Multilevel Image Thresholding Based On Histograms` Peaks Clustering

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Abstract - **This paper presents an algorithm for finding thresholds by clustering data formed thru detection in different size image parts histogram peaks.**

Keywords – **image, segmentation, thresholding.**

I. INTRODUCTION

Thresholding is a simple but effective tool for image segmentation. In many image processing applications, the pixels need to be classified as belonging to the foreground or the background. The use of a threshold can accomplish such a task. In multilevel image thresholding, pixels can be classified into many classes, not just foreground and background. Because of its importance, image thresholding has attracted a considerable amount of attention. In-depth survey and evaluation of various thresholding methods are given by [1].

Among the thresholding techniques, the Otsu method [2] was one of the better threshold selection methods for general real world images with respect to uniformity and shape measures [3]. This method selects threshold values that maximize the between-class variances of the histogram. The Otsu method is optimal for thresholding a histogram with bimodal or multimodal distribution, but it fails if the histogram is unimodal or close to unimodal. Another disadvantage of Otsu method is time consuming for multilevel thresholding. However this method still remains one of the most referenced thresholding methods. Numerous researchers revise this method so that it handles both unimodal and bimodal distributions equally well.

In this paper we provide a method for multilevel image thresholding which is free from kind of histograms distribution and its times costs are regardless of thresholding levels number.

II. METHOD

Human being can distinguish unnoticeable details on scene of analysis and keep it in mind for further operations. We propose the similar approach for image segmentation method based on thresholding.

Peaks on image histogram clearly show the significant details but no less important parts could de disguised by kind of grey-level distribution. This is clear for images with low contrast or with small objects on non-homogeneous background (Fig.1a). When divide the image into smaller parts and detects peaks on histogram we may obtain values that not belong to the main histogram peaks set. Varying the size of images parts we obtain the complete set of histograms peaks which fix mainly all important details on image.

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To detect peaks on images histogram we elaborate simple but efficient means. Majority of known methods for local extreme detection based on threshold for bins comparison or dimension of point's neighborhood. We propose to establish neighborhood size as ratio of image's historagam mean and mean of derivative image's historagam. Choosing a local maximum in this vicinity we obtain predictable local extremes of image's histogram. Gathering the extremes for all windows we receive a set of peaks and some of them may be repetitious.

Next we utilize the hierarchical clustering algorithm for set of peaks. Detected cluster's centers denote the reference points. Segmentation of image consists in assignment the label of class to point with the gray scale value nearest to cluster's center. Or, what are the same, thresholds is the mean value of two consecutive cluster's centers Experimental result of applying proposed method is shown on Fig.1e, which demonstrate more preferable result than Otsu's method Fig.1d.

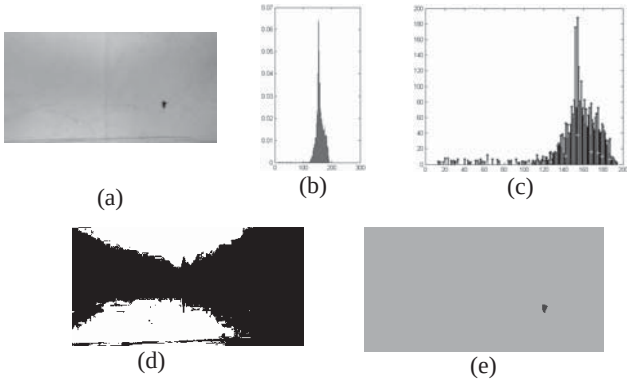

Fig.1 (a) – input image, (b) – histogram of image (a), (c) – histogram of detected peaks, (d) – thresholded image obtained by Otsu's method, (e) — thresholded image obtained by proposed method.

III. CONCLUSION

Utilization of grey level local extreme's set formed by means of image's part histogram proceeding allow gain more precise result of segmentation in case images with small object on non-homogeneous background.

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