

Assignment A07

Create Image:

Cross Shape

0	0	1	0	0
0	0	1	0	0
1	1	1	1	1
0	0	1	0	0
0	0	1	0	0

Design Filter:

Vertical Edge Filter

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

Convolution outputs:

(0,0)

0	0	1
0	0	1
1	1	1

Calculation:

$$(-1*0)+(0*0)+(1*1)+(-1*0)+(0*0)+(1*1)+(-1*1)+(0*1)+(1*1) = 0+0+1+0+0+1-1+0+1 = 2$$

(0,1)

0	1	0
0	1	0
1	1	1

Calculation:

$$(-1*0)+(0*1)+(1*0)+(-1*0)+(0*1)+(1*0)+(-1*1)+(0*1)+(1*1) = 0+0+0+0+0+0-1+0+1 = 1$$

(0,2)

1	0	0
1	0	0
1	1	1

Calculation:

$$(-1*1)+(0*0)+(1*0)+(-1*1)+(0*0)+(1*0)+(-1*1)+(0*1)+(1*1) = -1+0+0-1+0+0-1+0+1 = -2$$

(1,0)

0	0	1
1	1	1
0	0	1

Calculation:

$$(-1*0)+(0*0)+(1*1)+(-1*1)+(0*1)+(1*1)+(-1*0)+(0*0)+(1*1) = 0+0+1-1+0+1+0+0+1 = 2$$

(1,1)

0	1	0
1	1	1
0	1	0

Calculation:

$$(-1*0)+(0*1)+(1*0)+(-1*1)+(0*1)+(1*1)+(-1*0)+(0*1)+(1*0) = 0+0+0-1+0+1+0+0+0 = 0$$

(1,2)

1	1	1
0	1	0
0	1	0

Calculation:

$$(-1*1)+(0*1)+(1*1)+(-1*0)+(0*1)+(1*0)+(-1*0)+(0*1)+(1*0) = -1+0+1+0+0+0+0+0+0 = 0$$

(2,0)

1	1	1
0	0	1
0	0	1

Calculation:

$$(-1*1)+(0*1)+(1*1)+(-1*0)+(0*0)+(1*1)+(-1*0)+(0*0)+(1*1) = -1+0+1+0+0+1+0+0+1 = 2$$

(2,1)

1	1	1
0	1	0
0	1	0

Calculation:

$$(-1*1)+(0*1)+(1*1)+(-1*0)+(0*1)+(1*0)+(-1*0)+(0*1)+(1*0) = -1+0+1+0+0+0+0+0+0 = 0$$

(2,2)

1	1	1
1	0	0
1	0	0

Calculation:

$$(-1*1)+(0*1)+(1*1)+(-1*1)+(0*0)+(1*0)+(-1*1)+(0*0)+(1*0) = -1+0+1-1+0+0-1+0+0 = -2$$

Output Image

2	1	-2
2	0	0
2	0	-2

The final output image from the convolution process shows the strength and direction of the vertical edges detected in the input image. Positive values, like the 2s at positions (0, 0), (1, 0), and (2, 0), indicate strong vertical edges on the left side, highlighting areas where there are big changes in pixel intensity. On the other hand, the zero values at positions (1, 1), (1, 2), and (2, 1) point to areas that are relatively consistent and don't have any standout features. The negative values, especially the -2s at (0, 2) and (2, 2), hint at vertical edges on the right side, showing a shift from lighter to darker pixels. Overall, this output grid effectively shows where vertical edges are in the original image, which is super important for image processing tasks like object detection and segmentation, as it helps highlight key features that give a better understanding of the image's content.