

# A Review Paper on Image Segmentation and Various Previous Technique

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**Abstract-***The Image segmentation (IS) is known as one of the maximum significant processes of image processing (IP). It is the approach of separating or partitioning an picture into components, referred to as segments. It is ordinarily useful for applications like picture compression or object reputation, due to the fact for those kinds of applications; it is inefficient to manner the complete picture. So, image segmentation is used to section the components from picture for similarly processing. There exist numerous IS techniques, which partition the picture into numerous components primarily based on sure image functions like pixel depth fee, color, texture, and many others. These all strategies are categorized primarily based on the segmentation approach used. In this paper the various IS strategies are reviewed, discussed and ultimately a assessment in their advantages and disadvantages is listed.*

**Keywords-**Image segmentation; edge detection; fuzzy clustering; thresholding;

## I. INTRODUCTION

In the area of computer vision, the image segmentation is an essential issue, which can segment the focused parts from the image containing substantial info. Into unique elements which can be beneficial with admire to a specific application. It has large utility in numerous fields like, medical picture (Computer guided surgery) Finger print Recognition; Face reputation real-time visual monitoring, Locate objects in satellite images etc. Much more segmentation methods have been introduced in literature survey.

It is the system of splitting a Digital image (DI) into multiple widespread areas or set of pixels with admire to a certain application. The important cause of segmentation is to diminish the records for easy analysis it's also beneficial in Image compression (IC) and Image analysis. Transformation of color image to grayscale image is one of the image processing approaches used in different fields beneficially.

In the algorithms of IS, thresholding is easy and swift, As a classic thresholding method, the Otsu method is

robust and beneficial, and is broadly used in IS The Otsu approach can accumulate a firm segmentation popular, so it's miles usually used inside the detection of floor inadequacy. JSEG (Joint Systems Engineering Group) set of rules may be very valuable to conquer the issues of the vast computation it's far primarily based on regional boom and unsupervised color texture and IS boundary is very accurate. In one more algorithm K-approach is the clustering set of rules used to determine the herbal spectral groupings to be had in a facts set. It is an unsupervised the pixels in the precipitate area have near by the duplicate characteristic of data. Thus, the spatial courting of neighbouring pixels is primary distinct that may be of considerable resource in IS. [1].

## II. IMAGE SEGMENTATION

Image Segmentation is described because the approach in which an picture is partitioned into many parts, such that an picture is depicted into something that is easy to specific and clean to look at. It is important for significant evaluation and interpretation of medical images. Segmentation is the advanced technique in which a digitalized image is partitioned or segmented into numerous segments or parts based on the values of pixel. It is a perilous and important section of image exploration system. The cause of Image Segmentation is to separate a picture into semantically interpretable regions in regards to specific software and to recognize homogeneous regions in the picture as discrete and belonging to awesome gadgets. There are numerous algorithms and strategies that have been established for segmenting picture. Modern scientific imaging modalities like MRI and CT scans generate massive photographs which cannot be studied manually. This develops the requirement for more effective and robust image determination approaches, tailored to the problems met in medical images [2].

### Applications

1. Satellite imagery
2. Wire picture standards conversion
3. Medical
4. Imaging

5. Videophone
6. Character recognition and
7. Image enhancement [3]

### III. CLASSIFICATION OF IMAGE SEGMENTATION TECHNIQUES

There are several existing techniques which are used for IS. These all techniques have their own importance. Every technique can be applied on different images to perform required segmentation. These all procedure also may be categorized into 3 classes [4]

#### A. Structural Segmentation Techniques

The structural strategies are the ones strategies of IS that is predicated upon the data of the structure of required part of the photograph i.e. the desired location that is to be segmented.

#### B. Stochastic Segmentation Techniques

The stochastic system are those strategies of the IS that works at the discrete pixel values of the picture in preference to the structural statistics of place.

#### C. Hybrid Techniques

The hybrid strategies are those techniques of the IS that uses the ideas of both above techniques i.e. these uses discrete pixel and structural information together. In further parts of this paper the various techniques of segmentation are discussed and compared. The popular techniques used for image segmentation are: thresholding method, edge detection based techniques, region based techniques, clustering based techniques, Watershed primarily based strategies, partial differential equation based and artificial neural network (ANN) based techniques etc. These all techniques are different from each other with respect to the method used by these for segmentation.

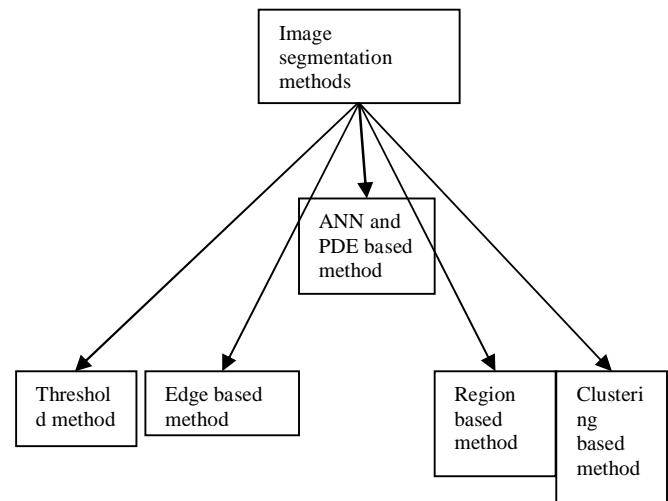


Fig 1 Image segmentation techniques

### IV. IMAGE SEGMENTATION TECHNIQUES

#### Thresholding Method

Thresholding methods are the simplest methods for IS. These process separate the picture pixels with admire to their intensity degree. These methods are used over pictures having lighter gadgets than history. The selection of these methods can be manual or automatic i.e. can be based on prior knowledge or information of image features. There are essentially 3 kind of thresholding:

##### Global Thresholding:

This is done by using any appropriate threshold value/T. This value of T will be constant for whole picture. On the basis of T the output image  $q(x,y)$  can be obtained from original image  $p(x,y)$  as:

$$q(x,y) = \begin{cases} 1, & \text{if } p(x,y) > T \\ 0, & \text{if } p(x,y) \leq T \end{cases}$$

##### 1) Variable Thresholding:

In this type of thresholding, the value of T can vary over the image. This can further be of two types: Local Threshold: In this the value of T depends upon the neighborhood of x and y. Adaptive Threshold: The value of T is a function of x and y.

##### 2) Multiple Thresholding:

In this form of thresholding, there are a couple of threshold values like T0 and T1. By using these output image can be computed as:

$$q(x, y) = \begin{cases} m, & \text{if } p(x, y) > T1 \\ n, & \text{if } p(x, y) \leq T1 \\ o, & \text{if } p(x, y) \leq T0 \end{cases} \quad (2)$$

The values of thresholds can be computed with the help of the peaks of the image histograms. Simple algorithms can also be generated to compute these.

**Edge Based Segmentation (EBS) Method**

The edge detection techniques are well developed techniques of IP on their own. The EBS methods are based totally on the rapid change of depth cost in a picture because a unmarried intensity fee does no longer offer top facts approximately edges. Edge detection techniques locate the edges where either the first derivative of intensity is greater than a particular threshold or the second derivative has zero crossings. In EBS methods, first of all the edges are detected and then are connected together to form the object boundaries to segment the required regions. The fundamental two EBS methods are: Gray histograms and Gradient based totally techniques. To stumble on the edges one of the fundamental side detection techniques like sobel operator, canny operator and Robert’s operator etc may be used. Result of these techniques is basically a binary picture. These are the structural techniques primarily based on discontinuity detection.

**Region Based Segmentation (RBS)Method**

The RBS techniques are the strategies that segment the picture into diverse areas having similar characteristics. There are simple strategies primarily based in this technique.

**Region growing methods (RGM):**

The region growing primarily based segmentation strategies are the methods that segments the picture into various regions based totally on the growing of seeds (preliminary pixels). These seeds may be selected manually (based on previous know-how) or mechanically (based on precise utility).Then the growing of seeds is controlled by connectivity between pixels and with the help of the prior knowledge of problem, this can be stopped. The basic algorithm (based on 8- connectivity) steps for region growing method are:

If  $p(x,y)$  is the original image that is to be segmented and  $s(x,y)$  is the binary picture wherein the seeds are positioned. Let ‘T’ be any predicate that is to be tested for each  $(x,y)$  position.

- First of all, all the connected components of ‘s’ are eroded.
- Calculate a binary image  $P_T$ . Where  $P_T(x, y) = 1$ , if  $T(x, y) = \text{True}$ .
- Compute a binary image ‘q’, where  $q(x, y) = 1$ , if  $P_T(x, y) = 1$  and  $(x, y)$  is related to seed in ‘s’.

These linked components in „q“ are segmented regions.

**Region splitting and merging methods:**

The region splitting and merging based segmentation techniques makes use of simple techniques i.e. splitting and merging for segmenting a picture into numerous areas. Splitting stands for iteratively separating a picture into regions having comparable characteristics and merging contributes to combining the adjoining similar regions. Following diagram shows the department based totally on quad tree. The fundamental set of rules steps for location growing and merging are.

Let ‘p’ be the original image and ‘T’ be the specific predicate.

- First of all the  $R_1$  is same to p.
- Each region is divided into quadrants for which  $T(R_i) = \text{False}$ .
- If for every region,  $T(R_j) = \text{True}$ , then merge adjacent regions  $R_i$  and  $R_j$  such that  $T(R_i \cup R_j) = \text{True}$ .
- Repeat step 3 until merging is impossible.

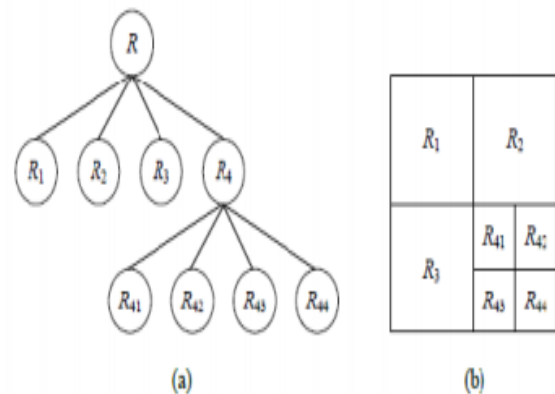


Fig. 1. Division of regions based on quad tree

**Clustering Based Segmentation Method**

The clustering based techniques are the techniques, which segment the image into clusters having pixels with similar characteristics. Data clustering is the method that divides the data elements into clusters such that elements in same cluster are more similar to each other than others. There are two basic categories of clustering methods: Hierarchical method and Partition based method. The hierarchical methods are based on the concept of trees. In this the root of the tree

represents the whole database and the internal nodes represent the clusters. On the opposite aspect the partition based totally methods use optimization methods iteratively to limit an objective feature. In between these two methods there are various algorithms to find clusters. There are basic two types of clustering.

#### 1) Hard Clustering(HC):

It is a smooth clustering method that divides the picture into set of clusters such that one pixel can most effective belong to handiest one cluster. In other words it can be said that each pixel can belong to exactly one cluster. These methods use membership functions having values either 1 or 0 i.e. one either certain pixel can belong to particular cluster or not. An example of a hard clustering based technique is one k-means clustering based technique known as HCM. In this technique, first of all the centers are computed then each pixel is assigned to nearest center.

#### Soft clustering:

The soft clustering is more natural type of clustering because in real life exact division is not possible due to the presence of noise. Thus soft clustering techniques are most beneficial for IS wherein department isn't strict. The instance of such sort of technique is fuzzy c-manner clustering. In this approach pixels are partitioned into clusters based totally on partial membership i.e. single pixel can belong to more than one clusters and this diploma of belonging is described with the aid of club values. This approach is extra bendy than different techniques.

#### E. Watershed Based Methods

The watershed primarily based strategies makes use of the concept of topological interpretation. When water reaches the border of basin the adjacent basins are merged together. To preserve separation among basins dams are required and are the borders of region of segmentation. These dams are constructed using dilation. The watershed methods don't forget the gradient of picture as topographic surface. The pixels having greater gradient are represented as boundaries that are continuous [15].

#### F. Partial Differential Equation Based Segmentation Method

The partial differential equation primarily based strategies are the quick strategies of segmentation. There are basic two PDE methods: non-linear isotropic diffusion filter (used to enhance the edges) and convex non-quadratic variation restoration (used to remove noise). The outcomes of

the PDE method are blurred edges and limitations that can be shifted by means of the use of near operators. The fourth order PDE technique is used to lessen the noise from picture and the second one order PDE approach is used to higher locate the edges and barriers.

#### G. Artificial Neural Network (ANN) Based Segmentation Method

The ANN based segmentation methods simulate the learning strategies of human brain for the purpose of decision making. Now days this method is mostly used for the segmentation of medical images. It is used to separate the required image from background. A neural network is made of large number of connected nodes and each connection has a particular weight. This method is independent of PDE. In this the problem is converted to issues which are solved using neural network. This method has basic two steps: extracting features and segmentation by neural network [4].

### V. LITERATURE SURVEY

Junpeng Wu, et al. [5] present that Markov Random Field (MRF) model along with Image Segmentation is anticipated to attain the sonar image segmentation. In this firstly, the assets of the field and the label field of sonar image is recognized by the MRF model. After this, the remaining image segmentation is handled by region growing centered on the primary image segmentation and finally this minimizes the segmentation signs which are a result of MRF method. In this paper, the experimental results demonstrates that the discussed technique obtains image segmentation well.

Yongjing Wan, et al. [6] Edge detection of an image is responsive to noise contained by natural images. This affects the quality of the Image division. A novel image segmentation algorithm by neighborhood main section analysis and Laplace operator is built to eliminate noise and upgrade accuracy of edge detection, then upgrading the quality of picture segmentation,. The feature vectors of each pixel are extracted through the main section analysis to get the main component, which effectively suppresses noise. Experimental results demonstrates that the algorithm can effectively improve the segmentation of the picture with a strong advantage in the accuracy and robustness

Rachid Sammouda, et.al. [7] In this paper, two image segmentation methods: K-means algorithm and fuzzy c-means (FCM) algorithms are discussed and compared. K-means algorithm and fuzzy c-means (FCM) algorithms are used to derive the differences between the extricated cancer clusters.

The K-mean is more accurate approach than FCM in extricating the actual shape of tumors.

P.Pedda Sadhu Naik, et.al. [8] Segmentation is a mechanism of dividing the image into considerable objects. It has great importance in many arena. for example- remote sensing, object identification, face tracking, medical applications and so on.

Sneha M. Mahajan, et.al. [9] The FCM membership function can easily deal with the overlapping clusters in an efficient manner with predefined number of clusters. This algorithm are not useful for clustering non-linearly separable data as well as choosing of initial cluster centre is difficult task which results in poor image segmentation. To outturn this limitation, Kernalized Fuzzy C-means (KFCM) clustering are used .In that kernel space clustering is used for clustering of nonlinear image, which have kernel functions which transform data in image plane into higher dimension feature space and these kernel functions are used to find non-Euclidean distance between feature point without defining transfer function, and then perform FCM in feature space. Here we use two different kernel functions for image segmentation and compare their outputs.

Nupur J. Gandhi, et al. [10] present that Image segmentation is an important and interesting matter in an image study. In an image, segmenting object is quite tough and costly. In Image Segmentation, the most essential phase is pre-processed image by a typical mean shift based segmentation that conserves needed gaps which are there in the image and guarantees over segmentation in the picture. This mean shift segmentation process which partitions the regions decreases the noise sensitivity and therefore increase the presentation of segmentation.

Amin Gharipour, et.al. [11] The segmentation mechanism include two stages. Processing of the local and global spatial information of the given cell image is done in first stage. Sequential integration of region based methods and fuzzy clustering for cell image segmentation.

B.K. Tripathy, et.al. [12] This approach was not as susceptible to noise when it is compared to the conventional FCM algorithm and derives better results. Intuitionistic describes the degree of reluctance that raises as a complication of lack of information. Proposed method is comparatively less hampered by noise and performs better than existing algorithms.

Souleymane Balla-Arabé, et.al. [13] An energy functional based on the fuzzy c-means objective function

which includes the bias field that counts for the intensity in homogeneity of the true world image. Using the rise descent method, we achieve the respective level group equation. The mechanism is fast, robust against noise, independent to the position of the original contour, effective in the presence of intensity in homogeneity and can detect objects with or without edges

Jay C. Acharya, et al.[14] present that the phenomena like atmosphere, water, temperature and pressure have a direct impact on the properties of submerged images. The significance of Image segmentation is decribed by digitalized image and is divided into various segments depending upon the pixels's values. Image Segmentation is the most advanced technique among all essentially computerized image recognition systems. There exists many such segmentation techniques that are used for segmenting submerged images. The presentation of an algorithm performing Image Segmentation is based on the interpretation of image. Image segmentation algorithms like adaptive image thresholding, Fuzzy C means with thresholding, K-means segmentation are applied for submerged images and these techniques are also compared on the parameters like Relative Entropy, Redundancy and Discrete Entropy. Fuzzy c means with thresholding (FCMT) performs far better than other methods is shown by the experimental results is shown in the paper.

LakshmanaPhaneendraMaguluri, et.al [15] Presents a novel clustering depending segmentation which can be utilizedforsegmenting noise in Digital images. This mechanism is called as Denoising based on Optimized K-means clustering algorithm (DOKM).

Vinod Kumar Dehariya, [16] Contracts with the use of typical fuzzy k-means clustering algorithms in the image segmentation region. In order to measure and match both editions of k-means and fuzzy k-means algorithm, suitable processes employed.

Table 1 Comparison Of Various Segmentation Techniques

Segmentation Technique	Description	Advantages	Disadvantages
Clustering Method	Based on division into homogeneous clusters.	Partial membership is used by fuzzy and is more useful for real complications.	Determining membership function is not easy.
Thresholding Method	Based on histogram peaks of the image to find particular threshold value	No need of previous information and is a simple method.	Depends on peaks and spatial descriptions are not considered.
Edge Base Method	It is depend upon detection of discontinuity.	It is good for images that has better contrast between objects.	Not suitable for wrong detected and too many edges.
PDE Based Method	Based on the working of differential equations.	Faster method and best for time critical applications.	More computational complexity.
Region Based	Based on division of	More immune to	Expensive method in

Method	images into homogeneous regions.	noise, useful when it is easy to define similarity criteria.	terms of time and memory.
ANN Based Method	Based on the simulation of learning process for decision making.	No need to write complex programs.	Lot of Time consumes in training.
Watershed Method	It depend upon topological interpretation.	Results are more stable, detected boundaries are continuous	Complex calculation of gradients.

## VI. CONCLUSION

In this paper, a review of image segmentation techniques, various image segmentation techniques are detailed described and compared. These all techniques are suitable for many medical image applications. These techniques can be used for object recognition and detection. It can be cast-off to detect cancer ,analysis of satellite images in order to detect roads and bridges. It clearly defines that various methods are suitable for several types of image applications. But from the study it is clear that no single method is sufficient for every image type and no all methods are suitable for a particular image type. Hence, there is need of image segmentation in many applications on large context.

### Conclusion

In this review of image segmentation strategies, diverse image segmentation techniques are designated described and in comparison. These all techniques are suitable for many medical image applications. These techniques can be used for object recognition and detection. In medical images those can be used to come across cancer and in satellite pictures those may be used to locate roads and bridges. Thus it's far clean that diverse methods are suitable for diverse forms of image programs. But from the study it is clear that no single method is sufficient for every image type and no all methods are suitable for a particular image type. Due to the want of picture segmentation in many programs, it has a tough future.

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