A Novel Method for Edge Detection of Natural Color Images

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***Abstract* — In this paper a novel natural color images edge detection algorithm is proposed using a relational operations. A relational shift operation can be found in order to detect the best quality edge in natural color images. First of all real complement of each channel is taken to get a matrices. After that each matrices converted into a binary matrices and each matrices are shifted left, right, up and down. After that <= operation is performed between original image and shifted matrices and result are stored in different variables. After that ~= operation is performed between the results. The results of ~=operation are summed together using addition operation. At last all the results for different channels are sunned together to get final image in which only edge are present. Experimental results on both the synthetic image and natural color images show that the proposed method is accurately gives better results. The method that is presented in this paper is simple and runs in polynomial time.**

Keywords- ***Color edge detection, circular shift operations, relational operations.***

I. INTRODUCTION

Image analysis is an area used for extracting the information from an image. Before extracting the information, the image has to be subdivided into constituent parts or objects. This process of subdivision and extracting an object is called image segmentation. Image segmentation is an essential preliminary step in most automatic pictorial pattern –recognition and scene analysis problems. In image segmentation edge detection is an important technique. Edges characterize boundaries and edge detection is one of the most difficult tasks in image segmentation hence it is a problem of fundamental importance in image segmentation. Edges in images are areas with strong intensity contrasts and a jump in intensity from one pixel to the next can create major variation in the picture quality. Edge detection of an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image. Edge detection is a vital step in image processing and is one of the most crucial steps towards classification and Recognition of objects. Color plays a crucial role in image analysis and recognition. A color image will have a vector of three values for every pixel unlike in gray images where a single value representing the intensity of a pixel. Human vision system chooses color rather than shapes and texture as the major discriminate attribute. Many algorithms have been proposed for edge detection of color images. Of all the edge detectors, Sobel is the standard detector and Canny is the modern standard and is used by researchers to compare their results with the results of Canny detector. Novak and Shafer [4] found that 90% of the edges are about the same in gray level and in color images. It implies that 10% of the edges are left over in gray level images. Since color images give more information than gray-level images, this 10% left over edges may be extracted from color images. In general, to extract edges from the images either gradient based methods [4] or vector based methods are used.

In this proposed method computation is done on four matrices i.e. red, green , blue matrices of RGB image and fourth matrix is combined form of all three matrices obtained by converting image to gray scale image .First of all read color image and obtained the real complement for the entire four matrices i.e. red, green ,blue and grayscale . This complement acts like a low pass filter and highlights the weak intensity pixels. The nature of the complement process is that it reduces the intensity distribution to 50%. Now these entire matrices are converted into binary matrices. Then circular shift operations are performed on theses matrices. All matrices are shifted left, right, top and bottom. The following terms are used for representing shift operations 1.circular left shift 2.circular right shift 3.circular top shift 4.circular bottom shift. Then proposed method i.e. relational operations are performed on these matrices. After we get circular shift matrices relational operations are performed on them to detect edges. Relational operators perform element-by-element comparisons between two matrixes. First of all relational less then or equal to (<=) operation is performed between original image matrix and circular shift matrix and after that not equal to (~=) operation is performed between the results. Then results of not equal to operation (~=) are summed together using the addition operation. At last all results for different channels are summed together to get final image in which only edges are present. This method can be applied to variety of colored images. Results obtained are better or comparable as compared to the results of other edge detection algorithms.

The rest of the paper is organized as follows. In Section II, various color spaces and their inter conversion is introduced. In sections III and IV proposed method approach and experimental results are discussed respectively. Section V concludes the work.

II. COLOR SPACES

A color space relates to number of actual colors, and is a three dimensional object which contains all realizable color combinations. Each dimension in color space represents some aspect of color, such as lightness, saturation or hue, depending on the type of space. Color spaces can be either dependent to or independent of a given device. Device-dependent spaces express color relative to some other color space whereas independent color spaces express color in absolute terms [6].

A. RGB Model

An RGB color space is any additive color space based on RGB color model. A particular RGB color space is defined by the three chromaticities of red, green and blue additive. RGB is a convenient color model for computer graphics because the human visual system works similar to an RGB color space.

B. HSL and HSV Model

HSL and HSV are two related representations of points in RGB color space which attempt to describe the perceptual color relationships more accurately than RGB. HSL stands for hue saturation lightness and HSV stands for hue saturation value.

C. YUV Model

YUV model defines a color space in one luminance (Y) and two chrominance (UV) components. YUV models human perception of color in a different way from the standard RGB model. Y stands for luminance (brightness) component and UV stands for the chrominance (color) components.

III. PROPOSED METHOD

The method proposed by us for extracting edges from color images. We combined circular shift and logical operation to extract the edge of the color image. The block diagram of the proposed method is given in Fig. 1. The steps of the proposed method are as follows.

Step (i) Read the color image.
Step (ii) Separate Red, Green and Blue and Grayscale matrix.
Step (iii) Obtained the real complement for all the four matrices.
Step (iv) Performed global thresholding to get binary matrices.
Step (v) Apply circular shift operations on entire matrices.
Step (vi) Apply relational operations on entire matrices.
Step (vii) For strong edges detection adds all the results.

IV. EXPERIMENTAL RESULTS

In this section, the results of the proposed method are presented. Both synthetic image and natural color images are used to show the efficiency of the proposed method. Results obtained are better or comparable as compared to the results of other edge detection algorithms. Results for synthetic and natural images are shown in fig.2 and fig.3.respectively.

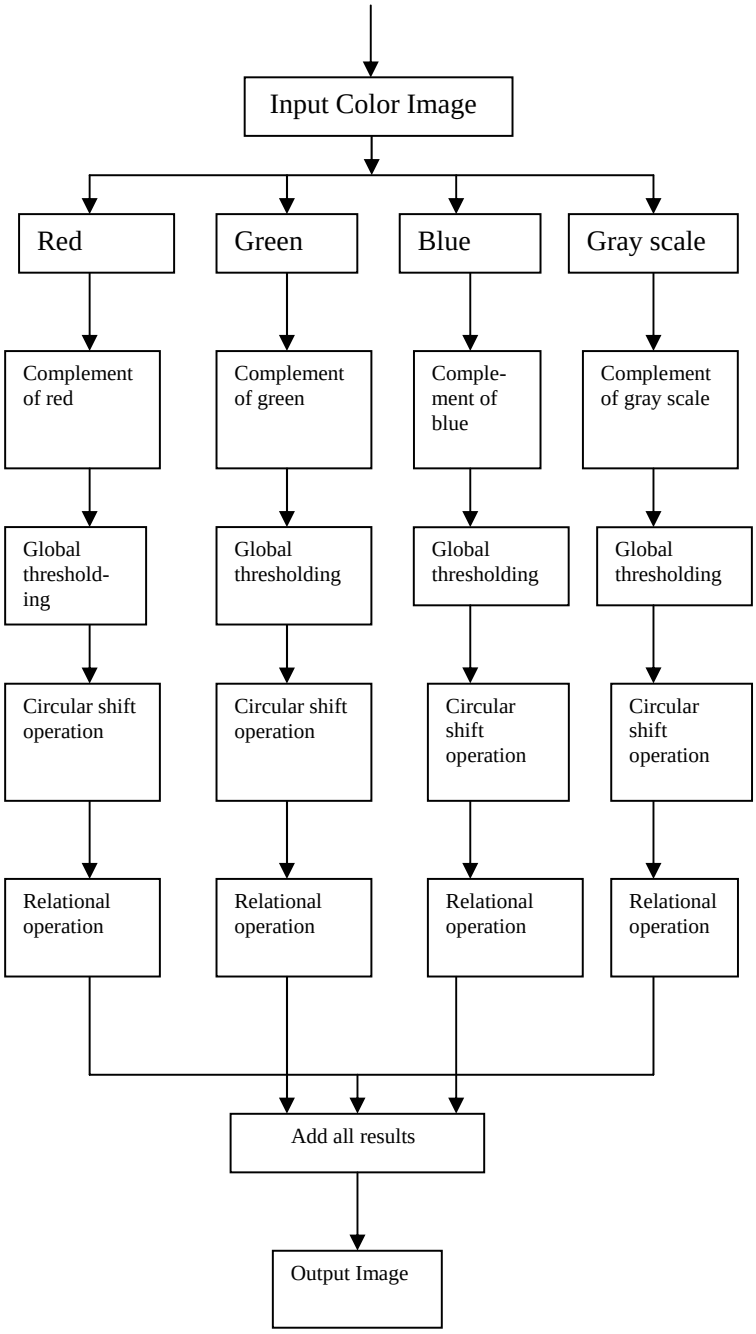

Fig.1 The Block diagram of the proposed method

A. *Experimental result on synthetic Image*

The synthetic image and its corresponding edge image are display in fig.2.

Fig.2 Synthetic image and its corresponding edge

B. *Experimental result on Natural Image*

The natural image and its corresponding edge image are display in fig.3.

Fig.3 Natural image and its corresponding edge

V. CONCLUSIONS

A new approach that is proposed in this thesis is used to extract real edges from color images. This algorithm incorporates simple shift and relational operations rather than using gradient and other operations which are computationally expensive. This proposed method manipulates entire image at a time which is never observed in normal edge detection process. Experimental results indicate that the performance of the proposed method is satisfactory in almost all cases and run in polynomial time.

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