Outdoor Scene Images Segmentation Using Graph Cut Method

Purnashti A.Bhosale[1], Yogesh M.Motey[2]
(Electronics Dept.), PIGCE, Nagpur
(Electronics & Telecommunication Dept.), GHRIET,Nagpur

Abstract-*The novel proposes analysis and segmentation of outdoor scene image based on different segmentation techniques. Basically Segmentation is the first stage in any attempt to analyse or interpret ant image . Some kind of segmentation techniques will be found in many application involving the recognition, detection, measurement of objects in images and also the clustering of images. This paper aims to recognize and differentiate the objects present in outdoor scene images using various segmentation techniques. And also compares the result of different segmentation techniques which will prove which segmentation technique efficiently differentiates the foreground and background present of the images. Hence finally we get foreground and background separated and the results obtained are compared with the standard database .*

Keywords-Image segmentation, Thresholding techniques, Clustering Technique, Graph cut methods, Graph Cut based on Color Method.

I. INTRODUCTION

Image Segmentation is the important topic in the field of Digital Image Processing. The purpose of image segmentation is to partition the image into several regions using different techniques. For Segmentation we need images, either in black and white form or colour. Segmentation is the process that partitions the image pixels into non-overlapping regions such as Each region is homogeneous (i.e., uniform in terms of the pixel attributes such as intensity, colours, textures etc.) and connected. Segmentation acts as bridges between low-level image processing and high-level image processing. Basically Segmentation divides an image into its particular regions or objects. That is, it partitions an image into distinct regions that are meant to correlate strongly with objects or features of interest in the image. Segmentation can also be considered as a process of grouping together pixels that have similar attributes. Image segmentation algorithms generally are based on one of two basic properties of intensity values that are discontinuity and similarity. Similarity approaches partitioning an image based on regions that are similar according to a set of predefined criteria. Techniques based on discontinuity attempts to partition the image by detecting abrupt changes in gray level i.e. Point, line, and edge detectors. Techniques based on similarity attempt to create the uniform regions by grouping together connected pixels that satisfy predefined similarity criteria. Therefore, the results of segmentation may depend critically on these criteria and on the definition of connectivity. Some types of segmentation technique will be found in the applications involving the recognition, detection, and measurement of objects in the images. The role of segmentation is crucial in most of the tasks requiring image analysis. However, in general, a reliable and accurate segmentation of an image is very difficult to achieve by means of purely automatic segmentation. The approaches based on discontinuity and similarity mirror one another in the sense that completion of a boundary is equivalent to breaking one region into two. Here in this we will be separation the foreground and the background of the outdoor scene images. Segmentation on outdoor scene images is a difficult task due to many variations in the outdoor scenes as compared to indoor scenes.

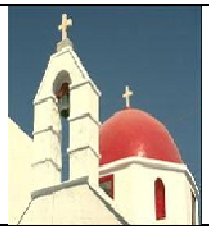
II. THRESHOLDING TECHNIQUES

Thresholding is the mostly used technique in image processing and is the simplest image segmentation algorithms. It is used to discriminate foreground from the background of the images. By selecting a proper and adequate threshold value T, the gray level images can be converted into binary images. The binary image contains all the essential information about the position and shape of the objects of our interest (i.e the foreground). It is advantageous to obtain first a binary image as it reduces the complexity of the data and simplifies the process of background and foreground detection. The common way to convert a gray-scale image to binary image is to select a single threshold value (T) depending on the gray level present in the image. Then all the gray level values below T will be classified as black colour, and those above T will be classified as white colour after the segmentation.

The method which is widely used to select threshold value is by analysing the histograms of the type of images that one wants to segment. In ideal case the histogram presents only two dominant modes and a clear valley. In this case the value of T is selected as the valley point between the two modes. Histograms are more complex, with many peaks and

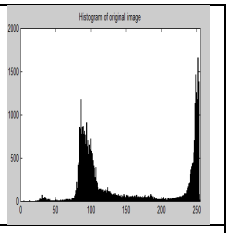
not clear valleys in some cases, and are not always easy to select the threshold value. So there are various methods to select the threshold values out of which one is automatic thresholding. It is the simplest way of thresholding. In this the threshold value for each image is selected automatically by the system is called an automatic threshold scheme. It requires the knowledge about the size of the objects, intensity characteristics of the objects, fractions of the image occupied by the objects and the number of different types of objects appearing in the given image. Then only the automatic thresholding method can be applied. The method which can be used for selecting the threshold value is by taking mean value of the pixels as the threshold value. It is being rarely used as it works well only in the cases where the half of the image is background and half of the image is foreground. In such cases only we can use this method for selecting the threshold value for other images where foreground and background are not equal different techniques are used for selection of threshold value.

There are two different types of thresholding techniques described in this paper are Global thresholding and Local thresholding techniques [12]. In global thresholding technique one threshold (T) value is required.



Original Images Fig (a)

Gray Scale Images Fig (b)



Histogram of Input Images Fig(c)

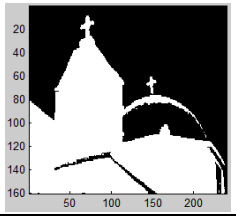
III. CLUSTERING TECHNIQUES

Clustering can be considered the most important unsupervised learning problem; so, as every other problem of this kind, it deals with finding a structure in a collection of unlabeled data. Definition of clustering is “the process of organizing objects into groups whose members are similar in some way”. A cluster is therefore a collection of objects which are “similar” between them and are “dissimilar” to the objects belonging to other clusters. [13], [14], [15], [16].

Clustering algorithms can be applied in many fields. Basically cluster is a collection of objects which are “similar” and are “dissimilar” to the objects belonging to other clusters. Clustering problems arise in many applications, such as data mining knowledge discovery [9], and data compression and vector quantization [10], and pattern recognition and pattern classification [11]. Clustering can be classified into four types, Overlapping Clustering, Exclusive Clustering, Hierarchical Clustering and Probabilistic Clustering. In first case the overlapping clustering, clusters the data using fuzzy sets, so that each point belongs to two or more clusters with different degrees of membership. In such cases, data will be associated to an appropriate membership value. The second type, the data’s is grouped in an exclusive way, so that if a certain pixel belongs to a definite cluster then it could not be included in another cluster. The hierarchical Clustering algorithm is based on the union between the two nearest clusters. The last type of clustering algorithm uses a completely probabilistic approach. The four most used algorithms are K-means, Hierarchical clustering, Fuzzy C-means, Mixture of Gaussians. Each of these algorithms belongs to one of the clustering types as above. Such as K-means is an exclusive clustering algorithm, Hierarchical clustering is obvious Fuzzy C-means is an overlapping clustering algorithm and lastly Mixture of Gaussian is a probabilistic clustering algorithm.

Clustering based on k-means is closely related to a number of other clustering and location problems. This paper describes K-mean clustering technique of segmentation.

The regions having pixels value less than this threshold value will be considered as background and the regions having pixels value more than this threshold value will be foreground. The result obtained by using global thresholding technique is as shown in fig (d).The results of global thresholding technique is satisfactory for some images wherethere is not much variation in the pixels value of the image i.e a one toned image .In local thresholding technique more than one threshold values are required. It is also known adaptive thresholding where Adaptive thresholding typically takes a gray scale or colour image and outputs a binary image representing the segmentation of the particular image. For each pixel of the image the threshold has to be calculated. Some methods for the selection of threshold are explained above. The results obtained by applying local thresholding technique are as shown in fig (e).



Global Threshold Fig (d)

Local Threshold Fig (e)

A.K-mean Clustering

In k-means clustering, it partitions a collection of data into a K number group of data .It classifies a given set of data into K number of disjoint cluster It is an unsupervised clustering algorithm. Here "K" stands for number of clusters. K-means algorithm is iterative in nature. In K-mean algorithm data vectors are grouped into predefined number of clusters [1] [2]. It comes under partitioned clustering method. It is the most popular used method for segmentation.

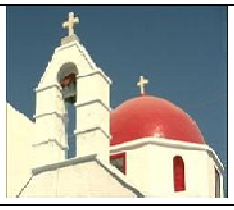
The K-mean algorithm follows the following steps, it first decide a value for K, the number of clusters. Then initialize the K cluster centres' (randomly, if necessary). Decide the class memberships of the N objects by assigning them to the nearest cluster centres. Then re-estimate the K cluster centres, by considering the memberships found above are correct. Repeat these steps until none of the N objects changes membership in the last iteration. The results obtained using K-mean clustering method is shown in fig (f). In that it can be seen that the clusters of the nearer value pixels are formed. For given ranges of pixel values a particular colour is given. In this k-mean clustering six ranges are defined of pixel values and six different colours are given to these groups of pixels. So the resultant image is grouped into six different clusters based on their pixels value.

IV. GRAPH CUT METHOD

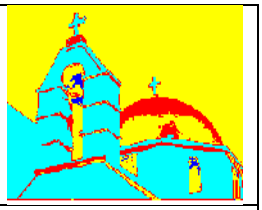
The task of interactive image segmentation has attracted the attention in recent years [8], [4], [5], [6].Graph cut is one of the most popular techniques for interactive image segmentation. An image segmentation problem can be interpreted as partitioning the image elements (pixels) into different categories. A Cut of a graph is a partition of the vertices in the graph into two disjoint subsets. Taking a graph with an image, one can solve the segmentation problem using graph cuts techniques in graph theory. In this paper graph cut method based on textures information is implemented [3]. The graph cut method can be applied on both gray scale images and colour images. Implementation of graph cut method on gray scale image is simple and easy so it is broadly used.

The resultant image obtained after applying graph cut method contains boundaries separating the objects based on texture information [7].

In this paper the boundaries obtained in resultant image are used on colour image and on the bases of colour it is decided that the region is a part of background or foreground like if the colour of the region is green then the probability is more that it is the part of background also the size of the region is an important feature to determine whether it is background or foreground as the background will be larger than the foreground. Now after determining this for each region one can take decisions to combine the background regions of the image and thus can separate the foreground from the background. Fig (g) shows the result of graph cut method which groups the similar value pixels and draws the boundary around it. Whereas fig (h) shows the result of graph cut method based on colour information which highlights the foreground and darkens the background of the input images.

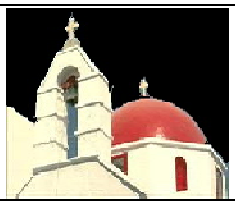


Original Images Fig (a)



K-mean clustering Fig (f)

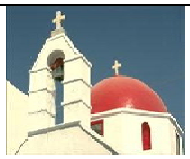
Graph Cut Method Fig (g)



Graph cut based on colour Fig (h)

V. CONCLUSION

This paper presents an implementation of various segmentation techniques on outdoor scene images and tried to differentiate the background and foreground of the outdoor scene images. The various segmentation techniques used are Thresholding technique: Global and Local thresholding, Clustering technique: K-mean clustering and Graph cut methods and graph cut based on colour. By comparing the results obtained by the various techniques it is concluded that the results obtained by graph cut based on colour are more accurate which clearly separates the background and foreground of the images and highlights the foreground as shown in Fig (h).The advantage of graph cut method is it can be directly applied on colour images and can separate the background and foreground of the images directly. For gray scale images having less number of variations in their pixel values global thresholding technique can be used. Further the results are compared to the Berkeley database. The comparison table is as shown above which proves the results obtained using Graph cut based on colour information are very close to accuracy and is the automatic segmentation technique where as the results in Berkeley database are obtained by ground truth which is nothing but done manually.

Original Images	PSNR	Entropy	Quality factor
	52.2049	7.2235	0.0064

REFERENCES

[1] Gregory A. Wilkin and Xiuzhen Huang "K-Means Clustering Algorithms:Implementation and Comparison," Second International Multisymposium on Computer and Computational Sciences IEEE 2007.

[2] Sharifah Lailee Syed Abdullaha, Hamirul'Aini Hambalia,b and Nursuriati Jamilc "Accurate Thresholding-based Segmentation Technique for Natural Images," IEEE Symposium on Humanities, Science and Engineering Research 2012.

[3] Yuxian Li1, Yifu Du2, Bin Liu2, Haibin Li3, Qiang Zhang3, Yaqian Li3 "Image Segmentation Method Based on Improved Graph Cut Algorith" IEEE 2012.

[4] C. Rother, V. Kolmogorov, and A. Blake. "Grabcut – interactive foreground extraction using iterated graph cuts". SIGGRAPH, August 2004.

[5] Y. Boykov and M.-P. Jolly, "Interactive graph cuts for optimal boundary And region segmentation of objects in N-D images". In ICCV, 2001.

[6] L. Grady, "Random walks for image segmentation" PAMI, 28(11):1768–1783, Nov. 2006.

[7] A. K. Sinop and L. Grady., "A seeded image segmentation framework unifying graph cuts and random walker which yields a new algorithm." In ICCV, Oct. 2007

[8] David R. Martin,Charless C. Fowlkes, and Jitendra Malik "Learning to Detect Natural Image Boundaries Using Local Brightness, Color, and Texture Cues," IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 26, NO. 5, MAY 2004.

[9] U.M. Fayyad, G. Piatetsky-Shapiro, P. Smyth, and R. Uthurusamy, ,"Advances in Knowledge Discovery and Data Mining." AAAI/MIT Press, 1996.

[10] A. Gersho and R.M. Gray, "Vector Quantization and Signal Compression" Boston: Kluwer Academic, 1992.

[11] R.O. Duda and P.E. Hart, "Pattern Classification and Scene Analysis" New York: John Wiley & Sons, 1973.

[12] Salem Saleh Al-amri, N.V. Kalyankar and Khamitkar S.D , " Image Segmentation by Using Thersholde Techniques" JOURNAL OF COMPUTING, VOLUME 2, ISSUE 5, MAY 2010, ISSN 2151-9617.

[13] U.M. Fayyad, G. Piatetsky7Shapiro, P. Smyth, R.Uthurusamy, Advances in Knowledge Discovery and Data Mining,AAAI/MIT Press (1996) .

[14] M.N. Murty, A.K. Jain, P.J. Flynn, Data clustering:a review, ACM Comput. Surv. 31(3) (1999) 2647323.

[15] A.K. Jain, R.C. Dubes, Algorithms for Clustering Data,Prentice Hall, Englewood Cliffs, NJ(1988).

[16] R.T. Ng, J. Han, Efficient and effective clustering methods for spatial data mining, in: Proceedings of the Twentieth International Conference on Very Large Databases, Santiago,Chile(1994) 1447155620