# A COMPARATIVE STUDY OF IMAGE SEGMENTATION METHOD

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**Abstract --- Image segmentation is the crucial step to investigate images and extract data from them. It is the field mostly researched and still offers different challenges for the researchers. This paper tries to put light on the essential standards on the methods used to segment an image. This paper focuses on the idea behind the fundamental methods used. Image segmentation can be comprehensively as semi-interactive approach and completely automatic approach and the algorithms which developed lies in either of this approaches. Image segmentation is a crucial step as it specifically impacts the general accomplishment to comprehend the image.**

*Keywords-- Segmentation Methods, Image, Region based methods, Cluster, Graph-cut.*

## I.INTRODUCTION

An image is a two dimensional function of spatial coordinates, f(x, y) and amplitude of this function at a given direction gives the intensity value of the image. The image can be expressed as the product of elements of illumination and reflection.

$$f(x,y) = i(x,y) . r(x,y)$$

where i(x,y) is a function of intensity and r(x,y) is a function of reflectivity.

Digital image processing is application of various algorithms on the image to improve the quality of the image by removing noise & other noisy pixels and also to obtain more information on the image.

Among the different image processing techniques image segmentation is very essential step to analyze the given image. This paper mainly focuses on this segmentation method, the different methods followed and few algorithms that are mainly used. The images are operated using MATLAB software tools.

## II. IMAGE SEGMENTATION

Image segmentation is a medium level processing technique used to examine the image and can be characterized as a processing method used to classify or cluster an image into a few disjoint parts by grouping the pixels to produce a region of consistency based on the pixel characteristics like gray level, color, texture, intensity and other features. The main aim of the segmentation process is to get more information in the region of interest in an image which helps in instruction of the

object scene**.** Image segmentation aims at domain-independent partition of the image into a set of visually different in quality and homogeneous regions with respect to certain properties**.** The main aim of segmentation is to just change the representation of an image into something that is more meaningful and easier to consider.

If R represents an image, then image segmentation is simply division of R into subregions $R_1, R_2, \ldots, R_n$, such that

$$R = \bigcup_{i=1}^{n} R_i$$

and is governed by next set of rules:

    a)   $R_i$ is a adjacent set, i=1,2,…..n.
    b)   $R_i \cap R_j = \emptyset$ for all i and j, $i \neq j$
    c)   $Q(R_i)$ = True for i= 1,2,…n.
    d)   $Q(R_i \cup R_j)$ = False for adjacent regions, $R_i$ and $R_j$

Where $Q(R_k)$ is a logical predicate**.** The rules depictd above notice about continuity, one-to-one relationship, homogeneity and non-repeatability of the pixels after segmentation individually.

There are numerous information based approaches to deal with segment an image and can be recorded as

1. Intensity based methods
2. Discontinuity based methods
3. Region based methods
4. Clustering methods
5. Edge-based methods
6. Graph based methods

In the following sections a brief discussion is made on these methods.

### III. RELATED WORKS:

The segmentation of an image is very useful in medical applications to diagnose the abnormalities in the image  also satellite imaging and in computer vision as well as in ANN. The  main criteria for segmenting the image is very difficult to decide as it varies from image to image and also varies significantly on the modality used to capture the image. There is huge amount of literature available to understand and analyze the mage segmentation techniques.

In the clustering techniques have been examined for medical image segmentation in especially for MRI Images of brain and are effective in combining fuzzy c means and k-means to get novel fuzzy-k means algorithm. Hybrid techniques for medical image segmentation is proposed  and it for the most part works on fuzzy-c means and otsu''s method in the wake of applying on vector median filter, for segmentation and have attempted to demonstrate the robustness of their method several kinds of noise have been added to image and have acquired acceptable results.

Another procedure for broadly useful interactive segmentation of N-dimensional images utilizing graph-cut method has been proposed by Yuri and Jolly. In their proposed  strategy the user denote certain pixels as "object" or "background" to give  hard requirement for segmentation.

They assert that their strategy gives best balance of boundary and region properties contrasted with other segmentation methods and also that gives optimal solution for N-dimensional segmentation.There are different overview and surveys done on these methods periodically.

The following sections gives brief principle followed to segment images.

### IV. INTENSITY BASED SEGMENTATION

One of the simple concept to segment an image is based on the intensity levels is called as threshold based methodology. Threshold based method classifies the image into two classes and works on the postulate that pixels belonging to definite range of intensity values which   represents one class and whatever remains of the pixels in the image speaks to alternate class. Thresholding method can be actualized either globally or locally. Global thresholding method distinguishes object and background pixels by examining with threshold value chosen and uses binary partition to segment the image. The pixels that are pass the threshold test are considered as object pixel and are defined the binary value "1" and different pixels are defined binary value "0" and treated as background pixels. The threshold based segmentation method are cheap, computationally quick and can be used in real time applications with the help of particular equipment.

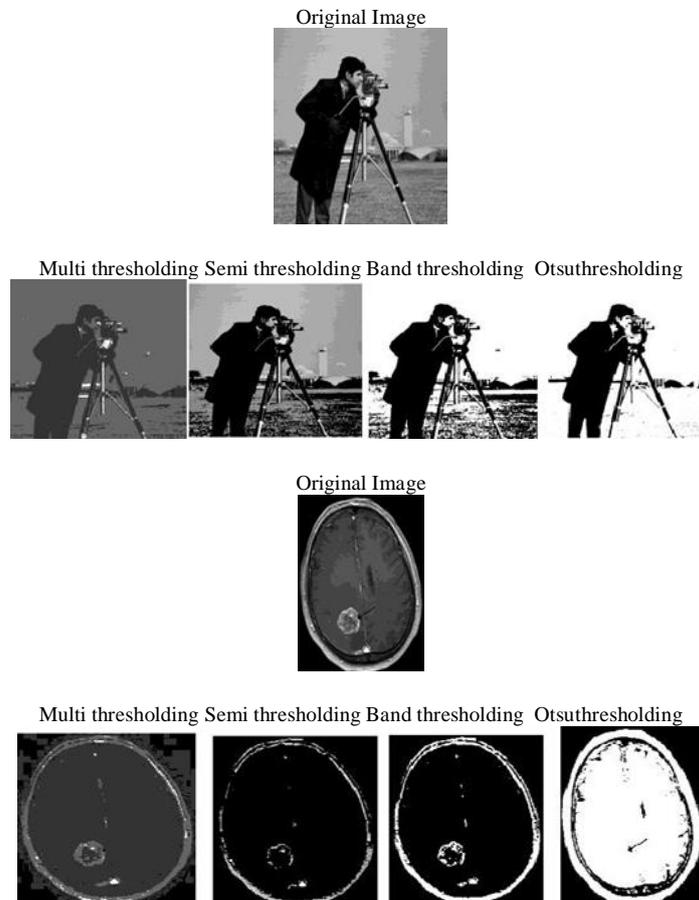$$g(x,y) = \begin{cases} 1 & \text{for } i(x,y) \geq t \\ 0 & \text{for } i(x,y) < t \end{cases}$$

where g(x,y) is the output image and i(x,y) is the input image and t is the threshold value.

In adaptive thresholding method the threshold value varies over the image rely on the local characteristic of the subdivided regions in the image. The algorithm followed by adaptive thresholding can be stated as follows:

1. Divide the image into sub-image.
2. Choose a local threshold for sub image  considered.
3. Examine the pixels in that sub-image and segment the region.

4. Consider all sub-images separately and select corresponding threshold values.
5. Stop segmentation when all the sub-images are processed.

In case of global thresholding method, the threshold value select remains the same for the entire image and acts as a cut-off value. In case of local thresholding method, the image is subdivided into subimages and the threshold is to be select depending on the features of local pixels in that subimage. Threshold value can be restricted and are categorized as band thresholding method, multi-thresholding method and semi-thresholding method. Either the global thresholding or local thresholding produced the result of threshold chosen. Hence the choice of threshold is essential and complicated. Otsu technique is optimal for thresholding a large objects from the background. This method gives an optimal threshold choose by the discriminant criterion by maximizing the discriminant measure η.

Original Image



Multi thresholding  Semi thresholding  Band thresholding  Otsuthresholding



Original Image



Multi thresholding  Semi thresholding  Band thresholding  Otsuthresholding



Pros of threshold based methods:
1. Relatively inexpensive
2. Fast and simpler to implement
3. Can work in real-time applications. Cons of threshold based algorithms:
1. Neglects the spatial information of the image.
2. Highly noise sensitive.
3. Selection of threshold value is important and often results in over or under segmentation.
May lead to pseudo edges or missing edges.

## V.  DISCONTINUITY BASED METHODS

The discontinuity based methods are based on the standard of intensity variations in the pixels. If the image consists two or some objects boundaries exists and subsequently can be applied to segment the image. The significant changes in the intensity levels among the near pixels in certain direction is termed as edges and results is obtained in the discontinuity in the pixels. Edge detection specifically includes the smoothing image, edge detection and edge localization.
A smoothing filter is applied on test image to remove the unwanted pixels from the image to make it desirable for segmentation. Then the "possible" edges are gathered to check for candidature and then the "true" edges are sick by localizing the edge "candidates". There are three different edge types which available in the image (a) step edge (b) ramp edge (c) ridge edge are shown in the fig respectively.
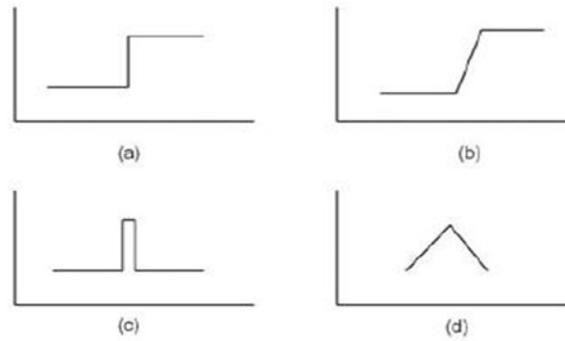
Edges can identify by applying masks over the image. The gradient or the zero crossing techniques are employed to detect the edges in the given image. The operation between the mask and the image check the edge set for the image.

Edge detection operators can be classified into the two categories
(1) First order derivative operators .
(2)Second order derivative operators.

### A. *First order derivative operators:*

There are basically two methods for first order derivative edge detection. 1) The first approach is evaluating the gradients make along two orthogonal directions. 2) The second approach is to utilize a set of discrete edge templates with different orientations. The first derivative operator uses gradient method to find the edges by using the maximum and minimum value of the gradient. The gradient is a measure of change in a function.

$$\nabla f = G[f(x,y)] = \begin{bmatrix} G_x \\ G_y \end{bmatrix} = \begin{bmatrix} \dfrac{\partial f}{\partial x} \\ \dfrac{\partial f}{\partial y} \end{bmatrix}$$

Direction of gradient is given by

$$\alpha = \tan^{-1}\left[\dfrac{g_y}{g_x}\right]$$

And α is measured with respect to x axis.

The operators used in this method are Robert's operator, Prewitt's operator and Sobel's operator.

i. Robert's operator: It is a simple first derivative Robert's operator that can be used to seek the edges in the given images. It find out  the edges in row and columns individualy and are gathered to find the resultant edge. The masks are used to solve the purpose of x and y direction respectively are

| -1 | 0 |
|----|---|
| 0  | 1 |

| 0 | -1 |
|---|----|
| 1 | 0  |

ii. **Prewitt's operator**: This operator utilizes 3 X 3 mask to find the edges and the mask is  used along x and y direction are

| -1 | -1 | -1 |
|----|----|----|
| 0  | 0  | 0  |
| 1  | 1  | 1  |

| -1 | 0 | 1 |
|----|---|---|
| -1 | 0 | 1 |
| -1 | 0 | 1 |

**iii. Sobel's Operator**: This is mostly used first derivative operator to find out edges and its modification of Prewitt's operator by continuous changing the centre coefficient to "2". The sobel operators are given as

| -1 | -2 | -1 |
|----|----|----|
| 0 | 0 | 0 |
| 1 | 2 | 1 |

| -1 | 0 | 1 |
|----|----|----|
| -2 | 0 | 2 |
| -1 | 0 | 1 |

*B. Second Order Derivative operators:*

The second order derivative operators works on zero crossing perception of the second derivative of the gradient. It find out  the local maxima in gradient values and interact in a certain way as edges. The Laplacian operator is used second derivative operator. The Laplacian operator for every function f(x, y) is given by

$$\nabla^2 = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

Where

$$\frac{\partial^2 f}{\partial x^2} = f(x, y+1) - 2f(x,y) + f(x, ,y-1)$$

$$\frac{\partial^2 f}{\partial y^2} = f(x+1, y) - 2f(x,y) + f(x-1,y)$$

 The often used second order derivative operators for edge detection are Laplacian of Gaussian and Canny edge operator.

**i. Laplacian of Gaussian Operator:**

The Laplacian operator of an image highlights regions of rapid intensity change. The laplacian operator takes a single gray level image as a  input and produced another gray level image as output. The kernels used for approximation of second order derivatives Laplacian operations are taken. The graph cut method method unable to overcome the blockiness artifacts. This method does not provides the accuracy of  segmentation results. Boundary detection method cannot be used for this method.

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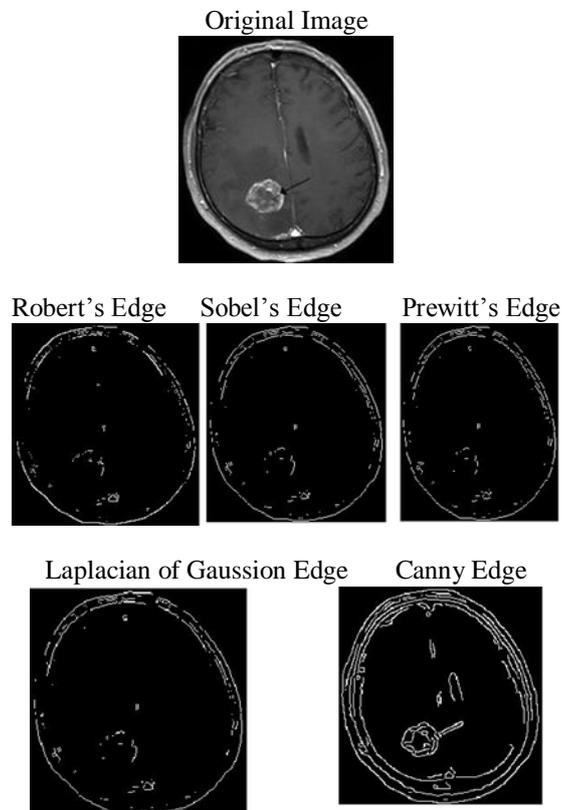| 1 | 1 | 1 |
|----|----|----|
| 1 | -8 | 1 |
| 1 | 1 | 1 |

| -1 | 2 | -1 |
|----|----|----|
| 2 | -4 | 2 |
| -1 | 2 | -1 |

| 0 | 1 | 0 |
|----|----|----|
| 1 | -4 | 1 |
| 0 | 1 | 0 |

**ii. Canny Edge Operator:**

Canny edge operator is considered as a superior edge detection operator among the available operators which is based on the experimental results as it calculate strong and weak edges in the image. An image is a first smoothed by using circular two-dimension of Gaussian function and computing the gradient of the result then using the gradient magnitude and direction to correct edge strength and direction.The gradient magnitude array consists of undesirable ridges around local maxima and are to be inhibited to get discrete orientations of the edge normal by processing of the nonmaxima suppression. The technique of double thresholding is employed to remove false fragments. Two thresholds are uses to solve the purpose T1 and T2 where $T2 \approx 2T1$.

Original Image

Robert's Edge          Sobel's Edge          Prewitt's Edge

Laplacian of Gaussion Edge          Canny Edge

**VI. REGION BASED SEGMENTATION**

This method works at the guideline of homogeneity by considering the way that the neighboring pixels inside a region possess same characteristics and are different to the pixels in other regions.The regions though regarded as homogeneous in nature but there is provision to note any considerable change in the characteristic of the near pixels. The simple approach to segment an image based on the similarity assumption is that every pixel is examined with its neighbor for similarity check (for gray level, texture, color, shape). If the result is positive, then specific pixel is "added" to the pixel and a region is "grown" like-wise.
Region based methods are divided as follows:

1. Region growing method

2. Region split and merge method

**A. Region growing methods:**
There are a few important points that consider when trying to segment an image. You must have regions which is disjoint because a single point cannot be contained in two unique regions. The regions must traverse the entire image because each point has belongs to one region or another region. To produce regions at all, you must define some property that will be true for each region which you define. If these criteria are met, then the image is segmented into regions. This paper is discusses two different region determination techniques: (1)one technique that focuses on edge detection

(2)and another that uses  region growing areas of the image. The region growing techniques illustrates the potential sequences of processes by using region growing.
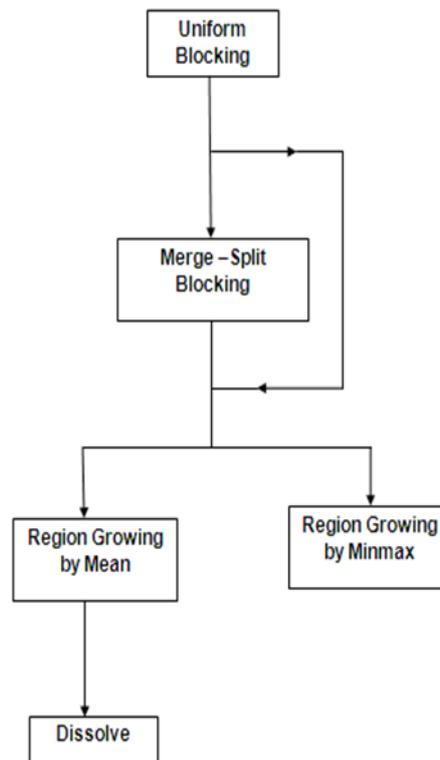


**Block Diagram of Region Growing Process**

**Uniform Blocking:**

Uniform blocking is the initial step in any of our algorithms. This step involves separating the images into uniform blocks for processing. We normally used 2x2 blocks if region growing was to be working directly or 16x16 blocks if the region with merge-split algorithm was to be used. It shouldn't make any difference what block size is fed into the merge-split routine, but handling an intermediate value improve the speed of the  images.

*Merge-Split Blocking:*

The merge-split blocking is an optional stage of our region growing based segementation scheme. This threshold figures out which blocks can be converted into a single block and which blocks can be divided into smaller blocks .

 If the max-min difference of a block is near to the max-min difference of its neighbors  then the blocks are converted into a single block. A block is divided in half if the max-min difference of the block increases the threshold. The merge-split mechanism is implying that the merging and splitting of blocks goes from 4 to 1 and 1 to 4 severally.

This procedure is done recursively until, no blocks fulfill the idea to be split or merged. Thus a block whose max-min difference increases the threshold will continue to be split till the max-min difference of the subsequent block(s) are within the threshold. There is likewise a minimum block size argument which allows the user to a the assign smallest block size that can be created through splitting. Merge-split algorithm has blocks that are no smaller than a specified size. Without this component there is a impedance for the merge-split routine to return some small blocks.

*Region Growing by Mean or Max-Min:*

Region growing is finished by examining properties of each block and combining them with adjacent blocks that satisfy some criteria. We use one of two Rule. One rule is to look at the max-min difference and consolidate adjacent regions whose max-min difference is inside a tolerance of the seed block's. This tolerance does not need to be the same as the

threshold used in the merge-split algorithm. On the other hand, the mean values of the blocks can be utilized to determine which blocks should be merged.

### *Dissolve:*

This algorithm works  with the mean-based region growing to convert regions that are less than a specified size into the nearest region with the closest mean value. This process helps to give a segmented image that corresponds  to the segmentation that a human can do by hand. The number of regions is decrease by eliminating the less significant regions, ignoring an excessive amount of segmentation.

Advantages:

1. Region growing method can correctly isolate  the regions that have same properties we characterize.
2. Region growing method can give the original images which have clear edges with good segmentation results.
3. The idea is simple.
4. We can decide the seed points and the criteria we want to make.
5. We can pick the multiple criteria at the same time.
6. It performs good with respect to noise.

### A. *Region Split and Merge method:*

The figure given below illustrates the process and also the algorithm is given,

Algorithm:

Let R stands the entire image region and let P be any predicate.
If P(R)  == False
 Partition an image into quadrants If P if false for any subquadrant
  divide that quadrant into subquadrant..
Stop partitioning when P is true.
Merging the regions Rj & Rk (j ≠ k; j=1,2,3…n, k=1,2,3…n)
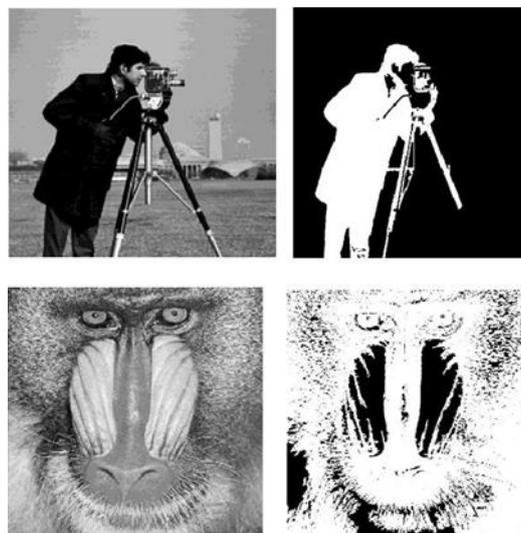if P( Rj U Rk) == true



Fig.1: Results of region growing algorithms for segmenting images.

The following table gives a comparison between the approaches used. The corresponding entries are based on the perception of the result images shown above in discussion.

| Parameter | Threshold Based Segmentation | Edge Based Segmentation | Region Based Segmentation |
|---|---|---|---|
| Nature of the Output Image | Black-White | Black-White | Black-White |
| Spatial Information | Neglected | Neglected | Considered |
| Region-Continuity | Moderate | Moderate | High |
| Computation Complexity | Less | Moderate | High |
| Speed | Fast | Moderate | Slow |
| Noise Immunity | Less | Less | Less |
| Detection of Multiple objects | Poor | Poor | Moderate |
| Automaticity | Interactive (Semi Automatic) | Interactive | Interactive (Semi Automatic) |
| Accuracy | Moderate | Moderate | Good |

## VII. CLUSTERING BASED METHODS

Clustering is a process of organizing the groups based on its attributes. The goal of clustering methods is to identify bunch in data. A cluster contains a group of same pixels that belongs to a specific region and different from other regions. Images can be grouped based on its content. In content based clustering, grouping is completed depending on the genetic characteristics of the pixels like shape, texture etc.There are different clustering methods employed, the mostly used are K-means algorithm and fuzzy C-means algorithm. The Clustering methods are divided into hierachical algorithms and partitional algorithms.

### A. *Agglomerative clustering:*

This is a gradable approach and starts grouping by calling each data point to separate a cluster and then convert the appropriate clusters into single clusters. The main step for this algorithms is to calaculate the distance. This method results in a few partitions. The dissimilarity matrix is used to select which clusters are to be converted; the smallest entry gives the data points that are least not similar and hence are the most candidates to be converted.

Algorithm of Agglomerative Hierarchical clustering**.**

1. select the big similarity value from the input similarity matrix and its session is Si,Sj and combine and form its composition Si,j.
2. create a matrix with Si,j.
3. Find cell values of matrix as Similarity(Si,j, Sk) = min { similarity (Si,Sk), Similarity(Sj,Sk)}
4. Repeat step 2 again until single cluster in matrix cell.

### B. *Partitional clustering:*

These algorithms works on specifying the number of groups initially and converging them iteratively. The partitional clustering methods divides the data points into clusters such that the total distance of data points to their respective cluster centers is nominal. An algorithm to achieve this is called *K-means clustering algorithm.* The partitional clustering results in a single partition of the image.

### i. K-means algorithm :

In K-mens clustering algorithm, it clusters the point closest to the centroid. The centroid is basically the mean of all points in that cluster and has rearranged as the arithmetic mean over all points in the cluster, separately for every dimension.

**Algorithm: *K*-means clustering**

1. Choice the number of desired clusters $k$. Then place the $k$ cluster centers at different initial locations in the image.
2. Define each data point to the cluster whose center is closest.
3. Recompute the cluster centers.
4. Go to step 2 until no more changes occur or a maximum number of iterations is reached.

This K-means algorithm minimizes the total distance of data points to the cluster center, of the cluster they are assigned to. Also it does not need the actual computation of distances. A disadvantage of k-means algorithm is that the number of desired clusters needs to be set before. Although hierarchical methods can be more accurate, partitional methods are utilized in applications involving large data sets .

*ii. Fuzzy C-Means [FCM] Algorithm:*

In this FCM algorithm the test pixel is allowed to be member of two or more clusters with different membership coefficient. This algorithm is iterative in nature and creates fuzzy partition matrix and also requires cluster centre with objective function. The values for cluster and objective function are updated for each single iteration and are stopped when the difference between two object function values is minimum than predefined threshold value. The objective function and the algorithm are as given below

$$J_{FCM} = \sum_{k=1}^{n} \sum_{i=1}^{c} (v_{ik})^q \, d^2(x_k, v_i)$$

Where x=\{$x_1$,x2,$x_3$,..........,$x_n$\}$\subseteq$ R;
      dataset n= number of data items
      c= number of clusters; $2 \leq c < n$
$v_{ik}$ = degree of membership of $x_k$ in i$^{th}$ cluster q= weighting exponent of each fuzzy member

$v_i$ = prototype of center cluster i

Algorithm:

1. Define the values for c, q and threshold value and also initialize the partition matrix U .
2. Initialize the cluster centers and a counter p.
3. Choose the membership values and store in an array.

4. For each iteration calculate the parameters $a^p$ and $b^p$ where

$$a_i^p = a_i^p + v_i x_k$$
$$b_i^p = b_i^p + v_i$$

5. After each iteration update cluster centre and compare it with the previous value ( $ll^b$_$ll^b$_$^1$)

6. If the difference of comparison is less than the assigned threshold value stop iteration else repeat the procedure.

The hybrid of the k-means clustering algorithm and fuzzy c-means algorithm also exists and is called as fuzzy k-c means algorithm and it coinside fuzzy c-means algorithm in most situations but with an improved efficiency.

**VIII. EDGE BASED METHODS**

The edge-based methods make use of different edge operators to produce an "edginess" value at each pixel. The values are then thresholded to produce the edges. The regions inside connected edges can be considered as various segments because they lack continuity with respect to adjacent regions. The Sobel operator was studied and implemented to detect edges in images. The edges are thus found could also be used as aids by different image segmentation algorithms for refinement of segmentation results.

In simple methods, the operator calculates the gradient of the image intensity at each point which gives the direction of the large possible increase from light to dark and the rate of change in that direction. The result shows that how

"smoothly" the image is changes at that point therefore how likely it is that part of the image represents an edge and also how that edge is likely to be oriented.In theorotical, the operator consists of a pair of $3 \times 3$ convolution masks which is shown in Figure 1.

| -1 | 0 | +1 |
|----|---|----|
| -2 | 0 | +2 |
| -1 | 0 | +1 |

Gx

| +1 | +2 | +1 |
|----|----|----|
| 0 | 0 | 0 |
| -1 | -2 | -1 |

Gy

One mask is just the other rotated by 90 degrees. This is fundamentally same as the Roberts Cross operator.

These masks are intended to respond maximally to edges running vertically and evenly in respect to the pixel framework, one cover for each of the two opposite introduction. The masks can be connected individualy to the input image, to got separate measurements of the gradient component in each orientation (call these Gx and Gy). These can be consolidated together to locate the absolute magnitude of the gradient at each point and the orientation of that gradient. The gradient magnitude size is given by:

$$|G| = \sqrt{G_x{}^2 + G_y{}^2}$$

Output values are gotten from the operator can easily overflow the maximum allowed pixel value for image types that only support smallish whole number pixel values (e.g. 8-bit integer images). When this happens the standard practice is to just set the overflowing output pixels to the maximum allowed value. The issue can be avoided by utilizing an image type that supports pixel values with a bigger extent. Natural edges in images regularly lead to lines in the output image that are several pixels wide because of the smoothing effect of the Sobel operator. Some thinning may be desirable to counter this. A few consequences of edges detected by the Sobel operator are shown in Figures 2, 3 and 4.
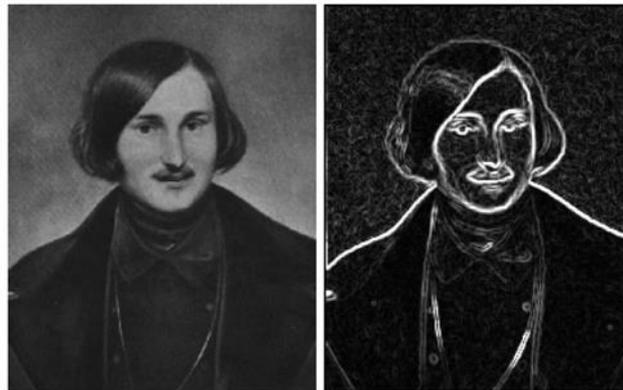


Fig.2: Edge detection of a man's image with the Sobel operator



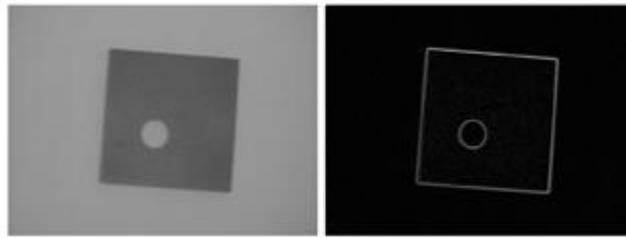Fig .3: Edge detection of a clown image with the Sobel operator.

Fig.4: Edge detection of a wedge image with the Sobel operator

Edge based segmentation is the area of pixels in the image which correspondes to the boundaries of the objects seen in the image. It is then accepted that since it is a boundary of a region or an object then it is shut and the number of objects of interest is equivalent to the number of boundaries in an image. For precision of the segmentation, the edge of the boundaries detected must be around equivalent to that of the object in the input image. For instance, these methods have problems with images that are:

1. Edge-less

2. Very noisy

3. Boundary that are exceptionally smooth

4. Texture boundary

## IX. GRAPH BASED METHODS

A Graph based methods for image segmentation has couple of good features in practical applications. It explicitly composes the image elements into numerically sound structures and makes the plan of the issue more flexible and the computation more efficient.

Let $G = (V, E)$ be a graph where $V = \{ v1, ..., vn \}$ is an arrangement of vertices comparing to the image elements, which may speaks pixels or regions in the Euclidean space. $E$ is an arrangement of edges associating certain pairs of neighboring vertices. Every edge $(vi,vj) \in E$ has a relating weight $w(vi,vj)$, it measures a specific amount in view of property between the two vertices connected by that edge. In the case of image segmentation, the component in V are pixels and the heaviness of an edge is some measure of the divergence between the two pixels associated by that edge (e.g., the distinction intensity, color, motion, location). An image can be partitioned into components, such that every segment $A$ will be associated graph $G = (V, E)$, where $V' \subseteq V$, $E' \subseteq E$ and $E'$ contains just edges worked from the nodes of $V'$. As , non emit were, non unfilled sets $A1, ..., Ak$ form a segment of the graph $G$ if $Ai \cap Aj = \varphi$ $(i,j \in \{1, 2, ..., k\}, i \neq j)$ and $A1 \cup ... \cup Ak = G$.

The graph based methods are categorized into four classes : (1)Minimal spanning tree based methods, (2)Graph cut based methods with cost functions, (3)Graph cut based methods on Markov random field models, (4)Shortest path based methods. Graph cut methods are mostly utilized and was at first proposed by yuri and marie. Graph theory characterizes, the level of uniqueness between two segment can be registered in the form of a graph cut. Graph cut is well suitable for segmentation of images. A graph cut is a subset of edges by which the graph $G$ will be partitioed into two disjoint sets $A$ and $B$ and the cut value is normally defined as:

$$cut\,(A, B) = \sum_{u \in A, v \in B} w(u, v)$$

where $u$ and $v$ is the vertices in the two different components.

The cost function is defined in terms of boundary and region properties of the segmentation. These properties can be viewed as soft constraints for segmentation.
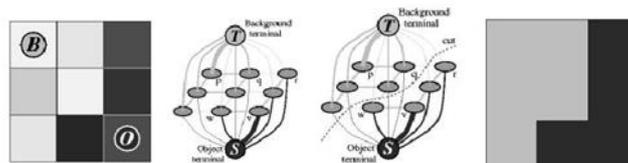


Fig(1):Image courtesy

Consider an image as appeared in the above fig 1(a). Utilizing the object and background seeds produce a graph with two terminals as shown in 1(b) and by utilizing the edge weights, boundary terms of cost function and positions of the seeds in the image separate two terminals by processing optimal minimum cut 1(c). This cut should give the segmentation

result as appeared in 1(d). There are many other methods that are used to obtain desired image segmentation using the graph theory. A detailed survey of graph based techniques is done by ping et.al and the reader can refer for more detailed information. The advantage of a graph based segmentation approach is that it might require no discretization by virtue of purely combinatorial operators and thus incur no discretization errors.

## X. DISCUSSIONS

Image segmentation is a step of partitioning an image into its constituent homogeneous regions to extract data from the attributes of the image. Thusly, a good segmentation should result in regions in which the image components should have uniform properties regarding of brightness, color or texture so on. Though the image is to be distributed into regions, the considerable changes inside the regions should be observable visually. The measurement of quality of segmentation is that the elements of the same region should be comparable and should have clear difference between elements of the other regions.The segmentation process can be isolated into various classification in view of the parameter selected for segmentation.

The result is obtained using one approach may not be the same as compared with other approach. In a general sense the segmentation can be semi-interactive or automatic. The algorithms developed for segmentation lies in this classification. With the real difficulty of ill-posed nature of segmentation it is hard to obtain single response for segmentation of given image.

In some cases manual correspondence to segment the image might be blunder inclined (for example, in case of seed selection) while the completely automated approach can give error output (for case if there should be an occurrence watershed segmentation) sometimes interactive methods can be laborious and time consuming. So a single way to segment all variety of images.might be practical unachievable. The prior knowledge on the image can give good response and gives user the decision to choose proper method to segment the image.

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