A Comparative Review of Image Segmentation Techniques

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Abstract— In today's computer science image segmentation has become the main focus of research as a universal algorithm for segmentation of images. There is no one method in the world for segmentation which is good for all type of images and produces the same quality of results always for all types of images. Due to these types of challenges the sector image segmentation always remains a focus of main research under the computer science e and image processing algorithm's it is considered as still a pending problem for the world of computers. Despite of these facts the image segmentation can still has given more methods for different kinds of problems the any other techniques under the image segmentation. This methodology is used to extract particular part of images as a separate identity itself. Unsupervised image segmentation is also a incomplete data problem because of the fact that model parameters and class labels are still unknown. There are many of the algorithms and basic methods developed during the time frame under image segmentation but need for new methods are still in need according to changing needs and advancement of technology. In this paper, we have analyzed and reviewed EMHMRF, Gaussian mixture model GMM-HMRF and K-GMM-EMM method and compare them on the basis of Time and energy activation graph.

Key words: Segmentation, EM-HMRF, GMM-HMRF, K-GMM-EM

I. INTRODUCTION

In the field of computer science as well as in the real life images are considered as one the most convenient way to give information and the person get it understood easily just by looking at the visual information displayed by the image. To maintain the quality if the information in the image noise present in the image should be eliminated. Image segmentation should also play a very critical role under the medical imagery. Under digital image processing today the image segmentation also used the combination of other algorithms to produce very good results under it like use of artificial intelligence, pattern and machine learning and also use of combination of fuzzy logic. Under Image analysis as a part of image engineering image segmentation is the first and most difficult part of the image analysis.

Image segmentation can be said as to divide an image into some meaningful structures. Under Image analysis as a part of image engineering image segmentation is the first and most difficult part of the image analysis. Under this the main focus is how to identify and represent the object and also on the methods that will help to identify the groups of the pixel that can be identified as a distinct object in an image to identify individually.

In past few years so many numbers of image segmentation methodologies have been made some of which are being presented here today in this paper and we cannot distinct them into categories because under image segmentation even very different approaches to achieve the segmentation may have some similar properties which would make them having in the same field or categories that is why under segmentation a disjunction field is not possible

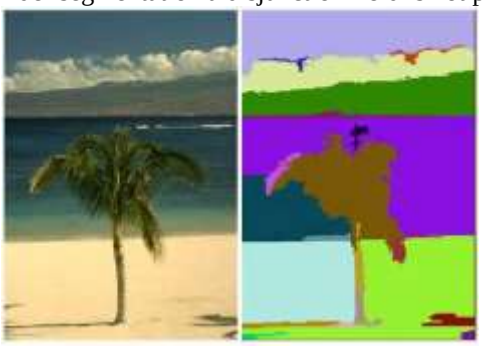

Fig. 1: Example of Image Segmentation

II. CATEGORIES OF IMAGE SEGMENTATION

A. *Threshold Based Segmentation*

To segment an Image Slicing Techniques and Histogram Thresholds are used. These methods can be used as pre process or post process in the segmentation to an image or these processes can be also applied directly to an image. Under image segmentation thresholding is very simple, old but very popular technique. Thresholding use under the image segmentation is very simple technique but very powerful and effective for images which have presence of light and dark backgrounds in image. On the basis of space regions this technique is based that is on the basis of the characteristics of an image.

Under thresholding operation a image having some multilevel is first converted into an binary image, that is under this a proper threshold T is chosen then using that Threshold the image pixels are divided from background into separate objects and separate regions. Intensity value is determined by using a Thresholding procedure and desired classes are separated using the threshold. Under this procedure all the pixels having intensity value lower than threshold are grouped into one class and all the other pixels having intensity value higher than the class are grouped into another class this way segmentation is achieved.

B. *Edge Based Segmentation.*

The detected edges in images are used to represent the boundaries of an object and which identifies that object separately from the remaining image. The one of the most effective and way to use way to detect an edge s in the image is to detect the rapid changes occurring in the intensities of pixels of an image. The other threshold method is proven to ill-posed and has many of the disadvantages in it for use. Intensity method is used as follow:

- Places where the magnitudes of intensities are larger than some threshold's first derivatives.
- Places have zero crossing where the intensities second derivatives have been used.

One of the structural techniques of image segmentation is edge detection technique in images. Gradient based edge detection and gray histogram are two main edge based methods for detection of edges under segmentation. In the first method first of all detection of edges are done and secondly these edges are linked together to form a unified identifiable boundary.

C. Region Based Segmentation.

A region based approach is totally opposite of edge based approach. While under edge based approach finding points on the boundaries to distinguish that object while in the region based approach starting point is center of region and then towards its boundaries the detection grows until whole object is not segmented.

As under the normal categories of zoology the Platypus does not seems to be fit under any same is in the field of segmentation. The methods which are categorized as insects after a close look they seems to have similar to the Birds or even Mammals.

D. Clustering Techniques

Agglomerative is a synonym for the clustering segmentation technique under this technique we uses data analyses in exploration of the pattern measurements which are of high dimensional in nature and those patterns are denoted first. In this the prime focus is to group together the similar patterns in one large group which have similarities in one sense or another. Some of the clustering techniques are pre ready to be applied in the segmentation because the core motive of the both algorithms is same.

E. Matching

When the segmentation is done on an image the separated objects which can be separately identified as unique objects can be matched now. Under the process of matching first of all we should what kind of object we are looking for after that the segmented objects can be matched with real object present in other image. This approach in segmentation is called Matching. Feature Descriptors could be used to identify the segmented objects and real object. Features are identified and then matched based on their gradient value and angle at which they are present hence by matching these two fields a successful matching can be easily done.

III. Implementation Steps for Algorithms

A. Expectation Maximization-HMRF

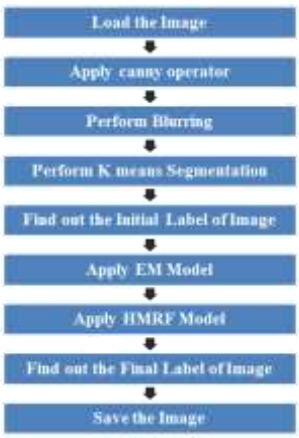

Fig. 3: Flow Chart of EM-HMRF

B. Gaussian Mixture Model- HMRF

Fig. 4: Flow Chart of GMM-HMRF

C. K Means Gaussian EM MODEL

Fig. 5: Flow Chart of KMG-EM-HMRF

D. New Proposed Technique

A new proposed technique which has not been implemented yet but in my future work I will present it with comparison with other technique in MATLAB.

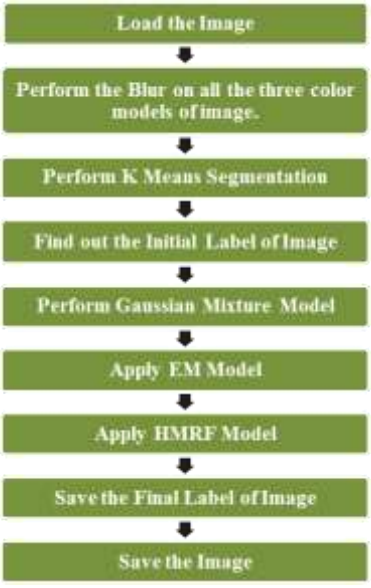

Fig. 6: Flow Chart of Proposed

IV. RESULTS

A. *Results of Implementation*

This section shows Implementation Results of Image Segmentation Techniques, the results of different approaches and compares the energy values and time of segmented images. Following are the results of segmentation algorithms for the techniques discussed in previously.

1) Results of EM-HMRF Technique

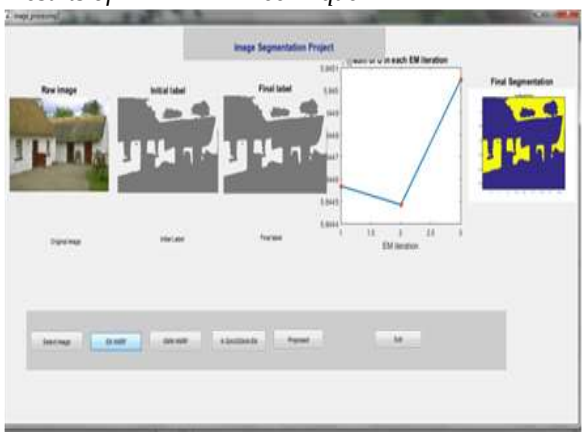

Fig. 7: Implementation of EM-HMRF Technique

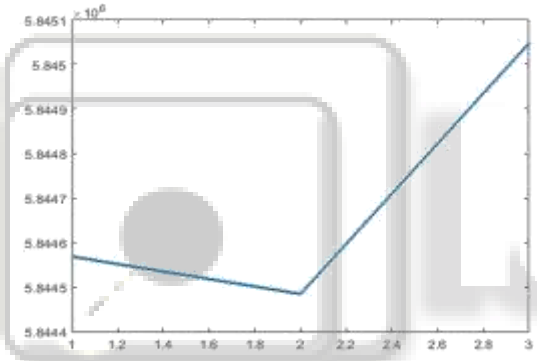

Fig. 8: Energy Graph of EM-HMRF Technique

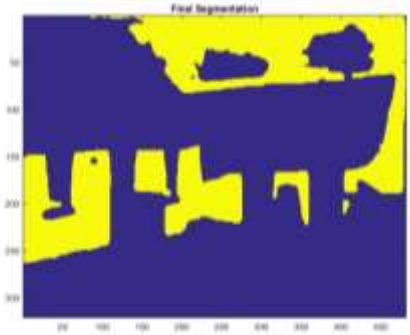

Fig. 9: Final Segmentation of EM-HMRF Technique

2) Results of GMM-HMRF Technique

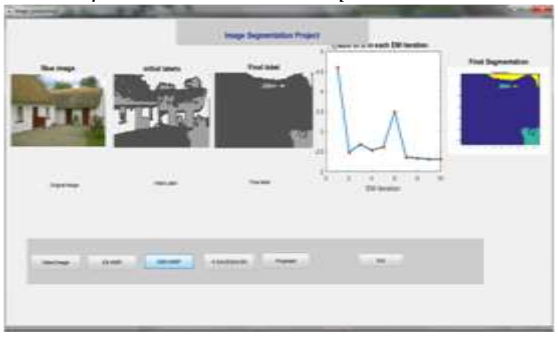

Fig. 10: Implementation of GMM-HMRF Technique

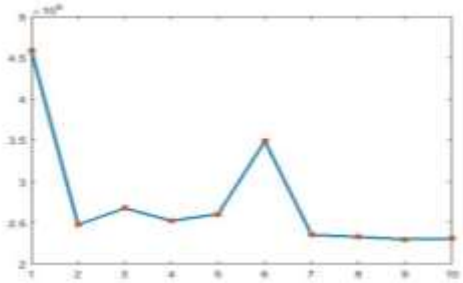

Fig. 11: Energy Graph of GMM-HMRF Technique

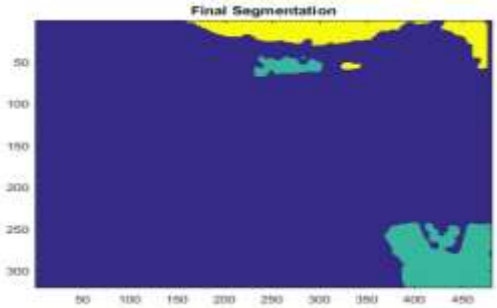

Fig. 12: Final Segmentation of GMM-HMRF Technique

3) Results of K-GMM-EM Technique

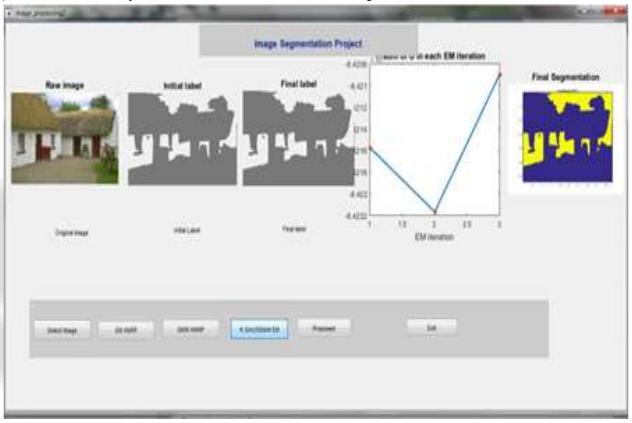

Fig. 13: Implementation of K-GMM-EMM Technique

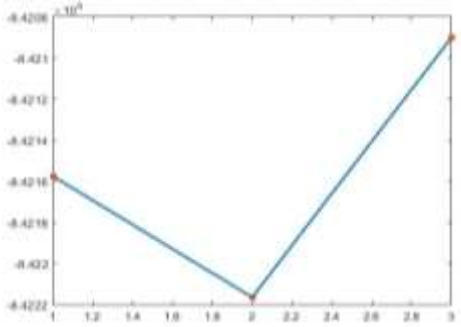

Fig. 14: Energy Graph of K-GMM-EMM Technique

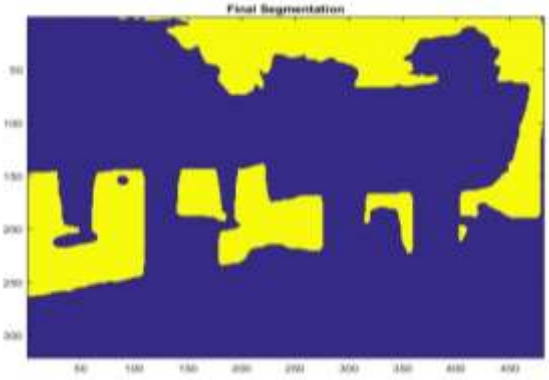

Fig. 15: Final Segmentation of K-GMM-HMRF Technique

The results displayed under the results section show us the GMM-HMRF has minimum energy ratings. In case of the EM-HMRF technique energy readings first lows to minimum then suddenly rises up for maximum position also time complexity for this technique is way higher than other techniques. In the last for the K Mean Gaussian EM energy value became flat after few peaks and remained same till end. Segmentation becomes more stable in case of GMM-HMRF and it also performed better than EM-HMRF and K Mean Gaussian EM model in the final image.

TECHNIQUE NAME	TIME TAKEN	ENERGY AT END
EM-HMRF	10.51 Sec	5.85×10^6
GMM-HMRF	184.87 Sec	2.51×10^6
K-GMM-EMM	5.87 Sec	8.421×10^5

Table 1: Comparison of Results

V. CONCLUSION

In this review of image segmentation study, the overview of three methodologies named GMM-HMRF, EM-HMRF and K-GMM-HMRF applied for digital image processing is explained briefly. This paper also reviews a serves brief introduction about various problem faced in research of segmentation methods and basic of some methodologies under the segmentation in digital image processing. These methods serve as a pre process for variety of application such as Medical MRI, Object Detection and Tracking etc. The conclusion about the three reviewed techniques is down below.

In the paper a new proposed technique has been proposed which uses the combination of three techniques. A new PROPOSED has not been implemented yet but in my future work I will present it with comparison with other technique in MATLAB. The results displayed under the results section show us the GMM-HMRF has minimum energy ratings. In case of the EM-HMRF technique energy readings first lows to minimum then suddenly rises up for maximum position also time complexity for this technique is way higher than other techniques. In the last for the K Mean Gaussian EM energy value became flat after few peaks and remained same till end. Segmentation becomes more stable in case of GMM-HMRF and it also performed better than EM-HMRF and K Mean Gaussian EM model in the final image. In future work the PROPOSED algorithm can be further implemented in terms of energy and in execution cycle. The results can also be applied for satellite image segmentation and for medical image processing.

REFERENCES

[1] Angrish, Hitul, and Sandeep Kaur. "A Survey on Feature Description Techniques."
[2] Image Segmentation – www.wikipedia.com
[3] Provos, N., & Honeyman, P. (2003). Hide and seek: An introduction to steganography. Security & Privacy, IEEE, 1(3), 32-44.
[4] Silman, J. (2001). Steganography and steganalysis: an overview. SANS Institute, 3, 61-76.
[5] Tayana, M. (2012). Image Steganography applications for secure communications. Msc. Thesis.
[6] Hamid, N., Yahya, A., Badlishah Ahmad, R., Najim, D., & Kanaan, L. (2013).Steganography in image files: A survey Australian Journal of Basic & Applied Sciences, 7(1).

