Analysis of Edge Detection with Color Control

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Abstract—Edges characterize boundaries and are therefore a problem of fundamental importance in image processing. Image edge detection significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image. Since edge detection is in the forefront of image processing for object detection, it is crucial to have a good understanding of edge detection algorithms. In this paper the comparative analysis of Image Edge Detection techniques is presented. The software is developed using MATLAB 7.0. It has been shown that the improved edge detection algorithm performs better than canny edge detection. The proposed algorithm has high value of PSNR than the canny edge detected method. Furthermore, the proposed algorithm has low value of mean square error than the canny edge detected method.

Keywords – Edge Detection, MSE, PSNR

I. INTRODUCTION

Edges characterize[1] boundaries and are therefore a problem of fundamental importance in image processing. Edges in images are areas with strong intensity contrasts – a jump in intensity from one pixel to the next. Edge detecting an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image.

Edge detection makes use of differential operators to detect changes in the gradients of the grey levels. Edge detection[2] plays a significant role in vision processing. Edge recognition is the name for a set of mathematical methods which target at classifying points in an image at which the image intensity varies sharply or, has discontinuities. The points at which digital image intensity turns sharply are stereotypically ordered into a set of line segments called edges. The similar problem of discovering discontinuities in 1D signal is identified as step detection and the problem of discovering signal discontinuities over the time is called as change detection. Edge detection is essential instrument in vision processing, machine vision and digital image processing, mainly in the areas of feature recognition. The problem is to find edges in an image, so the first step is the process of scene reconstruction. The edges can be used later for segmentation of the image into objects. The most straightforward edge detection can be done by using thresholds: pixels with gray level above some threshold are considered to be in one group and all the other pixels in the second. The edges should appear when you cross the border between the groups. This technique works in very straightforward domains, but by no means can provide as an edge detector in the real world. More sophisticated approach uses linear operators to find edges. For example if you relate a gradient operator on the image and only then relate the threshold technique, the result that you get is much better. Not only gradient operators can be used for edge detection. An edge is not a physical entity; it is just like a shadow. It is where the picture ends and the wall starts. It is where the vertical and the horizontal surfaces of an object assemble. It is what happens between a bright window and the darkness of the night.

II. LITERATURE REVIEW

Simranjit Singh Walia et al.[2] presented a review on different color based edge detection techniques. Edge detection has found to be most important step in many critical vision applications. It actually results in the black and white (binary) image where each object is differentiating by lines (either black and white). Edges are basically the area in the image where sharp changes exist. It has been found that the most of the existing techniques has neglected the use of colors while detecting the edges but in many applications a region can be categorized based upon the color. This paper has shown that the most of the existing techniques fails in case of images with complex background.

Ajay Mittal et al.[3] presented an evaluative review of various edge detection techniques for color images that have been proposed in the last two decades. The statistics showed that color images contain 10% additional edge
information as compared to their gray scale counterparts. This additional information is crucial for certain computer vision tasks. Although, several reviews of the work on gray scale edge detection are available, color edge detection has few. The latest review on color edge detection is presented by Koschan and Abidi in 2005. Much advancement in color edge detection has been made since then, and thus, a thorough review of state-of-art color edge techniques is much needed. The paper makes a review and evaluation of various color edge detection techniques to quantify their accuracy and robustness against noise. It is found that MVD edge detector has the best edge detection accuracy and RCMG-MM edge detector has highest robustness against the noise.

Shu-Yu Zhu et al. [4] examined the various approaches to edge detection for color images, including techniques extended from monochrome edge detection as well as vector space approaches. In particular, edge detection techniques based on vector order statistic operators and difference vector operators are studied in detail. Numerous edge detectors are obtained as special cases of these two classes of operators. The effect of distance measures on the performance of different color edge detectors is studied by employing distance measures other than the Euclidean norm. Variations are introduced to both the vector order statistic operators and the difference vector operators to improve noise performance. They both demonstrate the ability to attenuate noise with added algorithm complexity. Among them, the difference vector operator with adaptive filtering shows the most promising results. Other vector directional filtering techniques are also introduced and utilized for color edge detection. Both quantitative and subjective tests are performed in evaluating the performance of the edge detectors, and a detailed comparison is presented.

Jingxiu Zhao et al. [5] discussed that edge detection has been widely used in computer vision and image processing. Various edge detection methods of color image have been proposed which usually apply the components of a color image equally to obtain the ultimate result. In this paper they propose a novel method for edge detection in color image. First, the CLIP model of color image based on LIP model of gray image is developed, and then analyzed the existing problems of gradient algorithm with HSV color image characteristics and the separation by color hue, saturation and brightness information and proposes a color image edge detection method based on gradient extreme value of the local region and satisfying result is obtained.

Jingxiu Zhao et al.[6] presented a new method for quantifying color information so as to detect edges in color images. Their method uses the volume of a pixel in the HSI color space, allied with noise reduction, thresholding and edge thinning. They implement our algorithm using NVIDIA Compute Unified Device Architecture (CUDA) for direct execution on Graphics Processing Units (GPUs). Their experimental results show that: compared to traditional edge detection methods, their method can improve the accuracy of edge detection and withstand greater levels of noise in images; and their GPU implementation achieves speedups over related CUDA implementations.

III. EXPERIMENT AND RESULT

To see the qualitatively as well as quantitatively performance of the proposed algorithm, some experiments are conducted on several colored and gray scale images. The effectiveness of the approach has been justified using different images. The results are computed qualitatively as well as quantitatively using quality measures.

The following figures are the images of the proposed work which shows the different images which consists of original images and output images.

![Figure 1. Original Image](image-url)
Figure 2. Gray Scale Image

Figure 3. Binary Image

Figure 4. RGB Image
Figure 5. Improved edge detected image

Figure 6. Canny Image

Figure 7. Comparison of three images
Figure 8. PSNR of canny technique and improved edge detection technique

Figure 9. MSE of canny technique and improved edge detection technique

Figure 9. shows the PSNR (Peak Signal to Noise Ratio) and MSE (Mean Square Error) of Canny edge detection and Improved edge detection technique. This figure shows that PSNR increases and MSE decreases in Improved edge technique as compared to Canny edge Technique.

IV. CONCLUSION

This thesis is a basic step in edge detection of a digital image; these kinds of ideas are useful in many fields for developing useful detecting systems. The proposed algorithm has high value of PSNR than the canny edge detected method. Furthermore, the proposed algorithm has low value of mean square error than the canny edge detected method. In other words improved edge detected method detects the edge of image in real life better than canny edge detected method.

REFERENCES


