LAB Manual

PART A

(PART A : TO BE REFFERED BY STUDENTS)

**Experiment No.08**

**A.1 Aim:**

Write a program to detect edges in the image using Robert, Prewitt and Sobel operators.

**A.2 Prerequisite:**

1Matlab programming syntax (Refer the Matlab manual).

2. Knowledge of fundamentals of image segmentation and edge detection.

2. Availability of Soft copy of medical image.

**A.3 Outcome:**

**After successful completion of this experiment students will be able to**

1. Apply Robert, Prewitt and Sobel operators on given image.
2. Differentiate the outputs of different edge detection operators.
3. Identify applications of operators studied.

**A.4 Theory:**

**A.4.1. Edge Detection**

Edge detection is one of the most frequently used techniques in digital image processing. The boundaries of object surfaces in a scene often lead to oriented localized changes in intensity of an image, called edges. This observation combined with a commonly held belief that edge detection is the first step in image segmentation, has fueled a long search for a good edge detection algorithm to use in Image processing. Edge is nothing but a boundary between two regions having distinct intensity levels. The goal of edge detection is to select the pixels in a digital image at which the intensity level changes sharply. For image processing system to interpret an image, it must be able to detect the edges of each object in the image. Edge representation drastically reduces the amount of data to be processed by retaining the important information in an image such as the shape of objects. This description of an image is easy to integrate into a large number of object recognition algorithms. Edge detection generates an edge map that contains vital information of the image.

Image segmentation is an essential step in image analysis. The objective of segmentation is to simplify and/or change the representation of an image in to something that is more meaningful and easier to analyze. It divides (segments) an image into its constituent regions or objects. Generally, it is used to locate objects and boundaries in image. Image Segmentation is used when we need to automate a particular activity. Image segmentation methods are categorized on the basis of two properties discontinuity and similarity. The choice of image segmentation technique is depends on the nature of the problem under consideration. Edge detection is a part of image segmentation. The effectiveness of image segmentation depends on the perfection of detecting meaningful edges.

**EDGE DETECTION TECHNIQUES**

Edge detection techniques try to locate points with abrupt changes in an image. Edge is nothing but boundary between two regions having distinct intensity levels.

1. Robert Edge Detection

It is very simple computation technique, introduced by Lawrence Roberts. Here high frequency spatial frequency region is corresponds to an edge. 2-D mask for Robert edge detection is as shown in Fig.1.

Fig.1. Roberts Edge Operator

In this technique the output represents pixels of every point which estimated complete magnitude of spatial gradient of the image at that point.

2. Sobel Edge Detection

The Sobel edge detection method is introduced by Sobel in 1970. This method of edge detection for image segmentation finds edges using the Sobel approximation to the derivative. The Sobel masks are as shown in Fig. 2. The first mask is responsible for computing horizontal edges and the other one is responsible for computing vertical edges. One mask is simply the other rotated by 90o.

Fig.2. Sobel Operator

3. Prewitt Edge Detection

This edge detection technique was introduced by J.M.S. Prewitt in 1970. The Prewitt operator assigns similar weights to all the neighbors of the candidate pixel whose edge strength is being calculated. The Prewitt operator is as shown in Fig. 3.

Fig.3. Prewitt Operator

Similar to Sobel operator, The first mask is responsible for computing horizontal edges and the other one is responsible for computing vertical edges and one mask is simply the other rotated by 90o.

**A.5 Procedure/Algorithm:**

**A.5.1:**

**TASK 1:**

1. Read the i/p image

2.Apply Roberts, Sobel and Prewitt operator to the image as per following and

obtain the 3 outputs separately.

1. X gradient
2. Y gradient
3. Combined of both X and Y gradient.

3. Display the original and the output image.

4. Observe the output and complete PART B of lab manual.

5. Save and close the file and name it as **EX8\_Task1\_your Roll no.m**

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PART B

(PART B : TO BE COMPLETED BY STUDENTS)

***(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case the there is no Black board access available)***

|  |  |
| --- | --- |
| Roll No.: N049 | Name: Tarun Tanmay |
| Class :MBA Tech CE | Batch: B3 |
| Date of Experiment: | Date of Submission |
| Grade : | Time of Submission: |
| Date of Grading: |  |

**B.1 Software Code written by student:**

***(Paste your Matlab code completed during the 2 hours of practical in the lab here)***

clear all;

clc;

img1=imread('/Users/tjrox0825/Desktop/College.jpg');

re\_img1=imresize(rgb2gray(img1),[300,300]);

r1=[-1 0;0 1];

r2=[0 -1;1 0];

s1=[-1 -2 -1;0 0 0;1 2 1];

s2=[-1 0 1;-2 0 2;-1 0 1];

p1=[-1 -1 -1;0 0 0;1 1 1];

p2=[-1 0 1;-1 0 1;-1 0 1];

o1=re\_img1;

o2=re\_img1;

db\_img1 = double(re\_img1);

for i=2: size(re\_img1,1)-1

for j=2: size(re\_img1,2)-1

value1(i,j) = s1(1)\*db\_img1(i-1,j-1)+ s1(2)\*db\_img1(i-1,j)+ s1(3)\*db\_img1(i-1,j+1)+ s1(4)\*db\_img1(i,j-1)+ s1(5)\*db\_img1(i,j)+ s1(6)\*db\_img1(i,j+1)+ s1(7)\*db\_img1(i+1,j-1)+ s1(8)\*db\_img1(i+1,j)+ s1(9)\*db\_img1(i+1,j+1);

end

end

for i=2: size(re\_img1,1)-1

for j=2: size(re\_img1,2)-1

value2(i,j) = s2(1)\*db\_img1(i-1,j-1)+ s2(2)\*db\_img1(i-1,j)+ s2(3)\*db\_img1(i-1,j+1)+ s2(4)\*db\_img1(i,j-1)+ s2(5)\*db\_img1(i,j)+ s2(6)\*db\_img1(i,j+1)+ s2(7)\*db\_img1(i+1,j-1)+ s2(8)\*db\_img1(i+1,j)+ s2(9)\*db\_img1(i+1,j+1);

end

end

figure();

subplot(1,4,1);

imshow(re\_img1);

title('Orignal image');

subplot(1,4,2);

imshow(uint8(value1));

title('X gradient');

subplot(1,4,3);

imshow(uint8(value2));

title('Y gradient');

subplot(1,4,4);

imshow(uint8(value1+value2));

title('Sobel Edge Detection');

for i=2: size(re\_img1,1)-1

for j=2: size(re\_img1,2)-1

value11(i,j) = p1(1)\*db\_img1(i-1,j-1)+ p1(2)\*db\_img1(i-1,j)+ p1(3)\*db\_img1(i-1,j+1)+ p1(4)\*db\_img1(i,j-1)+ p1(5)\*db\_img1(i,j)+ p1(6)\*db\_img1(i,j+1)+ p1(7)\*db\_img1(i+1,j-1)+ p1(8)\*db\_img1(i+1,j)+ p1(9)\*db\_img1(i+1,j+1);

end

end

for i=2: size(re\_img1,1)-1

for j=2: size(re\_img1,2)-1

value22(i,j) = p2(1)\*db\_img1(i-1,j-1)+ p2(2)\*db\_img1(i-1,j)+ p2(3)\*db\_img1(i-1,j+1)+ p2(4)\*db\_img1(i,j-1)+ p2(5)\*db\_img1(i,j)+ p2(6)\*db\_img1(i,j+1)+ p2(7)\*db\_img1(i+1,j-1)+ p2(8)\*db\_img1(i+1,j)+ p2(9)\*db\_img1(i+1,j+1);

end

end

figure();

subplot(1,4,1);

imshow(re\_img1);

title('Orignal image');

subplot(1,4,2);

imshow(uint8(value11));

title('X gradient');

subplot(1,4,3);

imshow(uint8(value22));

title('Y gradient');

subplot(1,4,4);

imshow(uint8(value11+value22));

title('Prewitt Edge Detection');

for i=2: size(re\_img1,1)-1

for j=2: size(re\_img1,2)-1

valuer1(i,j) = r1(1,1)\*db\_img1(i,j)+r1(1,2)\*db\_img1(i,j+1)+r1(2,1)\*db\_img1(i+1,j)+r1(2,2)\*db\_img1(i+1,j+1);

end

end

for i=2: size(re\_img1,1)-1

for j=2: size(re\_img1,2)-1

valuer2(i,j) = r2(1,1)\*db\_img1(i,j)+r2(1,2)\*db\_img1(i,j+1)+r2(2,1)\*db\_img1(i+1,j)+r2(2,2)\*db\_img1(i+1,j+1);

end

end

figure();

subplot(1,4,1);

imshow(re\_img1);

title('Orignal image');

subplot(1,4,2);

imshow(uint8(valuer1));

title('X gradient');

subplot(1,4,3);

imshow(uint8(valuer2));

title('Y gradient');

subplot(1,4,4);

imshow(uint8(valuer1+valuer2));

title('Robert edge');

**B.2 Input and Output:**

**Input Images:**

**A person wearing glasses

Description automatically generated**

**Output Images:**

**Robert edge Detection**

**A screenshot of a cell phone

Description automatically generated**

**Sobel Edge Detection**

**A screenshot of a cell phone

Description automatically generated**

**Prewitt Edge Detection:**

**A screenshot of a cell phone

Description automatically generated**

**B.3 Observations and learning:**

***(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)***

In the above experiment we have studied and implemented various methods of edge detection and image segmentation like Robert , Sorbel and Prewitt. The outputs of each of the methods have been verified to be similar.

**B.4 Conclusion:**

*(****Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)***

Hence the edge detection in the image is done using Robert, Prewitt and Sobel operators.

**B.5 Question of Curiosity**

***(To be answered by student based on the practical performed and learning/observations)***

Q1. How segmentation of the image is achieved using Edge detectors?

Ans: Edge detection is a fundamental tool used in most image processing applications to obtain information from the frames as a precursor step to feature extraction and object segmentation. This process detects outlines of an object and boundaries between objects and the background in the image.

Q2. Explain Waterfall model of image segmentation?

Ans: The Waterfall model usually leads to a strong over-segmentation of an image. The Waterfall is a hierarchical approach that selects among all the contours of the Watershed those that are completely surrounded by more contrasted contours. By removing these contours, a simplified partition is obtained. The process may be iterated. At the end, a single region covering the whole image is obtained.

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