International Journal of Information Processing, 6(2), 83-89, 2012
ISSN : 0973-8215
IK International Publishing House Pvt. Ltd., New Delhi, India

Development of Edge Detection Technique for Images using Adaptive Thresholding

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Edge detection is a terminology in Image Processing and Computer Vision, particularly in the areas of feature detection and feature extraction, to refer to algorithms which aim at identifying points in a digital image at which the image brightness changes sharply or more formally has discontinuities. In this paper a simple edge detection technique is performed by convoluting the image using a five order mask and then Selecting a threshold from taking the sum of mean value and the standard deviation of the gradient image within a 3 X 3 window. In Canny edge detection a gauss kernel is used for smoothing the image in order to eliminate the noise. But in our algorithm a single mask perform the noise smoothing as well as finding the edge strength. We can also perform edge detection in each picture of a video film (consisting of multiple pictures) and then including all results in one frame, helps to motion estimation of the objects as well as the direction of the movement.

Keywords: Adaptive Threshold, Background Pixel, Gradient.

1. INTRODUCTION

Contours of images of objects or, in other words, edges in the paradigm of Image Processing and Computer Vision, provide valuable information towards human image understanding. Probably the most important image processing steps in human picture recognition system consists of edge-detection process. Edge detection is a very important low-level image processing operation, which is essential in order to carry out various higher level tasks such as motion and feature analysis, understanding, recognition and retrieval from databases.

Classical methods of edge detection involve convolving the image with an operator (a 2-D filter), which is constructed to be sensitive to large gradients in the image while returning values of zero in uniform regions. Variables involved in the selection of an edge detection operator include Edge orientation, Noise environment and Edge structure. Basically, there are two approaches in edge detection process. First one is gradient base and the second one is Laplacian of Gaussian method.

Gradient-based algorithms such as the Prewitt filter may have a problem of being very sensitive to noise. The size of the kernel filter and coeficients are fixed and cannot be adapted to a given image. An adaptive edge-detection algorithm is necessary to provide a robust solution that is adaptable to the varying noise levels of these images to help distinguish valid image contents from visual artifacts introduced by noise. The performance of the Canny algorithm depends heavily on the adjustable parameters, which is the standard deviation for the Gaussian filter, and the threshold values, T1 and T2 also controls the size of the Gaussian filter. This implies more blurring, necessary for noisy images, as well as detecting larger edges. Smaller values of imply a smaller Gaussian filter which limits the amount of blurring, maintaining finer edges in the image.

Canny's edge detection algorithm is computationally more expensive compared to Sobel, Prewitt and Robert's operator. However, the Canny's edge detection algorithm performs better than all these operators under almost all scenarios. Evaluation of the images showed

Figure 9. Edges obtained using Sobel method with 0.6 threshold value and Edges obtained using adaptive threshold

Figure 7. Edges in Lena Image obtained using Sobel Method with 0.6 Threshold Value and Edges in Lena Image Obtained using Adaptive Threshold

Figure 8. Original Image

not be the best solution for all type of images specially for those images where there exists non uniform illumination.
To overcome this non-uniform illumination a robust edge detection approach is presented. The approach consists of two main steps:

1. Obtaining the gradient of each pixel so that higher intensity pixels are getting maximum priority and the others points are attened out. Threshold1 = mean(G).
2. Detecting the edges by generating the threshold adaptively by summing the mean and standard deviation of the local neighbours.

Results in the binary images produced by the combination of the mask and the adaptive thresholding show that the edges of Lena image is ro- bustly detected. In addition, the presented edge detection approach is quite robust towards varying illumination conditions.
It has been observed, that the complexity of the given method is very less than the other existing method. The mask not only find the edge strength but also reduce the noise in a very efficient way where the most popular canny algorithm uses two convolution first for smoothing the image by the very completive Gaussian kernel and then with any other mask in order to find the edge gradient, thus complexity is very high. Moreover, the proposed methodology has been seen to score over the few existing techniques of using adaptive threshold but still the result needs more accuracy.

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