# A CRITIQUE ON IMAGE SEGMENTATION TECHNIQUES

*J.Veeralagan*, J.Rajeswari*

**Abstract**

Image segmentation techniques aim to identify and extract foreground objects in a photograph, resulting in individual segments. Segmentation of images is profoundly different from one type of image to the next because each has its context and different geometric properties, posing a challenge in designing a generic algorithmic process. This section provides an overview and comparison of image segmentation techniques as well as their applications. It also incorporates a wide range of procedures and the role of image segmentation in computer vision research.

**Keywords:** Segmentation, Thresholding, Region-based, edge-based.

## I. DIGITAL IMAGE PROCESSING-INTRODUCTION

Image Processing, or specifically, Digital Image Processing (DIP), is a progression where some algorithms are used on images to get image enhanced or extract complete information from the image, which can be used for further process. DIP involves a simple task and complex task. The simple task may include removal of noise, deducting edge. Typical tasks are object identification, person, text identification, etc. Complicated tasks involve classifying images, emotion detection, anomaly detection, segmentation, etc.

The steps below are the basic image processing process:

* Image is imported through some image acquisition tool.

* Image is manipulated and analyzed through the tool

* The output will be an altered image or report that supports image analysis.

With the expansion of AI algorithms and their ecosystem, Digital Image Processing using Neural Networks has become popular in recent times. Its application areas are security, banks, military, agriculture, law enforcement, manufacturing, medical, etc [1].

## II. PROCESS OF IMAGE SEGMENTATION

The critical goals of image segmentation are to divide and create an image into many sections to discover different image features and extract relevant information from an image and transform the image representation into relatively high units that are even more useful for future image analysis. The method of segmenting a digital image into subgroups (of pixels) is known as image segmentation [2]. Those groups may commonly be known as Image Objects; thus, the image's ambiguity is reduced, making analysis easier. In biomedical image processing, segmentation is critical. It is often the starting point of another process like registration, shape analysis, quantitative analysis.

## III. IMAGE SEGMENTATION TECHNIQUES

Image segmentation encompasses several numbers of methods [3], but they are broadly classified into three

- Thresholding based
- Edge base
- Region-based

### 1) THRESHOLDING BASED

Thresholding is among the most well-known used image segmentation techniques for distinguishing light objects from dark backgrounds using image attributes such as colour,

Department of Computer Science,
Karpagam Academy of Higher Education, Coimbatore, Tamil Nadu, India
*Corresponding Author

intensity, and texture. [4, 5, 6]Thresholding algorithms are of three types

- Global Thresholding
- Local Thresholding
- Adaptive Thresholding

**A) Global Thresholding:**

This method can be used when the pixel values of the components and the background are fairly consistent in their respective values across the entire image. If g(x, y) at some global threshold is a thresholding version of f(x, y),

g(x,y)={(=1,iff(x,y⩾T)

{ = 0,otherwise)

**B) Local Thresholding:**

A single threshold will not suffice when there is irregular lighting due to shadows or illumination direction. Threshold function T(x, y) is

given by g(x,y) ={=0, iff(x,y)<t(x,y)

=1iff(x,y)⩾t(x,y)

Where T(x, y) = f (x, y) + T

**C) Adaptive Thresholding:**

The most straightforward implementation takes a gray scale or color image as input and outputs a binary image representing the segmentation. This method has the disadvantage of being computationally expensive, reducing the availability for practical applications.

**2) EDGE BASE**

It is one of the most important methods in the image segmentation process [7], which focus on the boundary regions of the image. Images with flat borders, images without proper margins, and images with text boundaries are among the limitations. In this segment, we've gone through the most popular discontinuity-based edge detection techniques.

**A) Roberts Edge Detection:**

Using this method, we can calculate a 2-D spatial gradient on an easy and fast image to compute. The most widespread use of this technique is when the input is a greyscale image that matches the output.

**B) Sobel Edge Detection:**

It will begin where the gradient is the highest within the edges. The goal is to determine the estimated exact gradient magnitude at each point in an n-point greyscale.

**C) Prewitt Edge Detection:**

For eight directions, it will be measured in the 3x3 scale. All eight convolution masks must be determined. Then, for the largest module, one complication mask is chosen. It is computationally simpler to implement than Sobel detection, but the results are a little noisier.

**D) Kirsch Edge detection:**

A single mask is rotated in eight separate directions in this technique: north, northwest, west, southwest, south, southeast, east, and northeast.

**E) Robinson Edge detection:**

Masks are symmetrical along their axis of rotation, which is the axis that has zeros, in this case. Four masks must be calculated, and the remaining four can be obtained by negating the first four.

**F) Marr-Hildreth Edge Detection:**

It is a form of contact. Continuous identification of edges in digital images wherever there are well-built and easy variations in the landscape, there is curves. The brightness of the picture It's a simple approach that works by Using the LoG function to convolve the picture, or, as a last resort, DoGs have a simple approximation.

**G) Canny Edge Detection:**

It is a key technique for identifying edges by eliminating

noise from the picture before searching for edges. Unlike Roberts and Sobel, this operation is not particularly susceptible to noise. This detector would be superior if it worked properly.

**3) REGION-BASED**

The region-based technique, also known as "similarity-based segmentation," is used to assess region specifically. [8].It divides an image into uniform sub-regions based on texture, color, intensity, and other factors. Pixels with similar intensity characteristics and proximity can be grouped together and presumed to belong to the same entity. Since regions cover more pixels than edges, they contain more details. We use texture to detect areas, and it is it's not easy to work with the edges. Where edges are difficult to obtain in noisy images, the area rising technique is used. Some popular region-based techniques include the watershed algorithm; region split and merges algorithm, and region increasing algorithm. It is an easy and reliable method for correctly partitioning an image into uniform regions and producing an original image with clear edges using spatial information, but it requires a lot of computational power [9, 10].

## IV. LITERATURE REVIEW

Naida M.Zartoun[11], concluded that no universal segmentation method for all kinds of image and image can be segmented using different segment techniques.

Hiba Ramadan[12], focused on interactive image segmentation, also known as foreground and background separation, and compared these both by acquiring tools such as datasets and evaluation matrices.

Muhammad Waseem Khan [13], The author of this paper, concluded that there is no ideal method for image segmentation because the result depends on several factors such as pixel, color, texture, intensity, and so on. As a result, a single procedure for all image segmentation cannot be considered.

Bendale Dhanashri Dilip [14], According to their paper, the feature attribute thresholding method is the simplest.

Shubham Arjariya[15], emphasised the simplicity of the threshold method and concluded that local thresholding technique used a region-based segmentation process, whereas global thresholding concept used a single threshold for the entire process.

P.Jayapriya, Dr.S.Hemalatha [16], Marker-Controlled Morphological Watershed Segmentation was superior to K-means, Canny Edge Detection, Fuzzy C-means, Neural Network, Morphological Watershed, and Otsu's Thresholding techniques. Compared to K-means, Canny Edge Detection, Fuzzy C-means, Neural Network, and M-means, Marker-Controlled Watershed Segmentation helps solve and bring out segmentation with reduced over segmentation.

Rahul Basak [17], Conclusion: The most effective method for resolving the image segmentation issue is to use hybrid solution that incorporates two or more techniques. There is no widely accepted procedure for image segmentation, and there are various factors that influence the outcome. Images' homogeneity, spatial features, continuity, and texture, for example. Considering all of the above considerations in image processing and computer vision, image segmentation continues to be a big issue.

Thakur A. K [18], the paper offers a rundown of image segmentation methods and concepts, as well as their key applications. Since there is no perfect image segmentation process, some methods with common attributes will be combined to achieve higher accuracy in image segmentation performance.

## V. COMPARISON OF SEGMENTATION TECHNIQUES [TABLE 1]

| Parameters | Thresholding | Edge based | Region based |
|---|---|---|---|
| Performance | Best | Excellent | Good |
| Color space | HSI images are made up of a mixture of YIQ values, RGB, and Greyscale. | gray levels and RGB Image | Image strength and saturation in RGB and greyscale. |
| Segment level | homogeneity | homogeneity discontinuity | Homogeneity |
| Segmentation effect | Good | Average | Normal |
| Quality measurement | Depending on the threshold value selected. | Based on the difference in intensity | Centred on pixel regions that are identical |

## VI. CONCLUSION

Image segmentation is needed because temperature, noise, and pressure have a direct effect on image quality. First, image segmentation has many methods for generating meaningful information as an output, each with its own set of characteristics. According to the above comparison, all segmentation algorithms do not guarantee the same type. Of result for all types of images, so we can pick segmentation techniques that provide efficient and reliable results for our problem area. According to the survey, many researchers use Thresholding Algorithms because they are quick and easy to use.

## REFERENCES:

[1] Chandrakala M, Devi P. D. Threshold Based Segmentation Using Block Processing. International Journal of Innovative Research in Computer and Communication Engineering. 2016; Vol. 4, ISSN (ONLINE): 2320-9801, DOI: 10.15680/ IJIRCC. 2016.0401050.

[2] Singh P, Singh A. A Study on Image Segmentation Techniques. International Journal of Recent Trends in Engineering & Research (IJRTER).2016; Vol. 02, ISSN: 2455-1457.

[3] H. Narkhede, Review of image segmentation techniques, Int. J.Sci. Mod. Eng, vol. 1, p. 28, 2013.

[4] Savita Dubey, Yogesh Kumar Gupta, Diksha Soni,Comparative Study of Various Segmentation Techniques with their Effective Parameters, DOI: 10.15680/IJIRCCE.2016. 0410020.

[5] Abubakar F. M. Study of Image Segmentation using Thresholding Technique on a Noisy Image. International Journal of Science and Research (IJSR), India. 2013; Vol. 2, Issue. 1, ISSN (ONLINE): 2319-7064.

[6] Jamil A. M. Saif, Al-Kubati A. A. M, Hazaa A. S, Al-Moraish M. Image segmentation using Edge Detection and Thresholding. The 13th International Arab Conference on Information Technology (ACIT). 2012; ISSN: 1812-0857.

[7] Lim, Y.W., and Lee, S.U.: 'On the colour image segmentation algorithm based on thresholding and the fuzzy c-means techniques', Pattern Recognise., 23, (3), pp. 935–952, 1990.

[8] A. Manikannan, J. SenthilMurugan. A Comparative Study about Region Based and Model Based using Segmentation Techniques. International Journal Innovative Research in Computer and Communication Engineering. 2015; Vol. 3, Issue. 3, ISSN (ONLINE): 2320-9801.

[9] Banchpalliwar R. A, Salankar S. S. A Review on Brain MRI Image Segmentation Clustering Algorithm. IOSR

Journal of Electronics and Communication Engineering (IOSR-JECE). 2016; Vol. 11, Issue. 1, ISSN (ONLINE): 2278-2834, DOI: 10.9790/2834-11128084.

[10] P. Elayaraja, M. Suganthi. Survey on Medical Image Segmentation Algorithms. International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE). 2014; Vol. 3, Issue. 11, ISSN (ONLINE): 2278-1021.

[11] Nida M. Zaitouna, Musbah J. Aqel, Survey on Image Segmentation Techniques / Procedia Computer Science 65 (2015) 797 – 806.

[12] Hiba Ramadan, Chaymae Lachqar, and Hamid Tairi, A survey of recent interactive image segmentation methods, Computational Visual Media , Vol. 6, No. 4, December 2020, 355–384.

[13]Muhammad Waseem Khan, a Survey: Image Segmentation Techniques, International Journal of Future Computer and Communication, Vol. 3, No. 2, April 2014.

[14] Bendale Dhanashri Dilip , Dinesh Kumar Sahu, A Brief Review of Image Segmentation Based on Thresholding Technique, International Journal for Research in Applied Science & Engineering, Volume 5 Issue III, March 2017.

[15] Shubham Arjariya , Dr. Mahesh Motwani , Dr. SHIKHA AGRAWAL, A Survey on Image Segmentation Using Threshoding Methods, International Journal of Computer Trends and Technology (IJCTT) – Volume 41 Number 2 – November 2016.

[16] P.Jayapriya, Dr. S.Hemalatha, Comparative Analysis Of Image Segmentation Techniques And Its Algorithm, international journal of scientific & technology research volume 8, issue 10, October 2019 issn 2277-8616.

[17] Rahul Basak, Surya Chakraborty, Aditya Kumar Mondal, Satarupa Bagchi Biswas, Image Segmentation Techniques: A Survey, international Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 04 | Apr-2018.

[18] Thakur A. K, Madhusudan. Image Segmentation: A Comparative Study. International Journal of Advances in Computer Science and Technology. 2016; Vol. 5, No. 6, ISSN: 2320-2602.