MINAR International Journal of Applied Sciences and Technology

Article type : **Research Article**

Date Received :12 /07/2021
Date Accepted : 15/08/2021
Date published : 01/09/2021
: **www.minarjournal.com**
http://dx.doi.org/10.47832/2717-8234.3-3.15

DETECTING THE TEXTURE FOR MOBILE IMAGE BY USING PROPOSED TECHNIQUE

Anaam Kadhim HADI [1]

Abstract

In this proposed search, a new technique was applied as an attempt to detect texture and the edges of a test image for mobile, lines drawn on a draft paper. Then was applied traditional spatial filters such as Sobel and Canny, comparison between them, and proposed method to detect the line edge and texture for the same image were applied. The results were that the detection method using the Canny filter showed more visual information and better accuracy than the Sobel spatial filter method, and when using the proposed technique, it gaves more information about the texture of the paper and more accurate results than the Canny filter, which was unable to detect the texture of the image.

Keywords: Gradiant Edge Detection, Spatial Filters, Pattern Recognition, Visual Texture.

[1] Directorate of Space and Communications\ Remote sensing center, Iraq, anaamhadi@yahoo.com, https://orcid.org/0000-0002-0171-449X

Introduction

In this study, an image of lines drawn on a draft paper by pencil and have taken by mobile was used to study the rough brown paper texture. The results showed that the proposed technique succeeded in visually highlighting the rough brown paper texture. There is a flod in paper , it was not detected by Sobel filter but are detected by Canny operator and by the new technique also which is success to detect the texture of draft paper too, the drawn lines by pencil seen scattered on the paper and not polished. In this work the comparison between the results of the edge detection advanced technique used in a variety of applications that identifies lines, paper flod and texture of the brown paper in digital images. Edge Detection consist a variety of mathematical methods that identifying points in a digital image at which the brightness was change as sharply or have discontinuities, edge detection also means information extraction from the image. It is mainly tool in pattern recognition. The image edge detection methods are differential operator technique and high pass filtration. Basically, the edge detector is a high pass filter, which is applied to extract the edges from images. Widely used spatial operators are Prewitts, Roberts, Sobel and Laplacian their are sensitive to noises and are poor anti –noise performances. canny operator have been proposed, use new technique to convolution to the original image by huge compution[1].

The image point at brightness changes in sharply is typically organizing into a set of curve line signal is called edges[2]. In this paper, the comparison of three edge detection algorithms will be done namely, Sobel edge detection ,Canny edge detection and the proposed techniqu to extract lines frome image. The aim of edge detection to produce a line drawing of a scene from image[3]. Important features can be extracted from the edges of an image (for example lines, corners, curves).These features are extracted by used higher level computer vision algorithms (for example texture, tone, recogni ets).

Descripte of the edge:-

Edge of the normal: is the unit vector in a direction of the maximum change intensity.

Edge of the direction: unit vector to perpendicular to the edge normal.

Edge position : the image position or center at which the edge is located.

Edge of the strength: represents the local image contrast along the normal, Shown figure 1.

The magnitude of gradient gives information about the strength of the edge. The direction of gradient is perpendicular to direction of edge .

There are four edge detection steps[4]:

(A) Smoothing:- inhibit as much noises as probable, the true edges not destroying.

(B) Enhancement:- utilize sharpening filter to enhance the quality of the edges for output image.

(C) Detection:- the locate of any edge is noise pixels which should be retained (commonly, thresholding provides the standard are useing for detection).

(D) Localization:- limit the exacting location of an edge (pixel resolution might be required for the some applications, that is, estimation the location of an edge to best than the spacing between the pixels).

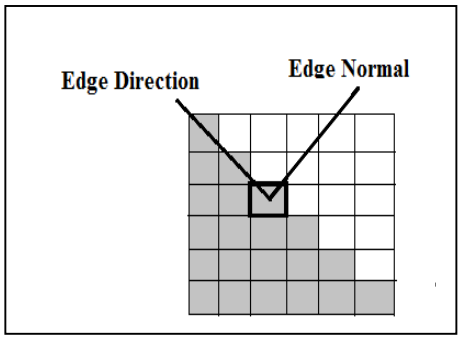


Figure 1. Edge normal and edge direction

1. Methodology

Sobel filter is the first order derivative filter, most edge detection methods work on the hypothesis that the edge occurs where there is a stopping in the intensity function or a very slope intensity gradient in the image. Using this hypothesis, if one take the derivative of the intensity value toward

the image and find points where the derivative is maximum then the edge could be existing. The gradient is a vector, whose components measure how quick pixel value are changing with distance in the x and y direction. consequently, the components of the gradient found by using the following equations 1. and 2.

$$\frac{\partial f(x,y)}{\partial x} = \Delta x = \frac{f(x+dx,y) - f(x,y)}{dx} \dots\dots.1.$$

$$\frac{\partial f(x,y)}{\partial y} = \Delta y = \frac{f(x,y+dy) - f(x,y)}{dy} \dots\dots.2.$$

The distance along the x and y are measuring the directions dx and dy respectively. consider dx and dy in terms of numbers of pixel between two points dx = dy = 1 (is the pixel spasing) point at which pixel coordinates are(i, j) so, the value of (Δx, Δy) could be calculated from equations 3. and 4 .

$$\Delta x = f(i+1,j) - f(i,j) \dots\dots\dots\dots\dots\dots.3.$$

$$\Delta y = f(i,j+1) - f(i,j) \dots\dots\dots\dots\dots\dots\dots 4.$$

In order to detect the gradient discontinuity, one could calculated the change in the gradient at (i, j) .This must be done by finding the following magnitude measure and the gradient direction (Θ) is given by the equation (5).

$\Theta = \tan^{-1}\frac{\Delta y}{\Delta} \dots\dots\dots\dots\dots\dots\dots\dots\dots.5.$

$$\Delta \boldsymbol{x} = \begin{bmatrix} \mathbf{-1} & \mathbf{1} \\ \mathbf{0} & \mathbf{0} \end{bmatrix} \quad , \; \Delta \boldsymbol{y} = \begin{bmatrix} \mathbf{-1} & \mathbf{0} \\ \mathbf{1} & \mathbf{0} \end{bmatrix} \dots\dots\dots\dots\dots \mathbf{6}$$

Sobel filter is a discrete differential operator, computing an estimation of the gradient of image intensity function[4,5].

The using the larger size of mask is advantage of that the errors due to the noise effect is reduced by used averaging within the mask neighborhood. Sobel edge operator is one important edge masks are given as (Δx, Δy) are approximations at (i, j) An advantage of utilize odd size mask that the operators are centered and can therefore provide an estimate that is based on a center pixel (i,j) [5].

$$\Delta \mathbf{x} = \begin{bmatrix} \mathbf{-1} & \mathbf{0} & \mathbf{1} \\ \mathbf{-2} & \mathbf{0} & \mathbf{2} \\ \mathbf{-1} & \mathbf{0} & \mathbf{1} \end{bmatrix} \; , \Delta \boldsymbol{y} = \begin{bmatrix} \mathbf{-1} & \mathbf{-2} & \mathbf{-1} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{1} & \mathbf{2} & \mathbf{1} \end{bmatrix} \dots\dots\dots \mathbf{7}$$

Operator is calculating the Gradient of the Image Intensity at each point(OGII)[6,7], giving the direction of the largest possible increase the rate of change in that direction from light to dark . therefore the result shows how (smoothly) the image changes at that point and for that reason posible it is that part of the image represents an edge, also that the edge is posible be oriented. This result of Sobel mask at any image point which is in a area of constant image intensity is a zero vector and at point on an edge is a vector that points are edge across, from darker values to the brighter values[8,9].

2. Algorithm and Experimental Results

In this algorithm have been applyed the edge detection by using the the traditional algorithms for sobel and canny to detect the texture for Mobile image and then applied the new algorithim to make comparision between them.

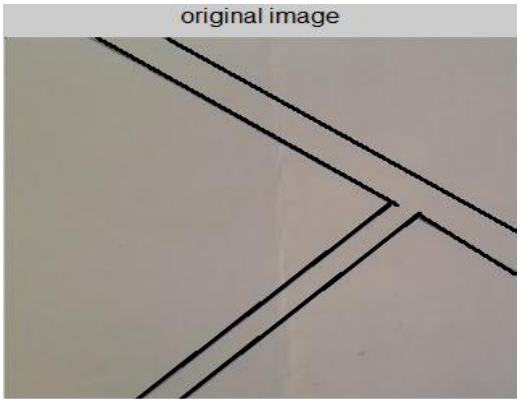


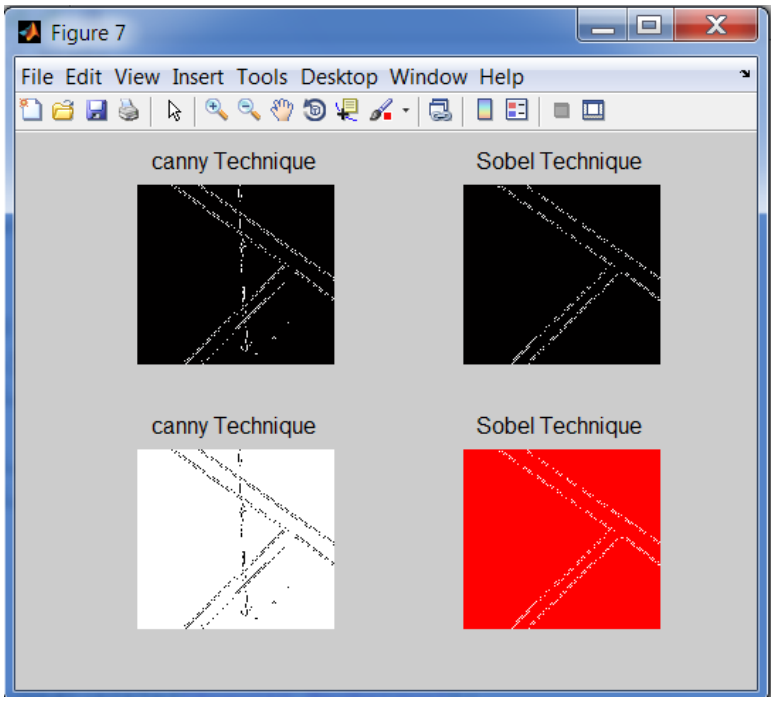
Figure 2. Original Image

2.1 The main work steps for Sobel operator :
Step 1 read RGB image, convert the color image to a grayscale image, apply the Sobel operator equation (7), will get the result output image as figure 3. (c) , cannot see the texture or paper flod.

2.2 The steps of the Canny edge detection are as follows:
1. First step: Grayscal conversion.
2. Second step : Remove any noise using a filter. Apply the Laplace operator [1 1 1,1 -8 1, 1 1 1]. is used for removing the noise.
3. Third step : Find the intensity gradient of the image.
a. Gradient along x, and y directions are calculated using the Laplace kernel masks of 3x3 as follows [-1 -1 -1,-1 8 -1, -1 -1 -1].
b. Gradient strength and direction of the edges are calculated as follows: Here Gx and Gy are gradients along x and y directions in the equation

$$G = \sqrt{Gx^2 + Gy^2} \quad \text{.....8}$$

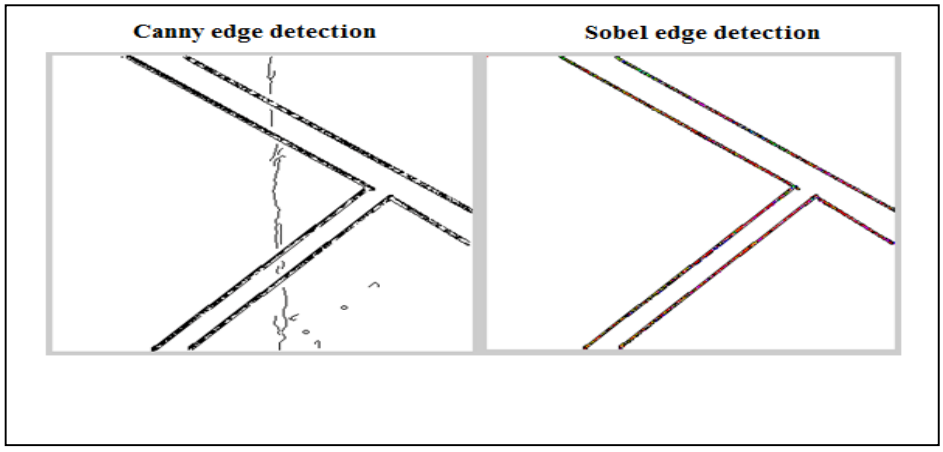
4. Fourth step: Non-maximum suppression is performed. This step removes pixels which are not considered as the part of an edge. The thin lines will remain, these contain pixels which are considered to be part of the edge.
5. The final step: Hysteresis, two thresholds are used title as upper and lower threshold.
a. If the gradient value of the pixel is higher than the upper threshold, then the pixel is considered as an edge pixel.
b. If the gradient value of a pixel is less than the lower threshold, then the pixel is unacceptable.
c. If the gradient value of the pixel is between the lower and upper thresholds, then the pixel will be accepted only if it is connected to a pixel that is above the upper threshold. Input image I(x,y), value of smoothing parameter sigma, high threshold Thr1 and low threshold Thr. Thr1 = 60, Thr = 20. If Thr is increased but Thrl remains the same, lesser edge components will be detected, but the lengths will be the same. If Thrl is increased but Thr is still same, then the same number of edge components will be detected but the lengths will be less.
applies detect Canny to get result in figure 3(a) ,we could see the paper flod, cannot see the paper texture



a **c**

b **d**

Figure 3. (a-b) Canny, (c) Sobel edge detection, (d) Sobel after inverse threshold



a **b**

Figure 4. (a) Canny Detection after inverse the threshold, (b) Sobel Detection

2.3 Apply new algorithims to detection texture of Mobile image

In this algorithm have been applied the edge detection by using the gradient operator, second derivative operator on original color image in figure 2. And on the same image after to converted to grayscal image to make comparsion between them which of them are best to detect the texture for the brown paper.

$$\nabla fc(x,y) = \frac{\partial fc(x,y)}{\partial x}\mathbf{i}_x + \frac{\partial fc(x,y)}{\partial y}\mathbf{i}_y \quad \ldots\ldots \quad \mathbf{9}$$

Where unit vectors ix and iy , the x and y directions.. Its magnitude, |∇fc(x0,y0) |, measures the maximum rate of change in the intensity at the location (x0,y0). Its direction is that of the greatest increase in intensity, its uphill points. To produce an edge detector, one may simply extend the one dimensional case described earlier. Consider the effect of finding the local extreme of ∇ fc(x, y):

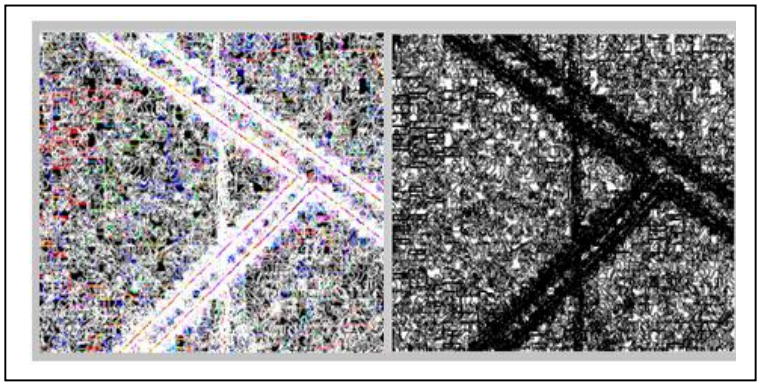
$$\left|\nabla fc(x,y)\right| = \sqrt{\left(\frac{\partial \mathbf{fc}(\mathbf{x},\mathbf{y})}{\partial x}\right)^2 + \left(\frac{\partial \mathbf{fc}(\mathbf{x},\mathbf{y})}{\partial y}\right)^2} \quad \ldots\ldots \quad \mathbf{10}$$

The work steps:

Step 1 read RGB image let call it G1(x,y), applying the second derivative operator on original image will get the result G2(x,y) image ,subtracted them will get image G3(x,y) in figure 5.(a) see equation (8),

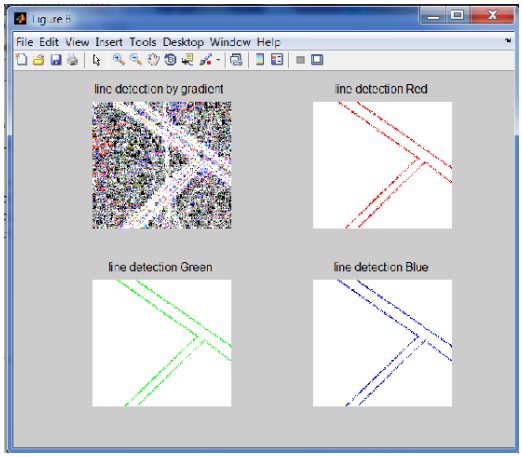
Step 2 convert the color imageG1(x,y) to a grayscale image G4(x,y) then applying the second derivative operator equation(on grayscale image will get the result in figure 5.(b)

Step 3 applies process Matlab programming to detect the lines by analysis the components of color image (RGB) .



a **b**

Figure 5. Edge detection by using the second derivative gradient operator on (a) RGB original image, (b) Grayscale image.



a **c**

b **d**

Figure 6. (a) Edge detection by second gradient on RGB image, (b) Lines segmented by green color, c) Lines segmented by red color (d) Lines segmented by blue color,

3 .Conclusion

In this work have been applying popular methods on edge detection in image processing . methods like Sobel, Canny and the gradient operator (second derivative operator). The most important finding in this work is that Canny's method is superior to Sobel's method in detecting the edge and cann't discovering the textur of paper, and that the proposing algorithm (gradient operator by second derivative) is better than Canny's method, where the fold was detected as well as the material of the paper or the texture of paper, therefore utilize the proposing technique is consider best algorithm to detected the texture for the draft paper , easily and clearly, As well as use the second derivative operar to detect the texture of paper without need to convert the image to grayscal image as usually.

References

Bezdek, J. C., (1999), Pattern Recognition with Fuzzy Objective Function Algorithms, Plenum, NY.

Chen, H. C. et al., Oct (2006), Visible color difference-based quantitative evaluation of colour segmentation, IEEE proceeding , Visual image signal process vol.153 No.5pp 598-609.

Eastman, J.R., and Laney, R., (2002) "Bayesian Soft Classification for Sub-Pixel Analysis: A Critical Evaluation," Photogrammetric Engineering and Remote Sensing, 68, 11, 1149- 1154.

Gevers, T. and Smeulders, A.W.M., (1999), Color-based object Recognition. Pattern Recognition, (32), 453–464.

Guangyao D., Huili G., Wenji Z., Xinming T., Beibei C, Index-(2015), Based Shadow Extraction Approach On High- Resolution Images, Nasg, Beijing 101300, China,.

J. Jiang et al., (2013), Journal of Computational Information Systems 9: 103783{3790 Journal of Computational Information Systems 9: 103783–3790 Available at http://www.Jofcis.com

Jiang, J. et al., (2013), Journal of Computational Information Systems 9: 103783{3790 Journal of Computational Information Systems 9: 103783–3790 Available at http://www.Jofcis.com

Lingkui Meng, et al, (2009), Study on Image Segment Based Land Use Classification and Mapping, IEEE, pp

Richards J.A., (2009), Remote Sensing Digital Image Analysis, Fifth edition, Springer- Verlag-Berlin, ISBN-978-3-642-30062-2