An Efficient Method for Color Images Edge Detection

Ritu Gupta\(^1\), Malini\(^2\), Sonia Sachdeva\(^3\)

\(^1\)Assistant Professor & Head, LBMM College, Nabha, INDIA
\(^2\)Assistant Professor, Govt. Ripudaman College, Nabha, INDIA
\(^3\)Assistant Professor, Gopichand Arya Mahila College, Abohar, INDIA

ABSTRACT

The purpose of this paper is to show how the edge histogram descriptor for image that can be efficiently utilized for image matching. Since the edge histogram descriptor recommended for the standard represents only local edge distribution in an image, the matching performance for image retrieval may not be satisfactory. In this paper, to increase the matching performance, we propose to use the global and semi-local edge histograms generated directly from the local histogram bins. Then, the global, semi-global, and local histograms of two images are compared to evaluate the similarity measure. Since we exploit the absolute locations of edge in the image as well as its global composition, the proposed matching method is considered to be a more image content-based retrieval. Experimental results support this claim. Experiments on test images for MPEG-7 core experiment show that the proposed method yields better retrieval performance especially for semantic similarity.

Keywords — Color Edge Detection, Kuwahara Filter, Sobel Operator.

I. INTRODUCTION

The aim of edge detection in color image processing is to significantly reduce the amount of data in an image and filter out information that may be regarded as less relevant, while preserving the important structural properties of an image.\[1\] Therefore, edge detected from its original image contains major information, which only need small amount of memory to store. The original image can be easily restored from its edge map. There are a number of edge detection algorithms which have been developed in the process of finding of perfect edge detector.\[3\] Edge detection is a vital step in image processing and is one of the most crucial steps towards classification and Recognition of objects.\[4\]

Color plays a very important role in image analysis and pattern 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.\[2\]

It has been 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 so that 10% left over edges may be extracted from color images.\[5\]

There are many kind of color models present such as RGB color space, YUV space, CMY color space, CMYK color space, HSV color space.\[2\]

In this proposed method HSV color space is used. First of all, read color image and get smoothed using the kuwahara filter. Kuwahara filter is called edge smoothing and a popular non-linear edge-preserving filter. Kuwahara filter can be implemented for a variety of different window shapes. The filter kernel is partitioned into four contiguous regions, all of which contain the center point. For each of these the mean is calculated along with the variance.\[6\]

After the smoothing of the image by the kuwahara filter, a sobel edge detector operator or filter is applied on the smoothed image. It resulted in the sobel gradient which produced the edge map of the color image.

II. DIGITAL IMAGE PROCESSING

Digital image processing plays a vital role in the analysis and interpretation of remotely sensed data. Especially data obtained from Satellite Remote Sensing, which is in the digital form, can best be utilized with the help of digital image processing. Digital image processing refers to processing of digital images by using digital computers. Image enhancement and information extraction are two important components of digital image processing. Image enhancement techniques help in improving the visibility of any portion or feature of the image suppressing the information in other portions or features. Information extraction techniques help in obtaining the statistical information about any particular feature or portion of the image. Early 1920s Bartlane cable picture transmission system used to transmit newspaper images.
across the Atlantic. Images were coded, sent by telegraph, printed by a special telegraph printer. It took about three hours to send an image, first systems supported 5 gray levels. 1964 NASA’s Jet Propulsion Laboratory began working on computer algorithms to improve images of the moon. Images were transmitted by Ranger 7 probe. Corrections were desired for distortions inherent in onboard camera. Now there is a need of a method, with the help of which, we can understand images and extract information or objects, image segmentation fulfill above requirements. Thus, image segmentation is the first step in image analysis. Some time image denoising is done before the segmentation to avoid from the false contour selection for segmentation to segment the image without loss of information for medical diagnosing purpose is a challenging job.

III. COLOR SPACE

Color Space: A color space or model is a method for specifying colors in some standard way. It generally consists of a three dimensional coordinate system and a subspace of that system in which each color is represented by a single point. [7]

The color space can be divided into two: Linear color space and Non Linear color space.

Linear color space includes RGB color space and CIE XYZ color space. Non Linear color space includes only HSV color space. [8]

RGB color space: The RGB (Red, Green, and Blue) color space is used most frequently in computer graphics and image processing applications. A color in this space is represented by a triplet of values typically between zero and one and is usually scaled by 255 for an 8-bit representation. Each color can be broken down into its relative intensity in the three primaries corresponding to the spectral response of one of the three types of cones present in the human eye: red, green and blue. [9]

HSV color space: HSV color space is from the human visual system to describe the color with hue, saturation and intensity. Hue describes the attribute of a solid color; saturation gives a degree of measurement that a solid color is diluted by white light, intensity is a subjective descriptor, reflecting the strength concept of a colorless, and is the key parameter to describe the color sense. [9]

IV. NEW PROPOSED METHOD

The new proposed method in this paper for extracting edges from color images. It used a combination of Kuwahara filter and sobel operator to extract the edge of the color image. The steps of the proposed method are given as:

Step 1. Firstly, read any RGB color image as an input and convert it into 3D matrix.

Step 2. Now initialize the kernel size and kernel region for the padding of image for accounting boundaries.

Step 3. Convert the RGB Image into HSI color Space.

Step 4. Computation of variance and Mean of kernel region for the calculation of mean color and variance per-region.

Step 5. Based upon the calculation, apply kuwahara filter over image. The kuwahara filter divides the area around the subject pixel into four segments. After finding the lowest variance segment, set the subject pixel equal to the mean value of the area with lowest variance. Move to the next pixel and compare variance for each region.

Step 6. After adding the four result matrix, create the index matrix and find the vector index from it.

Step 7. Based upon the index image, make the filtered image.

Step 8. Now apply the sobel operator on the filtered to find the gradient of the image by calculating in horizontal and vertical directions.

Step 9. Finally get the edge detected image by applying thresholding on the sobel gradient.

V. TECHNIQUES IN EDGE DETECTION

Edge detection is a well-developed field on its own within image processing. Region boundaries and edges are closely related, since there is often a sharp adjustment in intensity at the region boundaries. Edge detection techniques have therefore been used as the base of another segmentation technique. The edges identified by edge detection are often disconnected. To segment an object from an image however, one needs closed region boundaries. The desired edges are the boundaries between such objects. Segmentation methods can also be applied to edges obtained from edge detectors. Lindeberg and Li developed an integrated method that segments edges into straight and curved edge segments for parts-based object recognition, based on a minimum description length (MDL) criterion that was optimized by a split-and-merge-like method with candidate breakpoints obtained from complementary
junction cues to obtain more likely points at which to consider partitions into different segments. Soft Computing Techniques (Artificial Neural Networks, Genetic Algorithms, Fuzzy Logic Models, and Particle Swarm Techniques) have been recognized as attractive alternatives to the standard, well established “hard computing” paradigms. Traditional hard computing methods are often too cumbersome for today’s problems. They always require a precisely stated analytical model and often a lot of computational time. Soft computing techniques, which emphasize gains in understanding system behavior in exchange for unnecessary precision, have proved to be important practical tools for many contemporary problems. NNs and FLMs are universal approximators of any multivariate function because they can be used for modeling highly nonlinear, unknown, or partially known complex systems, plants, or processes. Genetic Algorithm and Particle Swarm Optimization Techniques have emerged as potential and robust optimization tools in recent years.

VI. EXPERIMENTAL RESULTS

In this section, the results of the proposed method are Presented.

In order to test the effectiveness of the algorithm, the experiment is performed on a sample color image. The result the proposed method is compared with the same color image output that is denoised by Harmonic filter and edges were detected by the Sobel Operator.

Fig.-1, show that the Harmonic Filter with Sobel operator can make clearly reflect edge information of the image, but easily missed –detect, therefore the detected edges is incomplete. [9]

Fig.-2 shows the result of the proposed method which has been performed by using the MATLAB R2008a software.

The edges detected by the proposed algorithm can effectively inhibit more edge information and detected edges are continuous, complete and clear.

![Figure 2](image)

On visual perception of the sample images considered, it can be concluded that the Sobel operator with Harmonic filter provides low quality edge maps relative to the Kuwahara filter. To summarize it can be said that between two filters Sobel operator is better suited with Kuwahara filter.

VII. CONCLUSION AND FUTURE WORK

In this paper, a better approach that is proposed in this present work is used to extract edges from color images. The HSV color space which corresponds to perceptual characteristics of the human eyes to process image takes full advantage of image's hue and intensity information. This edge detection approach uses a combination of Kuwahara filter with Sobel operator, it is a practical alternative since it is fast, and simple to implement and able to find out the best result that is closer to the optimal than other alternatives. The experimental results show that the algorithm presented in this work can make full use of hue, saturation and intensity information of the color image to effectively suppress multiple noises and adaptively extract complete edge information, and the algorithm has better versatility.

In our future work, our next goal will be improving each step of proposed method to subdue the complexity and the computing time.

REFERENCES

Recent Technologies in Communication and Computing 2009.


