**Department of Artificial Intelligence & Machine Learning**
**Academic Year 2023-2024**

**Name:** Abhay Mathur **SAPID: 60017210016**
**Batch:** A1

# Experiment No. 4

**Aim:** Feature Detection in Images

**Objective:** Develop a program to detect features in an Image (Edge)

**Theory:**

Image feature extraction involves identifying and representing distinctive structures within an image. Reading the pixels of an image is certainly one. But this is a low-level feature. A high-level feature of an image can be anything from edges, corners, or even more complex textures and shapes.

Features are characteristics of an image. With these unique characteristics, you may be able to distinguish one image from another. This is the first step in computer vision. By extracting these features, you can create representations that are more compact and meaningful than merely the pixels of the image. It helps further analysis and processing.

An edge is defined as a gradient on the pixel intensity. In other words, if there is an abrupt color change, it is considered an edge

## Sobel Mask

Following is the vertical Mask of Sobel Operator:

| | | |
|---|---|---|
| -1 | 0 | 1 |
| -2 | 0 | 2 |
| -1 | 0 | 1 |

This mask works exactly same as the Prewitt operator vertical mask. There is only one difference that is it has “2” and “-2” values in center of first and third column. When applied on an image this mask will highlight the vertical edges.

How it works

When we apply this mask on the image it prominent vertical edges. It simply works like as first order derivate and calculates the difference of pixel intensities in a edge region.

As the center column is of zero so it does not include the original values of an image but rather it calculates the difference of right and left pixel values around that edge. Also the center values of both the first and third column is 2 and -2 respectively.

This give more weight age to the pixel values around the edge region. This increase the edge intensity and it become enhanced comparatively to the original image.

Following is the horizontal Mask of Sobel Operator

| | | |
|---|---|---|
| -1 | -2 | -1 |
| 0 | 0 | 0 |
| 1 | 2 | 1 |

Above mask will find edges in horizontal direction and it is because that zeros column is in horizontal direction. When you will convolve this mask onto an image it would prominent horizontal edges in the image. The only difference between it is that it have 2 and -2 as a center element of first and third row.

**How it works**

This mask will prominent the horizontal edges in an image. It also works on the principle of above mask and calculates difference among the pixel intensities of a particular edge. As the center row of mask is consist of zeros so it does not include the original values of edge in the image but rather it calculate the difference of above and below pixel intensities of the particular edge. Thus increasing the sudden change of intensities and making the edge more visible.

## Prewitt Mask

The Prewitt operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Prewitt operator is either the corresponding gradient vector or the norm of this vector. The Prewitt operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical directions and is therefore relatively inexpensive in terms of computations

Following is the vertical Mask of Prewitt Operator:

| | | |
|---|---|---|
| -1 | 0 | 1 |
| -1 | 0 | 1 |
| -1 | 0 | 1 |

Following is the horizontal Mask of Prewitt Operator

| | | |
|---|---|---|
| -1 | -1 | -1 |
| 0 | 0 | 0 |
| 1 | 1 | 1 |

**Problem Definition**

- Edge Detection using First Derivative Filters (Sobel, Prewitt) X direction, Y Direction, Both the directions
- Compare Results

**Observations:**

SAPID: 60017210016
Name: Akshay Mathur    Class & Div.:    Roll No.:
Subject:    Topic:    Page No.:    Date:

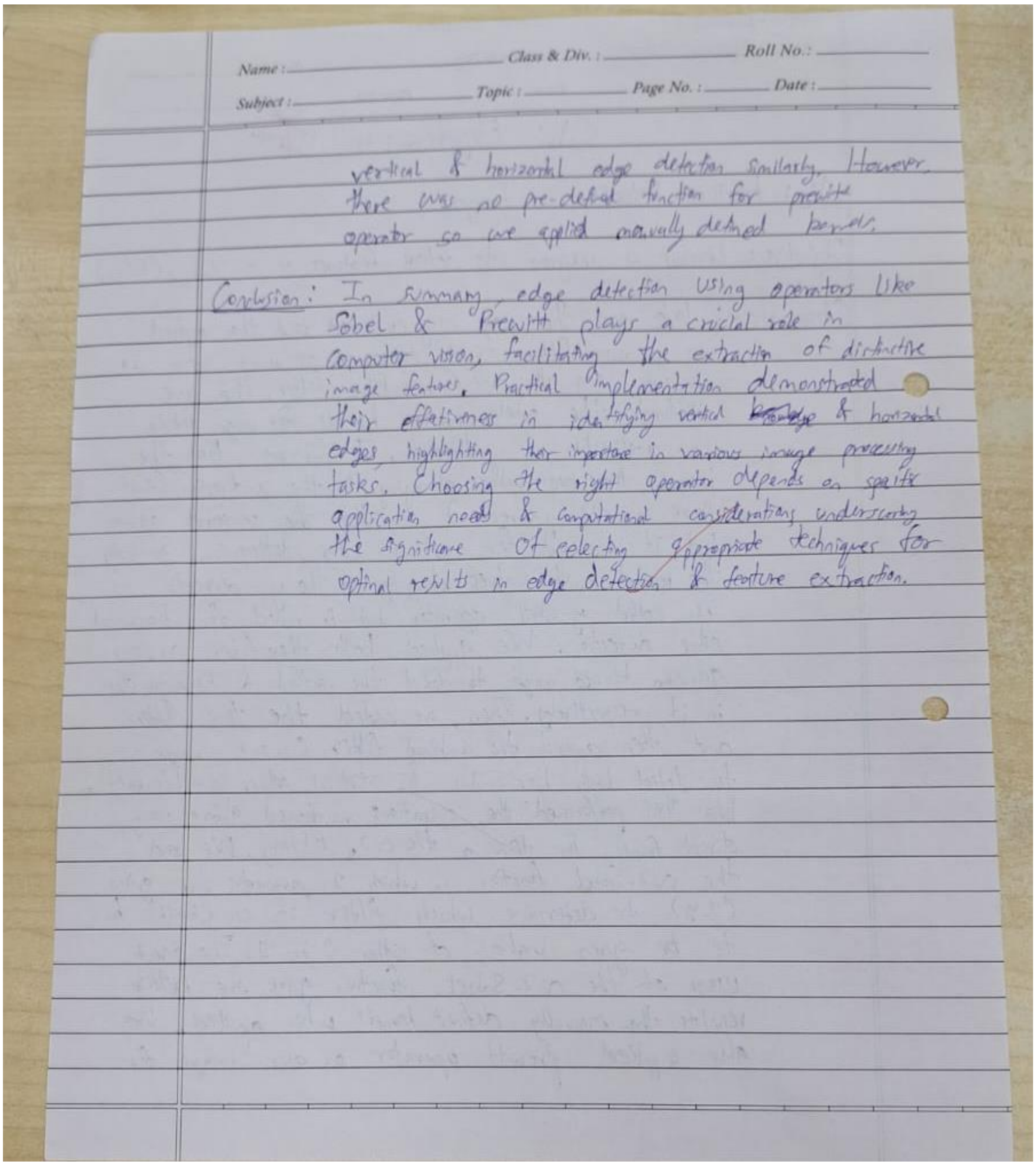
# CV Experiment 4

**Aim:** Feature Detection In Images

**Objective:** Develop a program to detect features in an Image (Edge)

**Observations:** We read the image using cv2.read and then applied a gaussian filter on it to remove as much noise as possible using the cv2.GaussianBlur filter. Then we defined the sobel operators kernels for edge detection in x-direction & y-direction. I noticed that the kernel that has values changing in the x-direction (and same in the y-direction) is called the x-sobel operator but it is used for vertical edge detection. Similarly, the kernel with values changing in the y direction is called y-sobel operator but is used for horizontal edge detection. We applied both these filters on our gaussian blurred image to detect the vertical & horizontal edges in it, respectively. Then, we added the two filters and then applied the combined filter on our image to detect both horizontal & vertical edges simultaneously. We then performed the operations mentioned above using direct functions for them in the cv2 library. We used the cv2.Sobel function in which 2 parameters are given (x, y) to determine which filter it is (both have to be given values of either 0 or 1. The direct usage of the cv2.Sobel function gave me better results than manually defined kernels when applied. We also applied prewitt operator on our image for

**Department of Artificial Intelligence & Machine Learning**
**Academic Year 2023-2024**



Name : Class & Div. : Roll No. :
Subject : Topic : Page No. : Date :

vertical & horizontal edge detection similarly. However there was no pre-defined function for prewitt operator so we applied manually defined kernels.

Conclusion: In summary, edge detection using operators like Sobel & Prewitt plays a crucial role in computer vision, facilitating the extraction of distinctive image features. Practical implementation demonstrated their effectiveness in identifying vertical & horizontal edges highlighting their importance in various image processing tasks. Choosing the right operator depends on specific application needs & computational considerations underscoring the significance of selecting appropriate techniques for optimal results in edge detection & feature extraction.

**Conclusion:**

In summary, edge detection using operators like Sobel and Prewitt plays a crucial role in computer vision, facilitating the extraction of distinctive image features. Practical implementation demonstrated their effectiveness in identifying vertical and horizontal edges, highlighting their importance in various image processing tasks. Choosing the right operator depends on specific application needs and computational considerations, underscoring the significance of selecting appropriate techniques for optimal results in edge detection and feature extraction.