

Group 8 (Jeffery Dirden & Bradley Johnson)

ITAI - 1378

Professor McManus

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A07 ITAI 1378 Manual CNN

Basic Cross Image

We decided to create a simple 8x8 cross.

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

Design Filters we'll be using.

Vertical Edge Detection Filter

[-1, 0, 1]

[-1, 0, 1]

[-1, 0, 1]

Horizontal Edge Detection Filter

[-1, -1, -1]

[0, 0, 0]

[1, 1, 1]

1st we will start with vertical edge detection, there are 8 rows and columns in our image so we have to break down our image in 3x3 parts to apply the filter we'll give an example on position (0,0) which is the 1st the 3x3 section of our image. The first nine numbers in our first 3x3 are all 0. Therefore it looks like this:

0	0	0
0	0	0
0	0	0

- *Reminder this is just part 0,0*

Okay now that we have the numerals for the first part of the picture now we need to incorporate our 3x3 vertical edge detection filter. We need to understand the Convolution Process since your filter size is 3x3 and our image size is 8x8 after convolution we will have 6 rows and columns based on this formula:

$$(8 - 3 + 1) \times (8 - 3 + 1) = 6 \times 6$$

Our final column for our image will 6x6 but now let's show the vertical edge detections numerals.

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

So now we need to come up with the sum we do that by multiplying each filter value with the corresponding image pixel. Sum all the multiplied values to get a single value, slide the filter one pixel to the right and repeat the process until the filter has been applied to the entire image.

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

$$0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 = 0$$

So the output value for the 1st part will be 0 we'll continue this process for the rest of image and show a complete grid of the output value for vertical edge detection show below.

0	3	3	-3	-3	0
0	3	3	-3	-3	0
0	3	3	-3	-3	0
0	3	3	-3	-3	0
0	3	3	-3	-3	0
0	3	3	-3	-3	0

Now that we have a understanding of how to find the output value and grid it correctly we will repeat this process for the horizontal edge detection filter step by step just using different numbers which you can see above is the correct values for our original image and filter so listed below we will have the complete horizontal edge detection output grid for our cross image.

0	0	0	0	0	0
3	3	3	3	3	3
3	3	3	3	3	3
0	0	0	0	0	0
-3	-3	-3	-3	-3	-3
-3	-3	-3	-3	-3	-3

So now we're able to sit back and analyze the differences between our vertical, and horizontal edge detection features. You can even add an extra row on top of the X and Y axis to have a columns and rows specified to make analyzing the output data even more easily for now we decided to just keep it simple. Analyzing the output data for our vertical data we can column 2 & 3 all the way down to row 6 have the highest output data, while columns 4 & 5 all the way down to row 6 have negative data and all other rows and columns are 0. Looking at our horizontal data we can see row 2 & 3 have the highest data, rows 5 & 6 have negative data, and all other rows consist of 0.