

# A REVIEW STUDY OF EDGE DETECTION TECHNIQUES

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## ABSTRACT

*Edge detection is one of the most important step in the digital image processing as it provides the information that is hidden in the image and also try to improve that information so as that the information can be understand by the human being and they can perform further actions on that information. This paper provides the various edge detection techniques survey that we use in the image processing to extract the important information from the image. Using these techniques we can extract the information in a short duration of time and also we can compare these techniques on the basis of various properties like Noise reduction capability, Computation time etc. We can say the edge detection methods are the combination of image smoothing and pre-processing of edge-labeling.*

***Keywords: Edge Detection, Sobel Edge Detector, Canny Edge Detector, Robert Edge Detector, Prewitt Edge Detector.***

## I. INTRODUCTION

Edge detection can be defined as the process of localizing the pixel intensity transitions or locating sharp discontinuities in the image. It is a technique which detects the points where image brightness gets changed sharply. The discontinuities are the abrupt changes present in the pixel intensity which characterizes the boundaries of the objects present in a scene. An image can be defined as the two dimensional function  $f(x, y)$ , where  $x$  and  $y$  are spatial or plane coordinates and the amplitude of  $f$  at any pair of co-ordinates  $(x, y)$  is called the intensity or grey level of the image at that particular point[1].

Many variables are generally involved in the selection of the proper edge detection operators like Edge orientation, Edge Structure and the most important Noise Environment. In edge detection the unwanted data gets filtered out and the important features of that image are preserved. Early edge detection methods comprises of the convolution of the image with a particular operator which is designed to be sensitive to the higher gradients present in the image. The operators are so chosen that they are so sensitive to the gradual change in the pixel intensity. Some serious issues are also present in the edge detection process like detection of false edges, a high processing time etc. Therefore, a comprehensive study on various edge detectors is performed.

Edge detection in image processing improves the pictorial information for the human interpretation and also it makes it more possible for automatic machine perception.

## II. EDGE DETECTION

An edge in the image can be said as a significant local change in the intensity. There are some discontinuities present in the image and these discontinuities are either Step Edge or Line Edges. However they are rare in real images. *The discontinuity of grey level of an image provides the edge in an object.*

### 2.1. Steps in Edge Detection

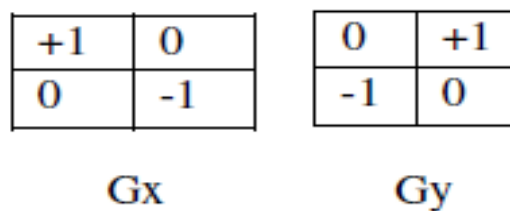
In edge detection three steps are included namely Filtering, Enhancement, and Detection. Overview of these steps is as follows:

- 1) **Filtering:** Often random variations in the intensity values generally called as Noise corrupts the images. There are various types of noise but some common types are Salt and Pepper Noise, Impulse Noise and the famous one Gaussian Noise. Salt and Pepper noise contains the random occurrences of both the white and black intensity values. More filtering of an image can reduce the strength of the edges in the image.
- 2) **Enhancement:** It emphasis on the significant change in the pixel intensity value and to calculate this we generally compute the gradient magnitude. It also facilitates the detection of intensity of the point in its neighbourhood.
- 3) **Detection:** Some of the points in an image can have a non-zero value for the gradient also not all of these points represents the edges for an application. So some methods should be applied to determine the edge points present in actual in the image. Thresholding is a good criterion for the detection purpose [2].

### 2.2. Edge Detection Methods

The most common edge detection methods that are used for comparison are (1) Roberts Detection, (2) Sobel Edge Detection (3) Prewitt Edge Detection and (4) Canny Edge Detection. The details are as follows:

1) **Roberts Detection:** The Roberts Operator performs quick, simple 2-D gradient measurement on an image. It thus highlights edges with the highlighted regions of spatial frequency. Pixel values at each point in the output represent the spatial gradient magnitude of the input image.



**Fig. 1. Roberts Mask**

2) **Prewitt Detection:** The prewitt edge detector is used to estimate the orientation and the magnitude of the edge. As differential gradient edge detection requires a time consuming calculation to estimate the magnitude of the orientation in the x and the y direction. This operator is limited to the only 8 possible orientations although the estimates of this operator are not much accurate.

-1	0	+1
-1	0	+1
-1	0	+1

Gx

+1	+1	+1
0	0	0
-1	-1	-1

Gy

**Fig. 2. Prewitt Mask**

3) *Sobel Detection*: The Sobel operator performs a measurement which is 2-D spatial gradient measurement to emphasis on the high spatial frequency corresponding to the edges. It is typically used to find the absolute gradient magnitude in input grey scale image at every point. This is generally similar to the Roberts operator.

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy

**Fig. 3. Sobel Mask**

4) *Canny Detection*: The process of Canny Edge Detector can be broken into five different steps:

- a) Firstly apply the Gaussian Filter in order to remove the noise from the noise.
- b) Secondly find the intensity gradients of image.
- c) Thirdly apply the non-maximum suppression to rid of spurious response of edge detection.
- d) Now apply double threshold to determine the potential edges in the image.
- e) In last, track edges by the method of hysteresis and then finalize the detection of edges by suppressing all the false and the weak edges that can't become the strong edges [3][4].

### III. LITERATURE SURVEY

**S. Kaur et.al**[5] proposed a study on various edge detection methods like Sobel, Prewitt, Fuzzy, Canny, Roberts and Morphological based multi structure edge detector technique.

**X. He et.al**[6] proposed a virtual hexagonal image structure in their paper and they claimed that the use of linear interpolation algorithms that has achieved a good edge detection performance.

**D. Sharma et.al**[7] have reviewed a wide range of methods of the edge detection and they suggested that as per the need we can select the required edge detection technique.

**Mitra Basu** [8] presented a survey of Gaussian-based edge detection techniques. These are described in a grey level image of an edge and this technique easily detects the intensity transitions.

### IV. CONCLUSION

A comparative study of various edge detection operators is done. Different edge detection methods can be experimented as per the need of segmentation of image and application requirement. Canny edge detector took long time as compared to the other techniques as compared by different authors.

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