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Research Paper | Engineering

Edge Detection using live video acquisition

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ABSTRACT

Edge detection is highly useful in many applications including image segmentation, pattern recognition. Edge detection is one of the fundamental approaches in digital image processing. In this paper Edge detection using live video acquisition is performed and obtained good results.

KEYWORDS: Edge detection, Image segmentation, Prewitt operator,Canny operator

I INTRODUCTION

Edge detection is the foundation of object recognition and computer vision. [1] In this paper results are obtained using MATLAB environment and presented. [2] In this particular method of image segmentation, we focus on the idea that edges define boundaries and that regions are contained within these edges. The first step to segmenting images into regions is to determine where the edges are. We tried several different edge-detection filters including true Sobel, true Prewitt, Laplacian of Gaussian, and a mix of Sobel and Prewitt. We learned from one of our sources that the combination of Sobel and Prewitt could provide a more optimal detection scheme. This 3x3 did in fact seem to work better than either one of them alone. Another attempt was to use a Laplacian edge detector, but it picked up so much noise that it was nearly impossible to determine any regions. Also, the Laplacian filter did give thin edges, yet some were so thin that when we tried filling in the enclosed regions, many of the regions ended up bleeding together. We also attempted a 5x5 Laplacian of Gaussian filter to do the edge detection because it was billed as a good edge detector yet more resistant to noise than a standard Laplacian 2nd order edge detector. Thus our final judgment was to stick with a pair of 1-D filters using a Sobel row-edge detector and a Prewitt column-edge detector.

II Edge detection OUTLINE:

The detection outline used in this paper is as follows:

1. Edge Detection: use gradient (Sobel row-edge detector and &Prewitt column- edge detector) or Laplacian of Gaussian edge detector on the image. [1]

The gradient of an image can be obtained by

$$\nabla f = \left[\left[\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}\right]\right]$$

The gradient direction is given by

$$\theta = \tan^{-1}\left(\frac{\partial f}{\partial y} / \frac{\partial f}{\partial x}\right)$$

The edge strength is given by the gradient magnitude

$$\| \nabla f \| = \sqrt{\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2}$$

The discrete gradient [3]

$$\frac{\partial f}{\partial x}[x,y] \approx f[x+1,y] - f[x,y]$$

Gradient operators:

$$\begin{matrix} 0 & 1 \\ -1 & 0 \end{matrix} \qquad \begin{matrix} 1 & 0 \\ 0 & -1 \end{matrix}$$

(a) Roberts' cross operator [4]

$$\begin{matrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{matrix} \qquad \begin{matrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{matrix}$$

(b) 3x3 Prewitt operator

$$\begin{matrix} -1 & 0 & 1 & 1 & 2 & 1 \\ -2 & 0 & 2 & 0 & 0 & 0 \\ -1 & 0 & 1 & -1 & -2 & -1 \end{matrix}$$

(c) 3X3 Sobel operator

$$\begin{matrix} -3 & -1 & 1 & 3 \\ -3 & -1 & 1 & 3 \\ -3 & -1 & 1 & 3 \\ -3 & -1 & 1 & 3 \end{matrix} \qquad \begin{matrix} 3 & 3 & 3 & 3 \\ 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 \\ -3 & -3 & -3 & -3 \end{matrix}$$

(d) 4x4 Prewitt operator

Filter masks used to compute the derivatives needed for the gradient are often called gradient operators, difference operators, edge operators, or edge detectors. [5] When diagonal edge direction is of interest, Roberts cross gradient operators can be a preference. Mask of size 2 x 2 are simple, but they are not as useful for computing edge direction as masks that are symmetrical about t of which are the center point, the smallest of which are of 3 x 3.Prewitt masks are simpler to implement than the Sobelmasks. [6]

The most straight-forward method of determining which points to keep is a simple thresholdmethod. Points with intensities above the threshold are kept as edges and the rest are thrown out. This is a good method on the surface, but it required a little adaptation to get it to work on a wide range of images.

Due to the various types of images that might need to be segmented, we determined that this threshold value needed to be adaptive in some way. Very noisy images were coming up with too many edge points that were false, while very smooth or sparse images might not have enough edge points to create the enclosed areas necessary to grow regions. Thus we took care of that problem in a rather simplistic yet fairly effective manner. Thus, we iteratively adjusted the threshold up or down accordingly until the number of edge pixels in the edge-detected image fit into this range. This worked well for most images, again leaving trouble for particularly sparse images. We implemented on different images which are available to our working place.

1) The Sobel method [1][3][4] finds edges using the Sobel approximation to the derivative. It returns edges at those points where the gradient of I is maximum.

2) The Prewitt method [1][5][6] finds edges using the Prewitt approximation to the derivative. It returns edges at those points where the gradient of I is maximum.

3) The Roberts method [1][2] finds edges using the Roberts approximation to the derivative. It returns edges at those points where the gradient of I is maximum.

4) The Laplacian of Gaussian method [1][2][3]finds edges by looking for zero crossings after filtering I with a Laplacian of Gaussian filter.

5) The zero-cross method [1][2][5] finds edges by looking for zero crossings after filtering I with a filter you specify.

6) The Canny method [1] [15] finds edges by looking for local maxima of the gradient of I. The gradient is calculated using the derivative of a Gaussian filter. The method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be fooled by noise, and more likely to detect true weak edges.

III Performance Evaluation

1. Evaluation is very difficult due to ad hoc nature of segmentation and highly dependent upon the intended use of the segmented image.

2. Look at `important' edges in the original and determine if they appear in the segmented image.

3. Determine if the important objects and areas are in fact classified as `regions' in the segmented image.

4. Count the number of regions and see if it matches expectations; again, this is very dependent on the application using the segmented image. [7]

5. Performance can be quantify by various parameters, but due to time constrain it is not calculated.

IV. EXPERIMENTS& RESULTS:

We adopt five images which are nearby to working place to demonstrate the performance of our experiment. The first image taken is Intel core 2 duo inside logo, which is available normally on every computer system. It can be seen from figure(1) that it gives very sharp edge detection. In second figure there are letters (characters) of branded model name of all in one printer device. Here also we obtain good results(figure 2). Third figure image is taken from my laptop screen, which is a matlab 7.6 menu. Results of edge detection from screen media are also distinguishable(figure 3). In fourth figure image taken is of keys of keyboard. Here also all characters are clearly distinguishable, though little noise is there(figure 4).And in last figure, image of mobile phone keypad is considered as input image & edge detection is done. Here also except little noise good edge detection is obtained(figure 5).The results of the edge detection scheme are obtained from color images instead of limiting to monochrome images.

V. CONCLUSION AND FUTURE SCOPE:

We accurately detected different images like 1.Intel core 2 duo inside logo 2.Characters written on model of all in one printer device 3.a matlab 7.6 menu from computer screen 4.Keys of keyboard 5.Image of mobile phone keypad which are different types of media like computer screen etc. Even though in all case of experiments very good edge detection using live video acquisition is obtained for color objects.These results can be quantified with various parameters, but in this paper due to time constraint it is not covered. Results can be compared with similar type of work for color images. Future scope is there to quantify our results & can be compared. Still complex objects edge detection using live video acquisition can be extended.

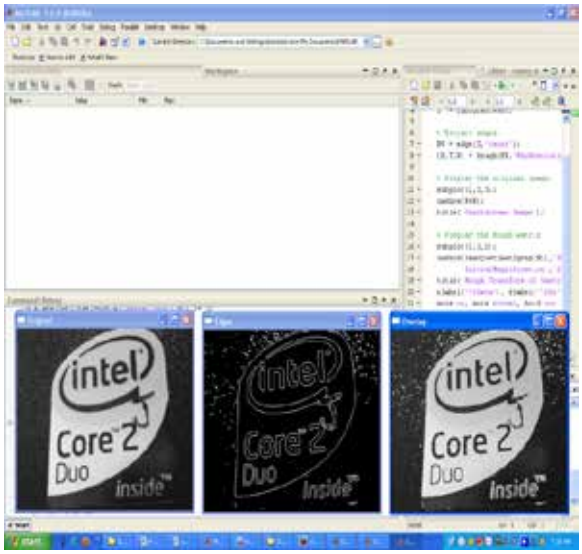

Fig (1) Edge Detection using live video acquisition forIntel core 2 duo inside logo

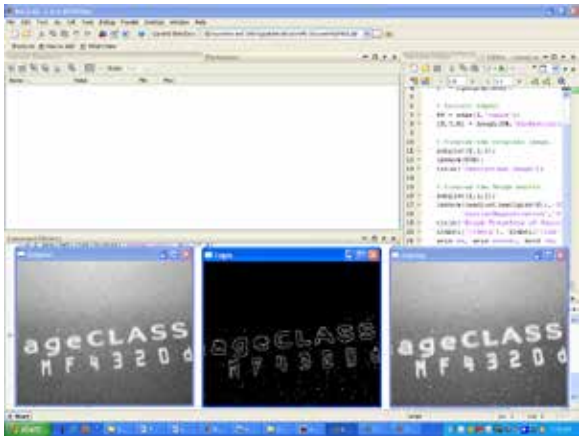

Fig (2) Edge Detection using live video acquisition for Characters written on model of all in one printer device

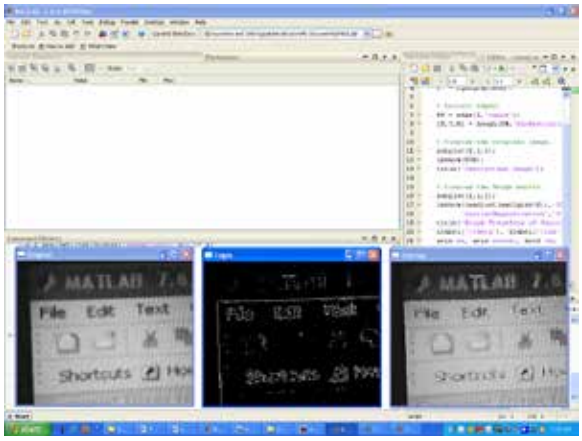

Fig (3) Edge Detection using live video acquisition fora matlab 7.6 menu from computer screen

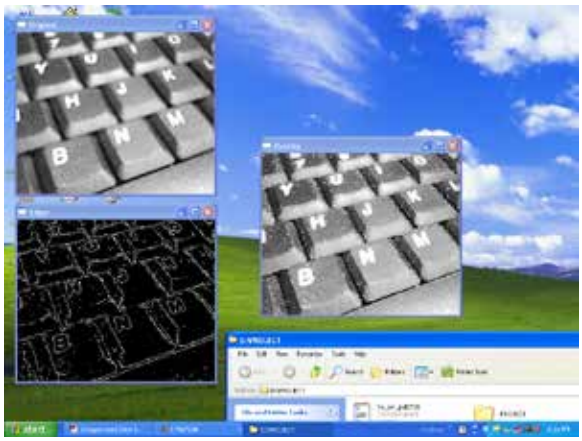

Fig (4) Edge Detection using live video acquisition forKeys of keyboard

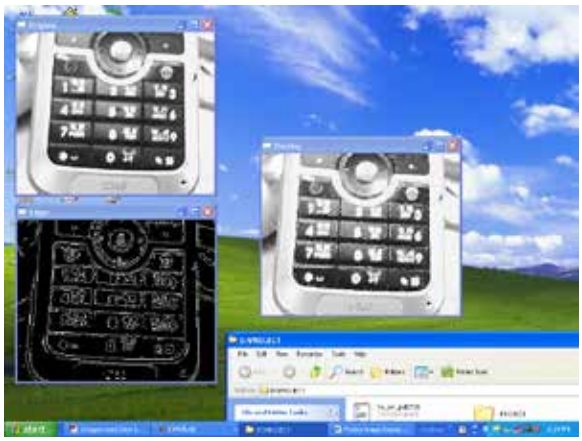

Fig (5) Edge Detection using live video acquisition forImage of mobile phone keypad

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