International Journal of Contemporary Research in Computer Science and Technology (IJCRCST) e-ISSN: 2395-5325
Volume1, Issue 7 (October '2015)

COLOR IMAGE SEGMENTATION BASED ON ENRICHED WATERSHED ALGORITHM AND REGION MERGING

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Abstract: Image segmentation is a major technology in image processing and computer vision application. It is used to enhance the capabilities of image, computer processing application and improve the feature of color image. Color image segmentation methods as an extension of the gray scale image segmentation method in the color images, but lot of original gray scale image segmentation method cannot be applied to the color images. It is necessary to improve the method according to the color image which improves the feature of information used in color image segmentation. This paper proposes a modified watershed algorithm and region merging of Color images. The proposed Segmentation method with the combination of edge detection algorithm, filtering, watershed algorithm and region merging can obtain superior results than other segmentation methods

Keywords: Image segmentation,edge detection,watershed algorithm,region merging

I. INTRODUCTION

IMAGE segmentation has been as widely applied as in almost every field that is related to image processing such as remote sensing image, medical image and traffic image etc. Image segmentation algorithms including threshold-selection-based image segmentation algorithm, boundary-based image segmentation algorithm and edge-detection-based image segmentation algorithm etc. are still widely in use. Because the human eyes have adjustability for brightness, which we can only, identified dozens of Gray-scale at any point of complex image, but can identify thousands of colors. Accordingly, with the fast improvement of computer processing capabilities, the color image processing is being more and more concerned by people in order to effectively scan large numbers of images and video data in digital libraries.

At present, some image segmentation methods have achieved reasonably good results in some particular applications, but they always have a lot of boundaries. In many pattern recognition and computer vision applications, the color information can be used to enhance the image analysis process and improve segmentation results compared to gray-scale-based approaches. As a result, great efforts have been made in recent years to investigate segmentation of color images due to challenging requirements. Specifically applied to the color image segmentation approach is not so much as for the gray-scale images, most of proposed color image segmentation methods are the combination of the existing gray-scale image segmentation method on the basis of different color space. Commonly used for color image segmentation methods are threshold, feature space clustering, region-based approach, based on edge detection methods, fuzzy methods, artificial neural network approach, genetic algorithm approach, based on physical model methods, etc. Segmentation algorithms for monochrome images generally are based on one of two basic properties of gray-scale values: Discontinuity: The approach is to partition an image based on abrupt changes in gray-scale levels. The principal areas of interest within this category are detection of isolated points, lines, and edges in an image. Similarity: The principal approaches in this category are based on thresholding, region growing, and region splitting/merging.

To perform image segmentation and edge detection errands, there are many methods that integrate region growing and edge detection techniques. In [3, 4], it is applying edge detection techniques and employ region growing techniques to work on the map. In [5] adaptive clustering algorithm and K-means clustering algorithm are generalizing to include spatial constraints and to account for local intensity variations in the image. In [17] methods for image segmentation consist of watershed segmentation using prior shape and appearance

knowledge. In [8] a method for small object detection by using watershed based segmentation.

The partition of this paper is as follows, in section II, An Overview of watershed algorithm. In section III, the proposed system is discussed. In section IV, results and comparison are given. In section V, the conclusion and future work is given.

II. WATERSHED ALGORITHM

The main goal of watershed segmentation algorithm is to find the "watershed lines" in an image in order to separate the distinct regions. To imagine the pixel values of an image is a 3D topographic chart, where x and y denote the coordinate of plane, and z denotes the pixel value. The algorithm starts to pour water in the topographic chart from the lowest basin to the highest peak. In the process, we may detect some peaks disjoined the catchment basins, called as "dam". The diagram shows in Figure 1.

The watershed algorithm is an agent in the application of mathematical morphology theory for image segmentation. Watershed algorithm is the object based on application-oriented; it is selected by the operator manually or by automatic process. The objects can use watershed algorithm to transform and develop regional growth after maker.

Every object of image (including background) as a separate part and requested there must have one tag at least in the each object (or seed points). Marker is knowledge about segmentation is usually targeted due to a number of factors including the complex of human anatomy structure, the differences between individuals and the variety properties of scanned object, so there is not a common method which is applicable to all image modes.

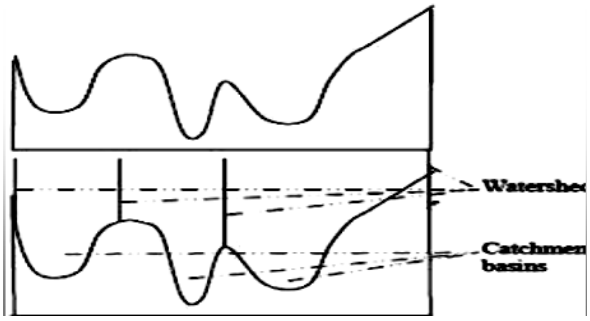


Figure 1: Watershed Line

The rainfall simulation describes that when rain falls onto the surface, any rain drop reaching a point in the surface will flow along its steepest descent until it reaches a minimum. The paths of pixels, which converge towards a common minimum, constitute a catchment basin. Watersheds are the elevated areas that divide the different catchment basins. The partitions, which we aim to obtain, are the catchment basins, and the boundaries between the partitions are the watersheds.

Advantages of the watershed transform include the fact that it is a fast, simple and intuitive method. More importantly, it is able to produce a complete division of the image in separated regions even if the contrast is poor, thus there is no need to carry out any post processing work, such as contour joining and its drawbacks will include over-segmentation and sensitivity to noise. An increasing interest in applying soft segmentation algorithms, where a pixel may be classified partially into multiple classes.

The watershed transform applied to the image does not produce contours of the features. On the converse, it partitions the image into the associated areas by the intensity gradient and considers the gradient image as a topographic relief, where the intensity of a pixel denotes the altitude of that pixel. Each pixel in this digital image is assigned a label during the transformation of the catchments basin of a regional minimum. When finished, the resulting network of dams defines the watershed of the image. Compared to the other methods, the watershed has several advantages as follows:

The gaps are handling properly and the placement of boundaries is at the most significant edges. The resulting boundaries form closed and connected regions.The disadvantage is that for textural images the watershed transformation does not use of texture information and produces excessive over-segmentation. The reason is that the image contains a lot of texture information that bring in too much seeds. So we adopt a two-stage method for textural image segmentation. The first stage uses standard watershed algorithm.

Watershed transformation has been widely used in many fields of image processing, including medical image segmentation.It has many advantages: simple, intuitive, fast, parallelizable, sensitive to poor contour, so it can get a single pixel wide, connectivity and closed accurate contour. But when the gray-scale image contrast is poor and the target is complex, the over-segmentation problem will be severe in the traditional method of watershed transformation. In order to overcome the problem, this paper proposes an improved watershed transformation

III. THE PROPOSED SYSTEM

In our proposed system, firstly the color image is transformed from the RGB to gray scale image, secondly compute edge detection using prewitt operator, thirdly we apply filtering to remove noise, Fourthly Watershed Algorithm is using for corresponding image and finally region merging applied to reduce the over segmentation. Then gray scale image is transformed to the RGB color image.

IV. RESULTS AND COMPARISON

The experimental results are shown figures, we obtained output images that consist of all edge information and region about the input image and our proposed method method. Figure 2 shows the original image, Figure 3 shows the segmented images with edges by watershed algorithm in color image, Figure 4 shows the segmented images with proposed watershed algorithm, Figure 5 shows the accurate edges after region merging segmented image, Figure 6 shows the output of proposed method of color images

Figure 2. Original image

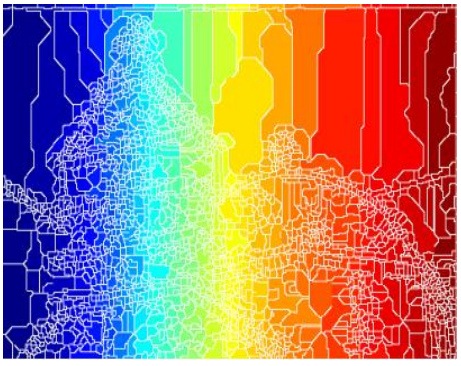


Figure 3. Segmented image by watershed Algorithm in color image

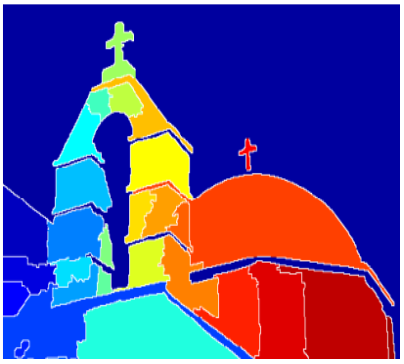
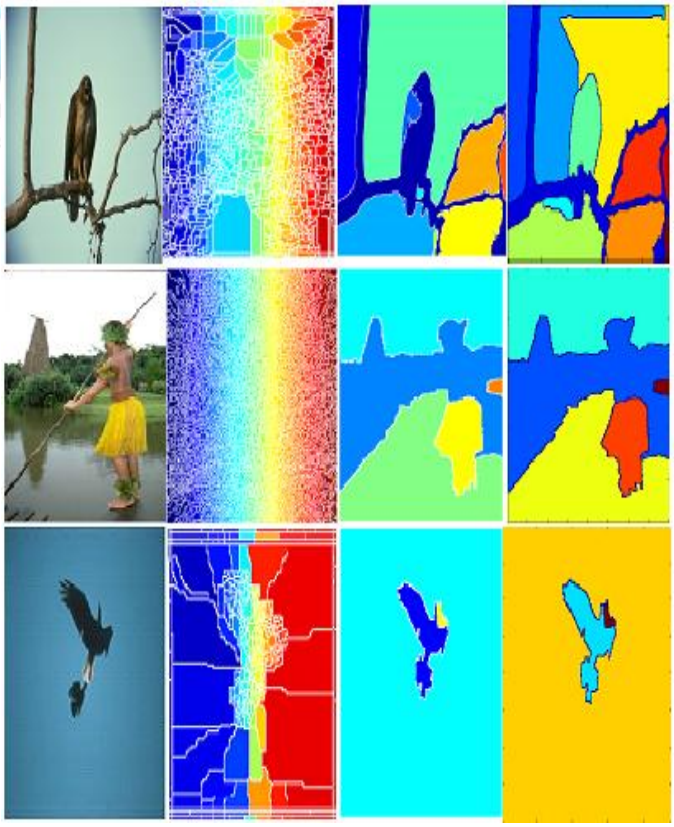


Figure 4. Segmented images by proposed watershed Algorithm in color image

Figure 5.Region merging output



(a) (b) (c) (d)

Figure 6.Segmentation results of some Berkeley data set images (a) original images. (b) Segmentation outputs bywatershed Algorithm. (c) Segmentation outputs by modifiedwatershed Algorithm (d) Final region merging output

V.CONCLUSION

In our proposed method, the segmentation regions and boundaries were defined superior and precisely positioned as in figure 5 and we solved the problem of undesirable over segmentation results produced by the watershed algorithm.Color image segmentation methods can be seen as an addition of the gray image segmentation method in the color images, but many of the original gray image segmentation methods cannot be openly applied to color images. This requires to improve the method of original gray image segmentation method according to the color image have the quality of information in new image segmentation methods which specially used in color image segmentation. Using color based image segmentation; it is possible to shrink the computational cost avoiding characteristic calculation for every pixel in the image. Although the color is not frequently used for image segmentation, it gives a high discriminative influence of regions present in the image.In future, this proposed algorithm can be enhanced with moving object image applications.

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