



A Review : An Optimized Technique For Image Segmentation

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Abstract: segmenting an image is evaluated as prime steps in processing of a representation. This partitioned a digitized image into different parts within categorize to evaluate them. It is also used to make distinction dissimilar objects in the representation. Various segmentation techniques for an image have been designed and use in practice by the researchers to make them smooth and easy to evaluate separately. In this paper a literature reviews of basic techniques for segmenting a picture from previous five years. Current researches in each of segmentation technique are existing in this paper.

Keywords: segmentation; region based; edge based; threshold based; feature cluster based; model based.

I. INTRODUCTION

Segmenting an image is a primary trouble in processing of an image. It has been researched actively [1–8], to partition an image into meaningful regions automatically. Separating entire image in various pieces which is something more relevant and easier for forward process. The objective is to partitioned the image into many segments or regions/sub regions, so that each sub regions have similar properties e.g. brightness, color & quality. The sub-regions discontinuity is generally in the Segmentation algorithms, i.e. the sub-regions equality, edges however the discontinuity & equality are possible by some segmentation algorithms. The differences between the image segmentation & sample classification are generally not clear. Thus, segmentation & sample classification often functions as individual & sequential method [9]. Before de-noising, segmentation of an image is done to regain the original one. The major motive of segmentation is to diminish knowledge for easy analysis. Segmentation is also beneficial in analysis especially in case of medical images, military purpose images, remote sensing etc. and in Image Compression. In case when the specific sub regions of a segmented image are isolated from other regions then it is assumed that segmentation is completed although it is difficult to segment independently.

II. CLASSIFICATION

Segmentation of an image justifies as follows:

- Region Based
- Edge Based
- Threshold
- Clustering Based
- Model Based

A. Region Based Image Segmentation

segmentation methods using Region-based approach are based on the truth that a pixel cannot be believed as piece of an object or not lies solely on its gray value (methods based over intensity). They incorporate measures of connectivity among pixels in order to decide whether these pixels fit to the similar region (or object) or not. Mathematically, region-based segmentation methods can be described as a systematic way to partition an image I into n regions, R_1, R_2, \dots, R_n , such that the following properties hold: Here $P(R_i)$ is a logical predicate defined over the points in set R_i and Φ is the empty set. The primary condition mention that the segmentation will be complete, that is, every pixel in the image will be labelled as belonging to one of the n regions. Property 2 requires that all points within a region be 4- or 8-connected. Property 3 states that the regions cannot overlap. Property 4 states which principle must be satisfied so that a pixel is granted membership in a certain region, for example, all pixel values must be within a certain range of intensities. Finally, property 5 says that two adjacent regions are different in the sense of predicate P . In Region based segmentation, we have to find same phase regions according to a specific criterion (intensity value, texture). We check neighbour pixels and detect whether the neighbour pixel should be added or not. Region based approach attempts to cluster the pixels with similar characteristics (such as approximate Gray level equality) into regions. we prefer two approaches in region-based methods:

1. **Region Growing:** It is one of popular methods. Begins with a pixel value and continue go on adding the pixels based on same class, to the region, repeat unless every pixel belong to some particular region [10].

Advantages: join together regions are assured; several conditions at the same instance and give very good results with less noisy

Disadvantages: In segmentation if the image found to be noisy or has variations in intensity, cannot recognize the shading of the real images and power and time consuming.

2. Region Splitting and Merging: In this approach, it is based on the clustering of neighboring pixels of a region that verifies specific assumptions. The Seed region is spread to contain all same kind neighbors and the process is repeated. The process ends when there is no pixel to be classified. In region splitting method, split in a position of regions that verifies a specific guess.

A) Various important issues:

- The selection of appropriate seed points is important.
- The worth, “to minimum area threshold”
- Corresponding threshold value.

b) Advantages

- We can regulate the seed point and the criteria we need to make.
- We can choose the various criteria at the same
- It implements well with respect to noise [11].

c) Disadvantages

Clustering algorithms like k-means clustering don't assured continuous region to overcome drawback use split and merge technique [10].

B. Edge Based Image Segmentation

Major applications are edge detection for segmented image. This approach of Segmentation presents a broad cluster of methods based on edges information in the image. Resulting image cannot be used as a segmentation result. Steps follow to join edges into chains of edge that correspond better with borders in the image. Difficulty of edge-based approach are an edge present when there is not any border and no edge visible where a border seen. The procedure of separating image into different parts of pixels is refers as image segmentation. Edge is a border between two same phase regions. Detection of edge is locating sharp gaps in an image. The border surface of object in a scene much time refers to oriented localized changes in image intensity, known edges. Edge detection change images to edge from the manipulation of grey tones in images. As a result, edge image is acquired without unexpectedly meet any manipulation in physical excellence of the original image.

It implicit that the edge of a region or an object then it is closed and that the number of objects of interest is equivalent to the number of boundaries in an image. For accurate segmentation, the edge of the boundaries identified must be equal to the object in the given image. For example, these methods have complications with images that are:

- Edge-less
- Very-noisy
- Edge that are very horizontal
- Texture –margin

Other difficult in this technique is to rectify ramp function hence thus produces objectionable results as:

- The segmented area might be smaller or larger than the real.
- The edges of the segmented area might not be attached.

- Terminated or under-segmentation of the image (get up of pseudo edges or missing edges).

C. Threshold Based Image Segmentation

Segmentation of image via thresholding is an uncomplicated other than strong effect for segmenting images having light objects on dark description. A multi-level image converted into a binary image using thresholding operation i.e., It pick out a proper threshold t to separated pixels in respective parts and distinct objects from background. There are 2 category of thresholding procedure they are classifying as global and local thresholding. If T is constant, recognized as global thresholding otherwise it is local thresholding. If the illumination from background is odd globalised thresholding function fail in local thresholding, multiple thresholds are used to reduce for not regular illumination. Disadvantages of thresholding function only 2 classes are introduced can't become overlies to multiple channel images. It does not take into experience the relative features of an image so it is responding rapidly to noise.

1) Self selected threshold: worth for every image by the mechanism without human action is called an automatic threshold arrangement. In variance of predefined selecting threshold function based on clustering of histogram variance means the value of t can be choose.

2) Histogram Based Threshold Selection: In histogram based threshold selection the method using histogram is lying on the positivity of the estimating the threshold worth that divides the 2 homogenous to acquire all happening uniform part in the image parts of the object and background of an image histogram based thresholding is applied. For the highest value of the histogram p_1 and p_2 be the gray value the value of threshold t is specified by eq.

$$T = (P_1 + P_2) / 2$$

3) EMT Technique: Image is threshold by deploying edge maximization method. In this case part of the object may be involved with the background or parts of the background may as an object. To this reason any of the predefined threshold choice function capabilities becomes much desirable in images with large homogenous and well distinct regions. This segmentation lies on the research about the maximum edge based threshold in the image to begins segmenting that image with help the edge detection techniques

D. Feature Based Clustering

Clustering play and lead role in segmentation. Following a various step where many of them use the method immediately to the image but here the image is change in form into histogram and then clustering [12]. Clustering is done over color image pixels for segmentation making practice of an unsupervised method fuzzy c. It becomes useful meant for regular images. If it is a noisy image, it outcome to fragmentation [13]. A necessary clustering algorithm i.e., K-means is worn for segmentation in textured descriptions [14]. It clusters the associated pixels in the direction of segmenting the image. Segmentation is prepared through attribute clustering and there it will be altered according to the color mechanism. Segmentation is also purely depending on the characteristics of the image [16]. Appearance is in use into report for segmentation [17]. Divergences in the strength and color ethics are worn for segmentation. On behalf of segmentation of color image, they employ Fuzzy Clustering method, which iteratively

generate color clusters by means of Fuzzy relationship function in color space concerning to image space. The procedure is flourishing in identify the color region [18]. Real time clustering based segmentation. An effective consideration section is capture truly for segmentation. [19] Picture is segmented crudely by multi-thresholding. It is after that superior by Fuzzy C-Means Clustering. The advantage is applied to any multispectral images [20]. Segmentation come within reach of for region growing is K-Means Clustering. [21] A cluster practice in favor of image segmentation is done with cylindrical verdict essentials of the color break. The float up is obtaining all the way through histogram and is detecting as a cluster by thresholding [22]. Seeded Growing Region (SRG) is worn in support of segmentation. It has a negative aspect of pixel arrangement for classification. So, to triumph over this margin tilting analogous pixel labeling concert is obtained to SRG [23].

E. Model Based Image Segmentation:

Markov Random Field (MRF) base segmentation is recognized like Model based segmentation [24]. An intrinsic state velvetiness restraint is accessible in MRF which is worn for color segmentation [25]. MRF is united by way of border recognition meant for identify the edges precisely [26]. MRF have spatial area faintness test out and at hand are correlation in the midst of the color mechanism. Expectation-Maximization (EM) algorithm ideals the factor is based on unsupervised operation. Multi-resolution based segmented technique named as "Narrow Band". It is quicker than the usual approach. The initial segmentation is performed at coarse resolution and then at finer resolution. The development moves on in an iterative manner. The oath base segmentation is prepared merely to the piece of the image. So, it is rapid [27]. The segmentation possibly will also be finished by using Gaussian Markov Random Field (GMRF) wherever the spatial dependency among pixels are well thought-out for the method [28] Gaussian Markov Model (GMM) based segmentation is worn for section growing. The additional room of Gaussian Markov Model (GMM) that detects the province as fit as edge cues inside the GMM structure. The feature space is also detected by using this technique [29].

III. LITERATURE REVIEW

This section represents some previous work in the area of image segmentation done in past which I have reviewed:

Waseem Khan [2013]: fresh investigate within image. This review addresses a variety of image segmentation technique, evaluate them and present the issue associated to individual's technique. Image segmentation is a method used to partition an image into manifold segments. It force create image flat and easy to assess. Segmentation process also helps to find area of attention in a fastidious image. The main goal is to make image more simple and meaningful. Obtainable segmentation techniques can't make happy each and every one form of images [30].

N. Senthilkumaran [2009]: the chief endeavor is headed for inspection the assumption of edge uncovering for image segmentation by means of soft computing come within reach of base on the Fuzzy logic, Genetic Algorithm and Neural Network. Soft Computing is a budding sports ground with the purpose of consists of harmonizing basics of fuzzy

logic, neural computing and evolutionary computation. Soft computing technique contain originate broad applications. Single of the nearly everyone chief application is frame exposure on behalf of image segmentation. Edge is a border line flanked by 2 uniform regions. Edge detection refers to the evolution of make out and position razor-sharp discontinuities inside an image [31].

A. Puraneeswari [2014]: the purpose has been to investigate and discuss different traditional and popular image segmentation techniques. Fundamental properties and approaches of different techniques have been highlighted. The advantages and disadvantages of methods discussed in short. Although various methods are available, each method works on specific concept hence it is important which image segmentation methods should be used as per application domain. With this analysis we conclude that segmentation algorithms has been planned in the works but there is no single algorithm that works well for all types of images, but specific work better than others for particular types of images suggesting that developed performance can be obtained by pick out the appropriate algorithm or methods [11].

K. K. Rahini [2014]: It is accommodating used for a right use of existing appraisal methods and meant for civilizing their concert as well as for thoroughly manipulative fresh estimation methods. Image segmentation is a significant investigate quarter in workstation visualization and hundreds of segmentation algorithms comprise been planned in the most recent 30 years. Image segmentation is a tool use to break up an image into multiple segments. The main goal is to make image additional easy and momentous. Mainly methods know how to be off the record into 3 groups: the analytical, the empirical goodness and the empirical discrepancy groups. All group have its be in possession of distinctiveness. Narrative of every one technique in each collection, various relative discussions about different method groups are first carried out. An investigational assessment for some experimental (kindness and inconsistency) method frequently recycled is subsequently performed to present a status of their valuation ability. In addition, some special methods are also discussed [32].

Savita Agrawal [2014]: Investigates in addition to compiles several of the technologies use image segmentation, which is fit suitable in favor of gray scale images multichannel images. More than a few general-purpose algorithms and techniques have been developed for image segmentation [33].

Akshay D. Isalkar [2014]: In This paper proposes an automatically threshold detection mechanism to perform a good segmentation. Diverse initial-point threshold are chosen along with specified on the road to regions by way of excessive and dreary changes during gray-level principles of a picture. The curve thresholds are preferred next to analyzing the rotting regions with the aim of preventing the seek out beginning past it into the wrong lane, and reduction in computational moment know how to be obtained. The outline exploration progression performance too believe the gradients of the left and right neighboring points of every forecasted contour point, in order to subordinate the opportunity of the way mortal not natural by the adjoining noise interferences. Most of the searching procedure requires only the calculation of the gradients of three directions using eight compass directions that reduce the

searching time. The designed way knows how to bear out segmentation on objects within another item and substance that are close up to every one other. In administration of shadowy objects from an out-of-focus flare-up, the projected method can be also segmenting the essential objects. The planned method could take the smallest amount of computational time to find strong and high-quality segmentation performance than the traditional ones. So, the projected scheme be able to be at length and productively operational in a variety of segmentation applications [34].

Mrs. Princy Mishra [2014]: represent a variety of methods of segmentation and clustering which know how to be helpful for medical image segmentation. This review container is helpful for upcoming researchers [35].

Ms. R. Saranya Pon Selvi [2014]: a concise draw round on a quantity of of the nearly everyone usually use segmentation techniques like thresholding, Region based, replica based, Edge revealing etc. Mentioning its reward as fine as the drawbacks. A number of the techniques are appropriate used for noisy images. The fresh technologies are budding in the grassland of Image processing; particularly in the province of segmentation. A number of image segmentation techniques include been urbanized by the researchers in arrange to construct images even and simple to assess [36].

Gloria Bueno [2004]: presents a new method of segmentation of anatomical configuration within health imagery. Adaptive PDE models helped just before uncover the expanse of concern. 3D brain MRI Image is used as a dataset. The model has outperformed ‘Snakes’ form and decrease a quantity of drawbacks of Snakes model [37].

Nameirakpam Dhanachandra [2015]: the most important endeavor is to assessment the presumption of edge revealing for image segmentation with soft computing come close to based lying on the Fuzzy logic, Genetic Algorithm and Neural Network. Soft computing method contain establish ample applications. Solitary of the the majority vital applications is edge detection for image segmentation. Edge is a frontier sandwiched between two identical regions. We know how to as well apply diverse clustering method with subtractive clustering algorithm [38].

Zhensong Chen [2015]: et al in this paper, we have proposed a novel image segmentation approach based on the DP clustering algorithm. This segmentation method could determine the cluster number and centers directly based on the decision graph, which is composed with the density ρ and distance δ . And the hierarchical segmentation could also be easily achieved via our segmentation approach. Extensive experimental results show that the proposed approach is a good compromise in-between state-of-art method. In conclusion, our proposed method could be a feasible preprocessing method for operations such as pattern recognition and image semantic annotation. In future work, we plan to explore how to select the value of parameter dc automatically based on the input image. [39]

Apurv Vashisht [2016]: the clustering based segmentation. It concludes by way of certain limitations of available techniques and also the possible solutions for the same for future use. The segmentation process breaks up a specified image keen on diverse area and items. Image Segmentation has turn into in style payable to its countless idea application. [40]

Ms. R. Saranya Pon Selvi [2014]: presents a brief outline on some of the most commonly used segmentation techniques like thresholding, Region based, Model based, Edge detection Etc mentioning its advantages as well as the drawbacks. Some of the techniques are suitable for noisy images. The new technologies are emerging in the field of Image processing, especially in the domain of segmentation. Segmentation is considered as one of the main steps in image processing. It divides a digital image into multiple regions in order to analyze them. It is also used to distinguish different objects in the image [41].

IV. EXPERIMENTAL RESULTS

As to apply segmentation technique I have taken some images and segment them using texture, shape etc. Two of them shown below

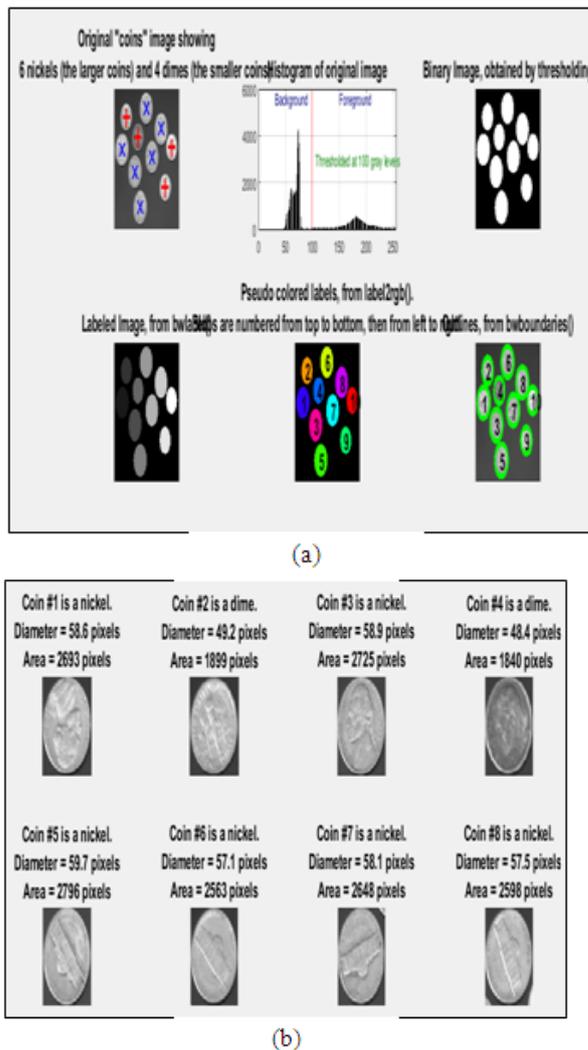


Fig.1.shows segmentation on coins' image

Fig.1. shows segmentation process on coins' image in which we have taken coins.png as input image then calculate area of each coin and call larger coins as nickels and the smaller as dime. Then binary image is obtained by threshold after that do labeling of coins shown in fig.1. (A). Then segment each coin with the help of their area and diameter. Segmented image is shown in fig.1. (b).

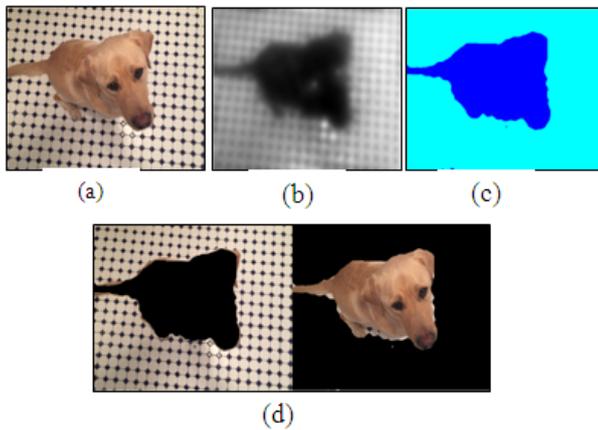


Fig.2. shows segmentation on Kobi image

Fig.2. shows the segmentation process of original Kobi image. In this process we reshape the original image and then show its RGB component. At last we have segment the object from the background shown in fig.2. (d).



Fig.3. (a) Original Kokala Image (b) Segmented kokala Image

Fig.3. (a) shows the segmentation process on the KOKALA image. For this original image is segmented using threshold value. The output image varies with the change in threshold. Fig.3. (b) shows the segmented KOKALA image where threshold is .395.

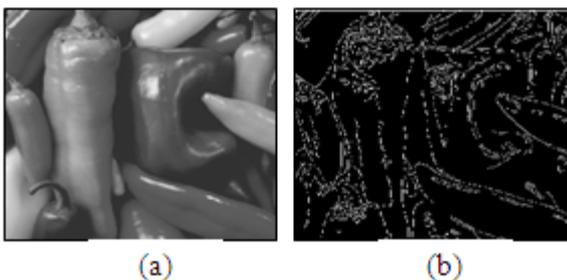


Fig.4. (a) Original Image (b) Segmented Image

Fig.4. shows the segmentation process on original pepper image using the edge based segmentation technique

V. CONCLUSION

This survey paper summarizes various segmentation techniques. Thus segmentation is done to estimate the surfaces. Segmentation can be applied to any type of image. Perfect method for segmenting image based on the result of image segmentation is depends on many factors, i.e., pixel,

color, texture, intensity, similarity of images, image content, and problem domain. Therefore, it is not possible to consider a single method for all type of images nor all methods can perform well for a particular type of image. Hence, it is good to use hybrid solution consists of multiple methods for image segmentation problem.

VI. REFERENCES

- [1] "cuts and image segmentation" by J. Shi, IEEE Trans. Pattern Analysis Mach. Intell., vol. 22, no. 8, pp. 888–905.
- [2] D. Comaniciu and P. Meer, "Mean shift: feature space analysis," IEEE Trans. Pattern Analysis. Mach. Intell., vol. 24, no. 5, pp. 603–619.
- [3] P. F. Felzenszwalb, "graphbased image segmentation," International Journal of Computer Vision, vol. 59, no. 2, pp. 167–181.
- [4] T. H. Kim, K. M. Lee, and S. U. Lee, "Learning full pairwise affinities for spectral segmentation," in Proc. IEEE CVPR, Jun. 2010, pp. 2101–2108.
- [5] Z. Li, X.-M. Wu, and S.-F. Chang, "Segmentation using superpixels: A bipartite graph partitioning approach," in Proc. IEEE CVPR, Jun. 2012, pp. 789–796.
- [6] P. Arbel'aez, M. Maire, C. Fowlkes, and J. Malik, "Contour detection and hierarchical image segmentation," IEEE Trans. Pattern Anal. Mach. Intell., vol. 33, no. 5, pp. 898–916, May 2011.
- [7] S. Gupta, P. Arbel'aez, and J. Malik, "Perceptual organization and recognition of indoor scenes from RGB-D images," in Proc. IEEE CVPR, Jun. 2013, pp. 564–571.
- [8] N. Silberman, D. Hoiem, P. Kohli, and R. Fergus, "Indoor segmentation and support inference from RGBD images," in Proc. ECCV, Oct. 2012, pp. 746–760.
- [9] H., Peng., J. W., Mario, J. P., Jim'enez and P., Shi, "A novel image thresholding method based on membrane computing and fuzzy entropy" In: Journal of Intelligent & Fuzzy Systems, Vol. 13, pp. 229–237, 2013, ISSN:1064-1246.
- [10] Nedra .M Zaitoun, Musbah. J. Agel "Survey of image segmentation" ICCMIT, Pages 797-806, 2015
- [11] S. Karthick, Dr. K. Sathiyasekar "A Survey Based on Region Based Segmentation" (IJETT) – Volume 7 Number pp143-147, Jan 2014
- [12] D. Comaniciu and P. Meer, "Robust analysis of featurespaces: color image segmentation," Proc. IEEE CVPR Conf, San Juan, Puerto Rico, June 1997, 750-755
- [13] Y. W. Lim and S. U. Lee, "On the color image segmentation algorithm based on the thresholding and the fuzzy C-means techniques," Pattern Recognition, vol. 23, no. 9, pp. 935-952, 1990.
- [14] A. K. Jain and R. C. Dubes, Algorithms for Clustering Data. Prentice Hall, 1988.
- [15] J. F. Khan, S. M. A. Bhuiyan, "Image Segmentation and Shape Analysis for Road-Sign Detection" on Intelligent Transportation Systems, Vol: 12, pp: 83-96, 2011
- [16] Y. Wang, Q. Wang, "Image Segmentation Based on Multi-scale Local Feature" on Image and Signal Processing (CISP), Vol : 3, pp: 1406-1409, 2010
- [17] Felzenszwalb, P. F., Huttenlocher, D. P.: Efficient graph-based image segmentation', Int. J. Comput. Vis., 2004, 59, (2), pp. 167–181
- [18] Chen, T. Q., Lu, Y.: 'Color image segmentation: an innovative approach', Pattern Recognit., 2002, 35, (2), pp. 395–405
- [19] Yu, Z., Wong, H.: 'A rule based technique for extraction of visual attention regions based on real-time clustering', IEEE Trans. Multimedia, 2007, 9, (4), pp. 766–784
- [20] Kurugollu, F., Sankur, B., Harmanci, A. E.: 'Color image segmentation using histogram multithresholding and fusion', Image Vis. Comput., 2001, 19, (13), pp. 915–928

- [21] R. O. Duda, P. E. Hart, and D. G. Stork. Pattern Classification. John Wiley, New York, 2001.
- [22] M Celenk ,”A color clustering technique for image segmentation” on Computer Vision, Graphics, and Image Processing, 1990
- [23] Fan, J., Zeng, G., Body, M., Hacid, M.: ‘Seeded region growing: an extensive and comparative study’, Pattern Recognit. Lett., 2005, 26, (8), pp. 1139–1156
- [24] Lehmann, F.”Turbo segmentation of textured images”, on Pattern Analysis and Machine Intelligence,vol: 33,pp: 16 – 29,2011
- [25] M.M. Chang, M.I. Suzan, and A. M. Tekalp, “Adaptive Bayesian estimation of color images,” J. Electron.Imaging, vol. 3, pp. 404- 414, October 1994.
- [26] J. Luo, R. T. Cray, and H.-C. Lee, “Incorporation of derivative priors in adaptive Bayesian color image segmentation,”Proc. ICIP’97, Vol. 3, pp. 58-61, Oct 26-29, 1997 Santa Barbara,CA.
- [27] J. Gao and J. Zhang M. G. Fleming,”a novel multiresolution color image segmentation technique and its application to dermatoscopic image segmentation”,Image Processing,vol.3,pp.408-411,2000
- [28] J.W. Woods, “Two-Dimensional Discrete Markovian Fields,” IEEETrans. Information Theory, vol. 18, no. 2, pp. 232-240, Mar. 1972.
- [29] Rotem, O., Greenspan, H., Goldberger, J.: ‘Combining region and edgescues for image segmentation in a probabilistic gaussianmixtureframework’. IEEE Conf. on Computer Vision and PatternRecognition, Minneapolis, MN, USA, 17–22 June 2007
- [30] Waseem Khan” Image Segmentation Techniques: A Survey “Waseem Khan Journal of Image and Graphics Vol. 1, No. 4, December 201
- [31] N. Senthilkumaran and R. Rajesh ”Edge Detection Techniques for Image Segmentation – A Survey of Soft Computing Approaches” International Journal of Recent Trends in Engineering, No. 2,pp 250-254 May 2009
- [32] K. K. Rahini, S. S. Sudha” Review of Image Segmentation Techniques: A Survey”, IJARCSSE pp842-845 Volume 4, Issue 7, July 2014
- [33] Savita Agrawal , Deepak Kumar Xaxa “ Survey on Image Segmentation Techniques and Color Models” (IJCSIT) , Vol. 5 (3) , pp 3025-3030, 2014
- [34] Prof. S. T. Khandare1 , Mr. Akshay D. Isalkar” A Survey Paper on Image Segmentation with Thresholding”, International Journal of Computer Science and Mobile Computing, Vol.3 Issue.1, January- 2014, pp. 441-446
- [35] Mrs. Princy Mishra , Mrs. Shikha Agarwal , Ms. Usha Kiran” SURVEY PAPER BASED ON MEDICAL IMAGE SEGMENTATION AND CLUSTERING TECHNIQUES “ (IJARCET) Volume 2, Issue 12, pp3191-3194, December 2013
- [36] Ms. R. Saranya Pon Selvi , Ms. C. Lokanayaki , “ A Survey Paper on Fuzzy Image Segmentation Techniques” Vol. 4, Issue 3, pp.429-434, March 2014
- [37] S. Bueno, A. M. Albala, and P. Cosfas, “Fuzziness and PDE based models for the segmentation of medical image,” in Proc. Nuclear Science Symposium Conference Record, IEEE, 2004, pp. 3777- 3780
- [38] Nameirakpam Dhanachandra, Khumanthem Manglem, Yambem Jina Chanu “Image Segmentation Using K-means Clustering Algorithm and Subtractive Clustering Algorithm “, Pp 764-771,2015
- [39] Nikita Sharma, Mahendra Mishra, Manish Shrivastava. (2012, May). “Color Image Segmentation Techniques and Issues: An Approach”. International Journal of Science & Technology Research. Volume 1 (issue 41), ISSN 2277-8616
- [40] Apurv Vashisht, Shiv Kumar Analysis of Image Segmentation Techniques:ASurvey (IJETR) pp42-47, Volume-4, Issue-1, January 2016
- [41] Ms. R. Saranya Pon Selvi#1 , Ms. C. Lokanayaki*2 “A Survey Paper on Fuzzy Image Segmentation Techniques” Int. Journal of Engineering Research and Applications Vol. 4, Issue 3 (Version 1), March 2014, pp.429-434
- [42] Xin-Jiang, Renjie-Zhang, Shengdong-Nie” Image Segmentation Based onLevelSetMethodInternational Conference on Medical Physics and Biomedical Engineering pp 840 – 845,2012