. The first step is to filter out any noise in the original image before trying to locate and detect any edges. The Gaussian filter is used in canny algorithm it can be computed using a simple mask.

After smoothing the image and eliminating the noise, the next step is to find the edge strength by taking the gradient of the image. Then, the approximate absolute gradient magnitude edge strength at each point is found by estimating the gradient in the x-direction columns and the other estimating the gradient in the y-direction rows.

After Finding the edge strength, edge direction using the gradient of x and y directions is found. Nonmaximum suppression is used to trace along the edge in the edge direction and suppress any pixel value sets it equal to 0 that is not considered to be an edge. This will give a thin line in the output image.

Hysteresis is used as a means of eliminating streaking. Streaking is the breaking up of an edge contour caused by the operator output fluctuating above and below the threshold. To avoid edge look like a dashed line, hysteresis uses two thresholds, a high and a low. Thus an image is segmented using edge detection.

Fig 4.1.1) Original image

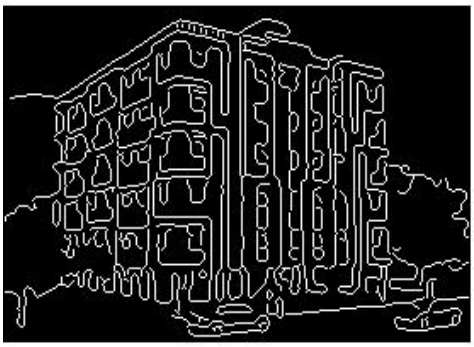

Fig 4.1.2) Segmentation using edge detection

Figure 4.1.2 shows the result of edge detection it segments the very fine features from the image.

4.2 Segmentation by Thresholding

One of the simplest approaches to segment an image is based on the intensity levels and is called as threshold based. Thresholding can be implemented either globally or locally. Global thresholding distinguishes object and background pixels by comparing with threshold value chosen and use binary partition to segment the image. Local thresholding is also called as adaptive thresholding. In this technique the threshold value varies over the image depending on the local characteristic of the subdivided regions in the image. Histogram thresholding is used to segment the given image; there is certain preprocessing and post-processing techniques required for threshold segmentation. Major thresholding techniques proposed by different researchers are Mean method, P-tile method, Histogram dependent technique, Edge Maximization technique, and visual technique.

b) Segmenting Using Adaptive Thresholding

The original image is segmented by adaptive thresholding. For this first the image is converted from rgb to gray. In this method local adaptive segmentation is based on maximum and minimum of mean method and is used to set threshold values. The size of rows and columns of this image are to find. Then the initial threshold value is set by obtaining mean of maximum pixel size of image and minimum pixel size of the image.

This resultant value is initial threshold value. Then using this threshold value image is segmented by basic thresholding technique, as the pixels within threshold follows one segment and other follows another segment. Likewise the process is repeated, until the threshold value becomes unmatched with the pixel value. The threshold values also repeatedly obtain for each segment. Thus an image is segmented using adaptive thresholding technique.

Fig 4.2.1) Original image

Fig 4.2.2) Segmentation using Thresholding

Figure 4.2.2 shows the result of thresholding, it segments the exact features from the image. It segments the image into two, one in foreground and another in background. Mostly the results of thresholding are reasonable.

4.3 Segmentation by Region based

In this technique pixels that are related to same object are grouped for segmentation. The thresholding technique 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 be any gap due to missing edge pixels in this region based segmentation the boundaries are identified for segmentation. After identifying the change in the color and texture, the edge flow is converted into a vector. From this the edges are detected for further segmentation.

c) Single Seeded Region Growing

Again the given input image is segmented using single seeded region growing technique. This technique is achieved using single seed. A single seed or pixel is taken and using this seed all the pixels related to this seed forms the region. Input image is read using image reading function. The position of the seedpoint is given, if it is not given, it is selected randomly. In this implementation the maximum intensity distance is defaults to 0.2.

The region is iteratively grown by comparing all unallocated neighbouring pixels to the region. The difference between a pixel's intensity value and the region's mean is used as a measure of similarity.

The pixel with the smallest difference measured is allocated to the respective region. This process stops when the intensity difference between region mean and new pixel become larger than a certain threshold (t). Finally output image is given by combining both the regions. Thus segmented image using single seed region growing is formed.

Fig 4.3.1) Original image

Fig 4.3.2) Segmentation Using Region Growing

Figure 4.3.2 shows the result of region growing; it segments features of the image into two parts.

4.4 Segmentation by Feature Based Clustering

Clustering a process of organizing the groups based on its attributes. A cluster usually contains a group of similar pixels that belongs to a specific region and different from other regions. The term data clustering as synonyms like cluster analysis, automatic classification, numerical taxonomy, botrology and typological analysis. Images can be grouped based on its content.The Clustering methods are usually divided as hierarchical algorithms and partitional algorithms. In content based clustering, grouping is done depending on the inherited characteristics of the pixels like shape, texture etc. There are various clustering techniques employed, the most widely used are K-means algorithm and fuzzy C-means algorithm.

d) Segmenting By K Means Clustering

The fourth segmentation technique used in this work is k means clustering algorithm. In this method first, the image is read using image reading function and displayed. Then a color transformation is done from original image to form test image. Again the image values are converted to double values. Using this, row and column values are obtained. Then the number of clusters to be created is assigned to five. Resizing and displaying are done in image values. The index creates five elementary arrays to store the cluster values and tiles are created for three different colors. The elementary array contains clusters. Finally the different clusters are displayed.

Fig 4.4.1) Original image

Fig 4.4.2) Segmentation Using Clustering

Figure 4.4.2 shows the result of edge detection it segments the very fine features from the image.

V. ANALYSIS AND DISCUSSION

On observing these techniques, edge detection yields better result with images that are having fine features such as flower, river and satellite images. Thresholding technique is best with images that are having fewer features such as face and fruit images. Single seeded region growing separate the image into parts according to features in the image. Clustering technique segments the image according to color features in the image. Thus by analyzing the results of these segmentation techniques with some images, region growing and thresholding gives better results than clustering and edge detection.

VI. CONCLUSION

Image segmentation has a promising future as the universal segmentation algorithm and has become the focus of contemporary research. As the result, image segmentation is affected by lots of factors, such as homogeneity of images, spatial characteristics of the image continuity, texture and image content. In this work, various techniques of image segmentation has been discussed, an overview of some related image segmentation techniques has been presented. The main image segmentation algorithms and classification of image segmentation are discussed. In this study, the overview of various segmentation methodologies applied for digital image processing is explain briefly.

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