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APPENDIX-II

An Improved Method for Outdoor Scene Image Segmentation using Graph Cut technique

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ABSTRACT

In this paper enhanced method for outdoor scene image segmentation using graph cut in analyzed and improved. The basic objective is to make the distinction between the structured and unstructured images such as sky, ground, vegetation and buildings people etc. respectively of the outdoor scene images based on their color and texture information. This paper shows the comparison of results obtained using graph cut method, graph cut based on color information and also with other techniques of image segmentation such as Clustering techniques and threshold techniques. A graph cut is the process of partitioning a directed or undirected graph into disjoint sets. The results obtained by using graph cut with color information are found to be accurate and satisfactory which highlights the foreground and darkens the background.

Keywords—Image segmentation, Threshold Techniques, Clustering techniques, Graph cut method etc

I. INTRODUCTION

Image segmentation is one of the fundamental problems for computer vision. A primary goal of image segmentation is to partition an image into various regions of coherent properties so that each region corresponds to an object or area of our interest. [10]. In general, objects in outdoor scenes can be divided into two categories, namely, unstructured objects (e.g., sky, roads, trees, grass, ground etc.) and structured objects (e.g., vehicles, buildings, people, etc.). Unstructured objects usually consist of the backgrounds of images. The background objects have nearly homogenous surfaces and are distinct from the structured objects in images. Segmentation algorithms are based on two basic properties of intensity values discontinuity and similarity. 1st category is to partition an image based on abrupt changes in the intensity. 2nd category is based on partitioning an image into regions that are similar according to the predefined criteria. Histogram Threshold approach falls under this category. In this we have taken second category (threshold techniques). Threshold segmentation techniques can be grouped in three different classes:

1. The Local techniques are based on the local properties of the pixels and their neighborhoods

2. The Global techniques segment an image on the basis of information obtain globally (e.g. by using image histogram; global texture properties).

3. Split, merge and growing techniques use both the motions of homogeneity and geometrical proximity in order to get good segmentation results. Finally image segmentation, say a field of image analysis, is used to group pixels into regions of interest to determine an image's composition. [2][3]

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They proposed an auto-adaptive threshold method of two dimensional (2-D) histogram based on multi-resolution analysis (MRA), by decreasing the calculation complexity of 2-D histogram whereas improving the searching precision of multi-resolution threshold method. Such method can originates from the extraordinary segmentation effects achieved by 2-D histogram threshold segmentation method through the spatial correlation of gray level and the flexibility as well as efficiency of the threshold searching of multi-resolution threshold segmentation method. Experimental results demonstrated that such a method can obtain segmentation results similar with the exhaustive 2-D histogram methods, whereas the calculation complexity decreases exponentially with the increase of resolution level [12]. The image threshold problem is treated as an important issue in image processing, and it not only reduces the image data, but also lays a good foundation for target recognition and understanding images. Character of both the local threshold segmentation and global threshold was analyzed in image segmentation. A new threshold statistic iterative arithmetic is presented to overcome the direct worth method in threshold, aiming at bigger arithmetic figure in ratio in a variety in gray of background image. Statistics iterative threshold segmentation based on Gauss statistics distributing and image gray histogram, obtain the expression of statistics iterative method in theory and the best worth threshold method and steps. Aviation image was threshold segmentation using adaptive method, histogram technique and statistic iterative arithmetic respectively. Compared three threshold results, it shows that statistic iterative method greatly improved the anti-noise capability of image segmentation and have good result to the image of the worth and not easy to segment in full value threshold method [4].

Threshold techniques can be categorized into two different classes: global threshold and local or adaptive threshold. In the global threshold, a single threshold value is used in an image. In the local or adaptive threshold, a threshold value is assigned to each pixel to determine whether it belongs to the foreground or the background pixel using local information around the pixel basically it groups the pixels having nearly same values. Because of implementation, the the advantage of simple and easy global threshold has been a popular technique since many years [5][6][7].

Bias correction is the procedure to estimate the bias field and restore true signals, thereby eliminating the side effects of the intensity in homogeneity [2][3]. Among all the various bias correction methods, those based on segmentation are more attractive. Segmentation and bias correction can be obtained by a level set evolution process. A salient advantage of this method is the smoothness of computed bias field is ensured by the normalized convolution [8] without giving extra cost. Moreover, the evolution is less sensitive to the initialization, thus well suited for the automatic applications.

II . THRESHOLD TECHNIQUES

Threshold is one of the most popular methods for image segmentation. It is useful in differentiating foreground from the background. By selecting a proper and adequate threshold value T, the gray level image is converted into binary image. The binary image contains all the essential information about the position and shape of the objects of interest (foreground). It is advantageous to obtain first a binary image as it reduces the complexity of the data and simplifies the process of recognition. The most common way to convert a gray-level image to binary image is to select a single threshold value (T). Then all the gray level values below T will be classified as

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black, and those above T will be white. The segmentation problem becomes one of selecting the proper value for the threshold T. A frequent method used to select T is by analyzing the histograms of the type of images that want to be segmented. When the histogram presents only two dominant modes and a clear valley is the ideal case. 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 ideal cases, and are not always easy to select the threshold value. The results of threshold techniques both global and local are shown in fig (d) and fig (e).

2.1 Automatic Thresholds –

In this the threshold value for each image is selected automatically by the system without human intervention is called an automatic threshold scheme. This requires the knowledge about the sizes 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 image. Then automatic threshold is possible and is the simplest way of threshold.

2.2 Threshold Techniques

Threshold technique is one of the important techniques in image segmentation. Threshold technique can be expressed as:

Let $T = T\{t_1, t_2, g(t_1, t_2), f(t_1, t_2)\}$ where T is the threshold value Where: T. t_1, t_2 are the coordinates of the threshold value point. g (t_1, t_2) ,f(t_1, t_2) are points the gray level image pixels. Threshold image I(t_1, t_2) can be defined: In Global threshold technique only one threshold value is selected T .The region having pixel values below this threshold value T will be considered as background and the region having pixel values above this threshold value T will be considered as foreground or object.

In local or adaptive threshold method more than one threshold values are required. Some methods for selecting the threshold values are as follows:

2.2.1) Mean Technique

This technique uses the mean value of the pixels as the threshold value and works well in strict cases of the images that have approximately half to the pixels belonging to the foreground and the other half to background. This technique is rarely being used now a day.

2.2.2) Histogram Technique

The histogram technique is dependent on the success of estimating the threshold value that separates the two homogonous region of the image that is foreground and background. This required, the image formation be of two homogonous and well-separated regions and there exists a threshold value that separated these regions. The histogram technique is suitable for image with large homogonous and well separate regions where all area of the objects and background are homogonous and except the area between the objects and background. The fig(c) shows histogram of original image.

2.2.3) EMT Technique

When there is more than one homogenous region in an image EMT technique is used or where there is a change on illumination between the object and background. In this portion of the object may be merged with the background or portions of the background may as an object. To this reason any of the automatic threshold selection techniques performance becomes much better in images with large uniform and well separated

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regions. This techniques segmentation depend on the research about the maximum edge threshold in the image to start segmentation that image with help the edge detection techniques operators.

III. CLUSTERING TECHNIQUES

Clustering is nothing but grouping of similar pixels in an image. By Using Clustering technique for image segmentation it forms clusters of similar value pixels. There are various techniques available for clustering such as Hierarchical Clustering, K-mean clustering etc among which K-mean clustering is most popularly used and is the standard clustering technique. This process can be repeated for fixed number of iterations. The result of K-mean clustering is as shown in fig (b).

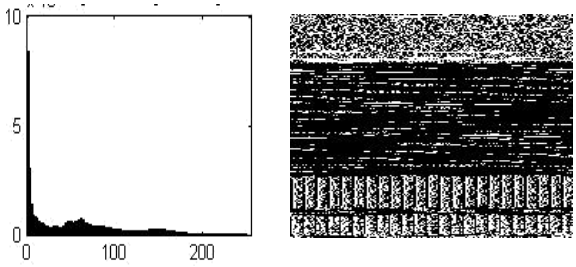
IV. GRAPH CUT METHODS

The process of partitioning a directed or undirected graph into disjoint sets is known as Graph cut method. It is a very popular approach as it minimizes an energy function consisting of a data term and a spatial coherency term. Many low-level vision problems can be posed as finding energy minimizing cuts in graphs these techniques have received a lot of attention in the computer vision community Graph cut methods have been successfully applied to image restoration, stereo, image segmentation and texture synthesis. The results of Graph cut method is as shown in fig (c).

V. RESULTS

(a) **(b)**

Figure 1. (a) Original image (b) Gray Scale image



(c) **(d)**

Figure 2. (c) Histogram of original image (d) Global Threshold

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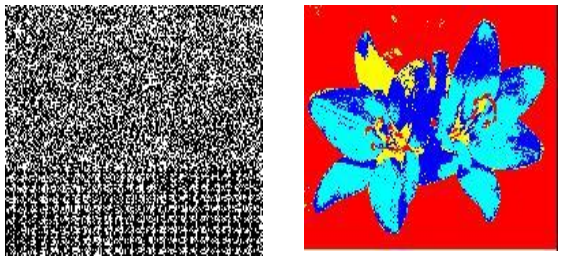

Fig. 3.(a) Local Threshold (b) K-mean clustering

Figure 4 Graph cut Method

V. CONCLUSION

A comparative study of outdoor image segmentation by using threshold segmentation techniques: Global and Local technique, clustering technique and Graph Cut method of image segmentation and tried to make the distinction between structured i.e foreground images and unstructured i.e. background. Because of the advantage of simple and easy implementation, of threshold techniques along with Graph cut technique found to be more significant in making the distinction. Further work can be done in order to improve and obtain more accurate results in recognizing background and foreground in an outdoor scene image.

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