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PERFORMANCE STUDY OF INNOVATIVE AND ADVANCED IMAGE SEGMENTATION TECHNIQUES

Mohamed Mustaq Ahmed. A
Lecturer,
Department of computer and information, Salman Bin Abdulaziz University
WadiAddawasir, Saudi Arabia
mustaqm55@yahoo.co.in

Dr. Saied M. Abd El-attySoliman
Head of Computer Science and Information Department
Salman Bin Abdulaziz University
WadiAddawasir, Saudi Arabia
sabdelatty@gmail.com

J.Adamkani
Assistant Professor
P.G Dept of Computer Science
The New College
Chennai,India
adam_kani@rediffmail.com

Abstract

Image segmentation is the fundamental step to analyze images and extract data from them. It is the field widely researched and still offers various challenges for the researchers. This paper tries to put light on the basic principles on the methods used to segment an image. This paper concentrates on the idea behind the basic methods used. Image segmentation can be broadly be categorized as semi-interactive method and fully automatic method and the algorithms developed lies in either of this approaches. The implementation of the various methods starts with the identification of all the adjustable parameters for each method. We have implemented and tested real images with and without noise. It starts in all cases by a simple and closed curve (circle or rectangle). Before

the segmentation is activated, one needs to initialize the contour that will be shown in the first frame of the subsequent results. In general, six experiments will be conducted, and six

methods are employed in this paper for performance comparison, 1.original level set by Caselles-Kimmel-Sapiro ,2. level set by Chan &Vese, 3. level set by Yezzi, 4. level set by Lankton 5. level set by Bernard et al. and 6. Proposed level set by Mohamed Mustaq Ahmedet. al.,

Keywords: Segmentation, Digital Image, Peak-Signal Noise Ratio, SNR

I. INTRODUCTION

Images are considered as one of the most important mediumof conveying information, in the field of computer vision, byunderstanding images the information extracted from themcan be used for other tasks for example: navigation of robots,extracting malign tissues from body scans, detection ofcancerous cells, identification of an airport from remotesensing data.[3]. Image segmentation is the foundation ofobject recognition and computer vision. In general, imagenoise should be eliminated through image preprocessing. Andthere is some specifically-given work (such as regionextraction and image marking) to do after the main operationof image segmentation for the sake of getting better visualeffect.[8]. The main goal of segmentation in the computervision system is to abridge or change the representation of animage into something that is more meaningful and informal toanalyze. Segmentation is mostly used to detect object, linesand curves in the image. More correctly, in segmentationvalue is assigned to every pixel in an image such that pixelwith the same value share certain characteristics, such ascolor, intensity or texture in a particular region.[12] Moreprecisely, image segmentation is the process of assigning alabel to every pixel in an image such that pixels with the samelabel share certain visual characteristics. The result of imagesegmentation is a set of segments that collectively cover theentire image, or a set of contours extracted from the image .Each of the pixels in a region is similar with respect to somecharacteristic or computed property, such as color, intensity,or texture. Due to the importance of image segmentation anumber of algorithms have been proposed but based on the image that is inputted the algorithm should be chosen to getthe best results.[1]

Sometimes image denoising is done beforethe segmentation to avoid from the false contour selection forsegmentation to segment the image without loss ofinformation for medical diagnosing purpose is a challengingjob.[3] The remaining of this paper is organized as below;section II introduces the term image segmentation. Section IIIdescribes the current image segmentation techniques andsection IV Concludes the overall study.

II. IMAGE SEGMENTATION

Image segmentation refers to the process of partitioning a digital image into multiple segments i.e. set of pixels, pixels in a region are similar according to some homogeneity criteria such as color, intensity or texture, so as to locate and identify objects and boundaries in an image.[3] Image segmentation is generally defined as the basic image processing that subdivides a digital image f (x, y) into its continuous, disconnect and nonempty subset f1 , f2, f 3,…… fn , which provides convenience to extraction of attribute.[8]Practical application of image segmentation range from filtering of noisy images, medical applications (Locate tumors and other pathologies, Measure tissue volumes, Computer guided surgery, Diagnosis, Treatment planning, study of anatomical structure), Locate objects in satellite images

(roads, forests, etc.), Face Recognition, Finger print Recognition, etc. [14][15]Many segmentation methods have been proposed in the literature. The choice of a segmentation technique over another and the level of segmentation are decided by the particular type of image and characteristics of the problem being considered.[3]

III. LITERATURE REVIEW

Liang and et al [10] proposed and approach for detection of edges in noisy images. Here pixels are classified as fuzzy sets based on their gray values. The performance of the algorithm is rather similar to that of the Canny algorithm but proposed one is meaningfully faster. Here the ground truth evaluation and evaluation parameter for comparison is not considered.

An image segmentation method is proposed by Dong and et al. in [12] for the segmentation of color image based on neural networks. In order to measure the color difference properly, image colors are signified in a modified color space L*u*v. It uses color reduction and color clustering technique with Neural Network. The ground truth evaluation and performance parameter is not considered. Evans and Liu proposed a Morphological gradient approach to color edge detection based on vector differences. The technique is computationally effectual and can also be readily applied to other vector-valued images [13]. The performance is compared with (vector order statics) VOS method and MVD (minimum vector dispersion) method. The method is robust to noise and computationally efficient. Performance evaluation parameter used here is SNR for noisy images.

Dollar and et al. proposed a supervised learning algorithm for edge and object boundary detection called Boosted Edge Learning (BEL). A decision of an edge point is made independently at each location in the image. It uses Probabilistic Boosting Tree classification algorithm for learning [14]. The algorithm is compared with Konishi and et al, It is highly scalable, adaptive and comparison is done on BSD images.

Nikou and et al. proposed a novel approach for image segmentation based on a hierarchical and spatially variant mixture model. According to this model, the pixel labels are random variables and smoothness prior is imposed on them [15].Comparison is done with Finite mixture model (FMM) and spatially invariant finite mixture model (SVFMM) on BSD images. Parameter used for evaluation is Probabilistic Rand Index (PRI).

In 2007, Unnikrishnan and et al. proposed (NPR) Normalized Probabilistic Rand Index and Probabilistic Rand Index (PRI) parameter for objective evaluation and quantitative comparison of image segmentation algorithms[16]. It has following physiognomies .It does not degenerate with respect to special segmentation cases. It does not make any assumptions about the data. It is normalized to give scores which are comparable between algorithm and images.

Max Mignotte in [17] proposed an approach for segmentation by using Fusion of histogram and kmeans cluster in different color space. The proposed method is fast to implement. The performance is compared with N-cuts, mean shift and compression based texture merging (CTM) methods. It gives better segmentation and PRI when evaluated on BSD images.

Yuan and et.al [18] proposed a method for segmentation by determining automatic thresholds using picture contents. A gradient of histogram and quad tree decomposition technique is used for decisive automatic threshold. It considers the ground truth evaluation and algorithm is compared with E-GVF (extended –gradient vector flow) and crisis

region growing. Performance evaluation parameter used is SNR on BSD images.

Ugarriza and et al. proposed automatic images segmentation by dynamic region growth in [19], which uses color gradient detection and clustering technique. The algorithm produces better segmentation and higher NPR, comparison is done on BSD images.

Bhoyar and Kakde[20] proposed an image segmentation algorithm based on JND (Just Noticeable Difference) histogram. The method is compared with (conventional color histogram) CCH. It gives better results than CCH technique. The algorithm is faster and gives better PRI and PSNR values. Here ground truth is not considered. Comparison is done on BSD images.

IV. COMPARATIVE ANALYSIS

The implementation of the various methods starts with the identification of all the adjustable parameters for each method. We have implemented and tested real images with and without noise. It starts in all cases by a simple and closed curve (circle or rectangle). Before the segmentation is activated, one needs to initialize the contour that will be shown in the first frame of the subsequent results. In general, six experiments will be conducted, and six methods are employed in this paper for performance comparison, 1.original level set by Caselles-Kimmel-Sapiro ,2. level set by Chan &Vese, 3. level set by Yezzi, 4.e level set by Lankton 5. level set by Bernard et al. and 6. Proposed level set by Mohamed Mustaq Ahmedet. al., The whole implementation (MATLAB coding) is run on a PC with a 3GHz Intel system. Table 1 summarizes the performance comparison of these six methods in different circumstances, where in general our scheme is superior to the others in terms of location accuracy and computational time. The details follow.

These values were normalized to facilitate their comparisons.

• **Visual criterion**: This criterion allows you to plot the results of the selected algorithms on the image to compare them with the reference you have selected.

• **Computation time**.

• Similarity criterion : Four similarity criteria can be computed between the result of the algorithms and the reference :

i. Dice criterion
ii. Peak signal-to-noise ratio(PSNR)
iii. Hausdor_ distance
iv. Mean Sum of Square Distance

Table 1.1. Criteria values for each of the methods for segmentation of image.

	GeodesiCactive Countour	**Chan and Yese Method**	**Yezzi Method**	**Lanktn Method**	**Bernad Method**	**Proposed**
Visual Criterion	1	1	1	0	1	1

Dice	0.69	0.68	0.28	0.6	0.7	0.76
PSNR	10.63	8.86	8.31	7.19	9.08	7.32
Computation Time	1.28	0.85	2.61	1.1	1.26	0.78
Hausdor Distance	21.32	31.92	21.54	16.97	20.10	28.52
MSSD	54.68	153.32	119.19	59.95	49.54	145.46

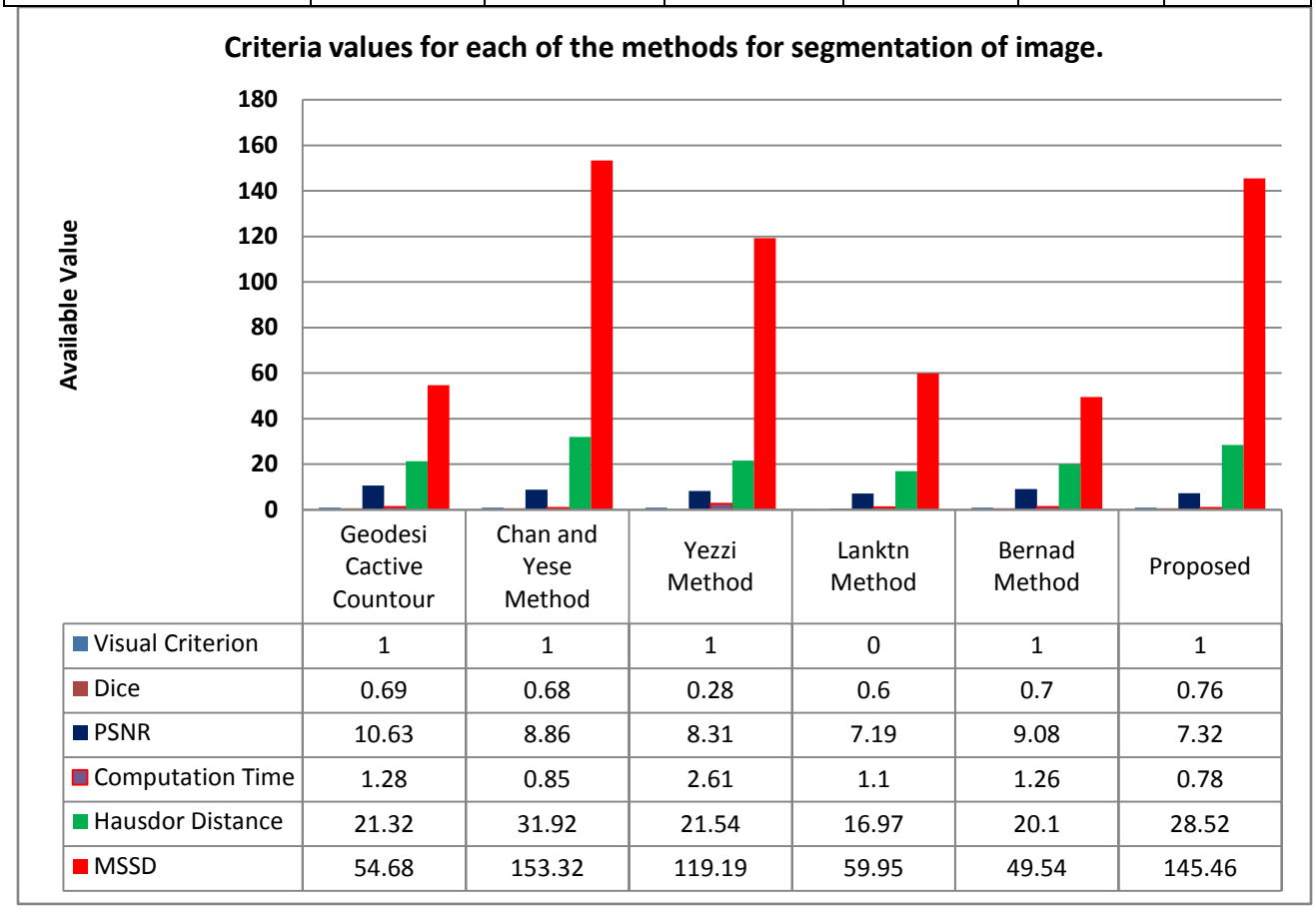

Figure 1. Performance of different Criteria values for each of the methods for segmentation of image.

According to our tests, our segmentation method seems to be the best. It depends on the nature of the image, and other parameters.

V. CONCLUSION

The document image under test isattempted with the help of global Thresholdingapproach while approximating most likelybackground information using an iterativealgorithm. In each iteration the averagestrength of the document image is accepted asthe midpoint between the pixels. In the nextstep the remaining pixels are equalized. Thenumber of iterations depends on the sensitivityof consecutive thresholds. This algorithm isfound to be effective on historical documentimages as well as camera captured stonecarvings. However, it is experimental that

furtherimprovement is necessary on palm leafmanuscripts.

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Mohamed MustaqAhmed.Ais a research scholar of Dravidian University, Andra Pradesh, India. He holds a B.Sc Degree in Physics, MastersDegree in Computer Applications at Bharathidasan University, Tiruchirappalli and M.Phil degree in Computer Science at Periyar University, Salem. His field of interest is Image Processing and Artificial Neural Networks.

Saied M. Abd El-atty received the B.S. and M.S. degrees from Menoufia University, Faculty of Electronic Engineering, in 1995 and 2001, all in Electronics & Communications Engineering respectively and PhD degree in Wireless Communication Networks from University of Aegean (UOA) at the Information and Communication Systems Engineering Department, Greece, Samos in 2008. He is a member of the faculty members in the department of Electronics and Electrical Communication at Faculty of Electronic Engineering, Menouf, Egypt. Currently, he is working as assistant professor in Salman Bin Abulaziz University, KSA. He is the head of computer science and information department in Science College. Dr. Saied's current research interests include design, analysis, and optimization of wireless mobile communication networks and vehicular networks as well as cognitive radio systems. Majoring in cross layer schemes, handover optimization, radio resource management, teletrafficmodelling, scheduling, small cell technology, and nanonetworking.

Mr.Adamkani received the M.Sc degree in Information Technology from University of Madras in 2003,M.Phil degree in Computer Science from Periyar University, India in 2006 and M.Tech in Information Technology from St.Peters University ,India in 2011.He is currently pursuing Ph.D in Computer Science from University of Madras,India. He is currently working as Asst.Professor in Dept of Computer Science,The New College,Chennai,India. His research area is Network Security.