

Cassy Cormier

1. This image represents a cross.

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

2. Design Filters.

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

1. Horizontal Edge Detector

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

2. Vertical Edge Detector

1	1	1
1	1	1
1	1	1

3. Simple Blur Filter

3. Convolve manually where I slide the 'filters' across the 'image' and perform the convolution operation manually.

- $(0 \times -1) + (0 \times -1) + (1 \times -1) += (0 + 0 + -1) + (0 + 0 + 0) + (1 + 1 + 1)$
- $(0 \times 0) + (0 \times 0) + (1 \times 0) += (-1) + (0) + (3)$
- $(1 \times 1) + (1 \times 1) + (1 \times 1) = \mathbf{2}$
- $(0 \times -1) + (1 \times -1) + (0 \times -1) += (0 + -1 + 0) + (0 + 0 + 0) + (1 + 1 + 1)$
- $(0 \times 0) + (1 \times 0) + (0 \times 0) += (-1) + (0) + (3)$
- $(1 \times 1) + (1 \times 1) + (1 \times 1) = \mathbf{2}$
- $(1 \times -1) + (0 \times -1) + (0 \times -1) += (-1 + 0 + 0) + (0 + 0 + 0) + (1 + 1 + 1)$
- $(1 \times -1) + (0 \times -1) + (0 \times -1) += (-1 + 0 + 0) + (0 + 0 + 0) + (1 + 0 + 0)$
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- $(1 \times 0) + (1 \times 0) + (1 \times 0) += (-1) + (0) + (1)$
- $(0 \times 1) + (0 \times 1) + (1 \times 1) = \mathbf{0}$
- $(0 \times -1) + (1 \times -1) + (0 \times -1) += (0 + -1 + 0) + (0 + 0 + 0) + (0 + 1 + 0)$
- $(1 \times 0) + (1 \times 0) + (1 \times 0) += (-1) + (0) + (1)$
- $(0 \times 1) + (1 \times 1) + (0 \times 1) = \mathbf{0}$
- $(1 \times 1) + (0 \times 1) + (0 \times 1) = \mathbf{0}$
- $(1 \times -1) + (1 \times -1) + (1 \times -1) += (-1 + -1 + -1) + (0 + 0 + 0) + (0 + 0 + 1)$

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- $(0 \times 0) + (0 \times 0) + (1 \times 0) = (-3) + (0) + (1)$
- $(0 \times 1) + (0 \times 1) + (1 \times 1) = -2$
- $(1 \times -1) + (1 \times -1) + (1 \times -1) = (-1 + -1 + -1) + (0 + 0 + 0) + (0 + 1 + 0)$
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- $(1 \times -1) + (1 \times -1) + (1 \times -1) = (-1 + -1 + -1) + (0 + 0 + 0) + (1 + 0 + 0)$
- $(1 \times 0) + (0 \times 0) + (0 \times 0) = (-3) + (0) + (1)$
- $(1 \times 1) + (0 \times 1) + (0 \times 1) = -2$

2	2	2
0	0	0
-2	-2	-2

Final Convolution Result

4. Interpretation of Features: High positive values on top. Low values in the middle and strong negative values on the bottom. The top and bottom of the cross have a horizontal edge. The zero in the middle indicates no strong horizontal edges in the center. It's flat in the center part of the cross.