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Review of Image Segmentation Algorithms and implementation of Threshold Algorithm

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Abstract*: Security of secret data is major concern in today's digitized world. It is an important task to preserve the secret data from the probable threats, during the transmission. Various techniques [1,2] have been proposed in literature for secure transmission of data but not much work has been done on the secret transmission of images which is one of the difficult task to accomplish. Secret image sharing is one of the important techniques used in case of image transmission. Images are encrypted before transmission over communication channel. In this paper we have discussed various techniques that are used for the image segmentation. Additionally we have discussed the strengths and weaknesses of algorithms and simplified threshold segmentation method.*

Keywords*:-Image Segmentation, Threshold segmentation, Regional growth segmentation, Edge detection segmentation, clustering.*

I.INTRODUCTION

Image segmentation process of partitioning a digital image into a couple of segments that is set of pixels, pixels in a vicinity are comparable in accordance to some homogeneity standards such as intensity or texture, color so as to discover and become aware of objects and boundaries in an image [16]. It makes an image easier to analyze in the image processing tasks. There are many distinctive techniques available to achieve image segmentation. In human vision, the complex image is right now segmented into the simple objects on the basis of color, texture, patterns, shapes, etc. The preference of these segmentation techniques to the any other technique and their degree of segmentation are decided by way of the specific kind of image and characteristics of the problem being considered.

II.IMAGE SEGMENTATION ALGORITHMS

Image is considered as one way of transforming information as it contains a lot if essential information. In the area of application of digital image technology, it is very important to understand about the image and extracting the necessary information from the same and the image segmentation. There are several commonly used image segmentation algorithms. We have discussed mainly five algorithms for simple analysis.

1) Threshold segmentation method: - This is one of the most regularly used segmentation practice in region-based segmentation algorithms [3]. It is essential as it automatically decides the optimal threshold based on a certain strategy, and achieves clustering to these pixels in accordance to the gray level. Threshold is used to generate binary image from a grayscale image that is a generating an image with only black or white colors. This is generally used for feature extraction strategy where desired features of image are transformed into white and rest everything to black. (or vice-versa)

The largest interclass variance method is most commonly used threshold segmentation algorithm (Otsu), which selects a globally optimal threshold by maximizing the variance between classes. In addition to this technique, there are still different methods used for

threshold segmentation such as minimum error method, entropy-based threshold segmentation method, moment preserving method, co-occurrence matrix method, probability relaxation method, statistical method, threshold methods combined with other methods and fuzzy set method [4].
Advantage:-The calculation is simple and the operation speed is faster.
2) Regional growth segmentation algorithm:-The fundamental thought behind this algorithm is the combination of pixels which are having similar properties to generate the region. In case of each region it is first to be divided to get a starting point pixel (seed pixel) as a growth point, and later it is merged with the nearby neighborhood with alike properties of the pixel in its area. [5] At the time of study it is identified that the advantage of this segmentation method is that it basically separates the regions that are connected and with the same properties and gives good edge values and results of segmentation. One more advantage is that it is simple and needs only few seed points to complete it. It is also identified that the noise and grayscale inequality may goes to be worthless and over-division. At the last is the shadow effect over the image is frequently not very good [6].
The major disadvantage is the cost of computation is very large.
3) Edge detection segmentation algorithm:-The major idea used in this algorithm is the utilization of discontinuous local features of an image. It means that the important piece of an image varies in local brightness for example gray or color, texture changes etc. These discontinuous areas of the edge are used to achieve image segmentation [7]. In the image we can easily found a gray edge in between two nearby regions along with different gray values and wherever there is a case where the gray value is not at all continuous.
This discontinuity can frequently be noticed with derivative operations, and these derivatives are calculated with the help of differential operators [8]. Parallel edge detection usually used as a technique of image preprocessing. Prewitt operator, Sobel operator and Roberts's operator are the most widely used in first-order differential operators. Kirsch operator, Laplacian, and Wallis operator is the most widely used second-order differential operator. [9]
4) Segmentation based on clustering: -
In case of segmenting the pixels in of an image, the feature space clustering method is used in correspondent with feature space points. For getting the segmentation end result the function house is segmented with their aggregation in the function space. Later they are mapped lower back to the original image space. This segmentation approach is primarily based on the clustering. According to the internal arrangement of sample set the image is separated into many subclasses The K-means is most generally used clustering algorithms. The key thought of K-means is to collect the samples into unique clusters primarily based to their distance. If the two factors are closer, they are viewed as incompact and independent cluster and reaches for making clustering objectives. [11].

K-means implementation process is as follows:
(1) First of all select k initial cluster center randomly.
(2) Later compute the distance between every sample and each cluster center, and return back each sample to the adjacent clustering center;
(3) For every cluster, compute the mean of all samples
(4) Until and unless the cluster center don't changes or reaches the defined number of iterations we have to repeat steps (2) to (3) [12].

The K-Means clustering algorithm is more popular because of the following
Advantages:-
1) It is fast and simple.
2) Its efficiency is high and is scalable for huge data sets.
3) Even the time complexity of it is very close to linear, and most suitable for mining large-

scale data sets.
The disadvantages of K-means are:-
The clustering number K has no unambiguous selection strategy hence it becomes difficult to estimate [10].
It is observed in K-means algorithm that every iteration traverses through the all samples, so the time required for algorithm is very expensive.
This is a distance-based partitioning method [13]. Hence it is not valid for nonconvex dataset and valid for convex data set.
5) Segmentation based on weakly-supervised learning in CNN:- This technique refers the difficulty of assigning a semantic label to each pixel of image . It consists of 3 parts.
1) Provide image which contains which objects.
2) Provide the border of an object.
3) The object area is marked with a partial pixel in the image [14].
Looking at the various Image Segmentation techniques and their advantages and disadvantages it is difficult to identify appropriate segmentation method which will adapt all images. It is also found that research study of image segmentation theory is not ideal or faultless. There are still several practical problems.
After comparing the advantages and disadvantages of the different image segmentation algorithms researcher has chosen Threshold segmentation method for generating template. The reason behind it is simple and the operation speed is faster among rest of the different segmentation methods. Thresholding segmentation method is capable of creating binary images from a gray scale image. By segmentation binary images are formed from color images. Segmentation is the technique where each pixel is assigned in the source image into two or more classes. The benefit of achieving binary image is that it reduces the complexity of the information and simplifies the procedure of identification and classification. For conversion of a gray scale image into a binary image, the most often way used is to pick a single threshold value (T). [15]
The research work has taken utmost care of simplification of algorithm. The next section elaborates simplified Algorithm for Threshold Image segmentation method.

III. SIMPLIFIED ALGORITHM FOR THRESHOLD IMAGE SEGMENTATION METHOD

Step I: - Let I be the input image where H, W be the height and weight of images respectively
Step II:-Now let's define offset=10
Step III:- Now start doing virtual template segmentation with the help of offset
Step IV: Define mat.
For(y=0 to h) increment by offset
For(x=0 to w) increment by offset
Step V:- Cnt=0
Step VI: For yy=0 to offset
For xx=0 to offset
Pixel=Read I(y+yy, x+xx)
If Pixel<128
Increment cnt
End if
End for xx
End for yy
Mat(index)=yy
End y

IV. CONCLUSION

Image segmentation is one of the ways to process and analyze images. Looking at the various Image Segmentation techniques and their advantages and disadvantages it is difficult to identify appropriate segmentation method which will adapt all images. It is also found that research study of image segmentation theory is not ideal or faultless.

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