1. Edge Detection

Sudden changes or discontinuities in image are called edges. Edges are significant local changes of intensity in an image.

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. This is used for image segmentation and data extraction in areas like image processing, computer vision, etc.

Generally edges are of three types:

* Horizontal edges
* Vertical edges
* Diagonal edges.

The edge detection composed of finding these edges in an image based on detection of the discontinuity in brightness

2. Edge operators

The edge operators are used to find edges. Some find horizontally and vertically, some find in one direction only and some find in all directions.

(i) Prewitt operator

→ It detects two type of edges: horizontal and vertical edges.

→ Edges are calculated by using difference between corresponding pixel intensities of an image.

→ Changes in image can only be calculated using differentiation. So masks are called derivative mask

→ All derivative mask should have properties:

- Opposite sign should be present in mask
- Sum of mask should be zero
- More weight means more edge detection.

→ Mask of Vertical detection:

-1	0	1
-1	0	1
-1	0	1

* When we convolve this mask to image, it will give you vertical edges. It works like first order derivative and calculate difference of pixel intensities in edge. As center column is zero, it calculates difference of left & right pixel values around edge.

→ Horizontal direction

-1	-1	-1
0	0	0
1	1	1

When we convolve this mask onto an image, as centre row is zero, it calculates the difference of above and below pixel intensities of particular edge. Thus increasing the sudden change of intensities and making edge more visible.

ii) Sobel Operator

→ Detects horizontal & vertical edges.

→ Major difference is from prewitt is here coefficients of masks are not fixed and they can be adjusted according to our requirements

Vertical mask

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

This is same as in Prewitt operators, but the difference is it as 2 and -2 in centre of 1st & 3rd column. This works based on the difference of left and right pixels. Since centre values in 1st & 3rd column are 2 and -2, this give more weight age to pixel values around the edge region.

Horizontal mask

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

Here the centre elements of first and third rows are set -2 and 2. It works based on difference of above and below pixels. Since centre values in 1st and 3rd row are 2 and -2, it give more weight age to pixel values around region of edge.

*We can change the coefficient accordingly to get more edge.

eg:

-1	0	1
-5	0	5
-1	0	1

-1	-5	-1
0	0	0
1	5	1