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/: ?Kan Chichi Shan

Convolution

Arithmetic arrays! In this exercise, we want to see how many kilos are the real use of arrays and so on? And let's see where its real use is and get acquainted with a series of concepts that are very attractive and interesting! In this way => 🤩🤩 After you have read the arrays, we will not explain them (we like it ^__^), let's go to a new concept and topic that is very good and hello, it is called image processing =)))) Image processing is used in many things. The same effects that you use more and more in Snapchat and laugh together and... this is all image processing or, for example, in some places, it saves the nation's life, for example, it detects blood clots in the cerebral vessels.

We want to see how exactly the edges of the images are recognized in the image? If you have paid attention, for example, the effects it puts on your face are different, so how does it know your face? Have you ever thought about it?
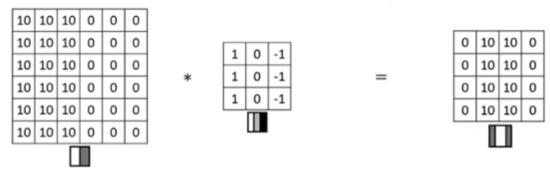
The answer is that it detects the contours of your face and then applies the effect on your face.

Now, in this exercise, we want to work more with presentations and see how to recognize an edge in images.

If you search on the net and for example this link https://en.wikipedia.org/wiki/Sobel_operator) see

You understand that there is a matrix that, if multiplied by the matrix of our image, results in a matrix in which we can see whether we have an edge or not.

Vertical edge detection examples

10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0

*

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

=

0	10	10	0
0	10	10	0
0	10	10	0
0	10	10	0

This operation is called convolution.

Now let's see how this works.

This matrix is called sobel matrix which you can see in the figure below. This matrix is a 3 by 3 matrix that is used to detect vertical or horizontal edges of images.

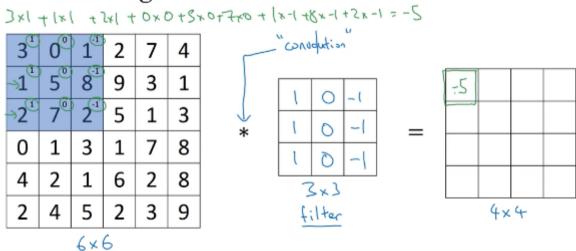## Vertical and Horizontal Edge Detection

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

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

Convolution is slightly different. As you can see in the figure below:

Vertical edge detection

$$3\times1 + 1\times1 + 2\times1 + 0\times0 + 5\times0 + 7\times0 + 1\times-1 + 8\times-1 + 2\times-1 = -5$$

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

6×6

"convolution"

*

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

3×3
filter

=
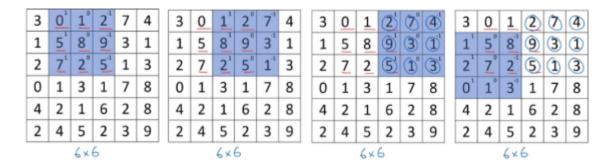
-5			

4×4

The way to multiply it is that you should consider a 3x3 window (the same part that is painted blue). Multiply this matrix step by step in the sobel filter you see. He wrote the multiplications done in green above. The division will give you a number that will be the first root of this output matrix.

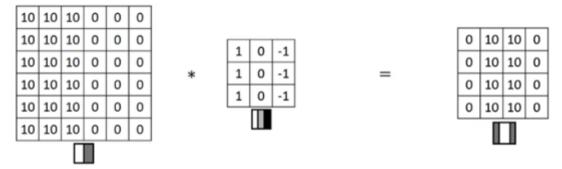Now, the next step is to shift this window to the size of a house . You can see the shifting in the image below that it shifts to the right until it reaches the end, then it returns to the first and one line goes down and so on until the end. In each step, you multiply the whole new blue area of your new window in that filter until you get the output matrix of all its

numbers.

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

6×6

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

6×6

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

6×6

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

6×6

Now what does this mean?

Vertical edge detection examples

10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0

$*$

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

$=$

0	10	10	0
0	10	10	0
0	10	10	0
0	10	10	0

If you look at this image, the matrix given to you is dark on one side and light on the other. It means we have an edge. Now, if you look at the output, the exact place where the edge is is specified, which means that the two middle rows have a value and the rest have no value.

simply!

Now what you have to do in this exercise is that you have to take a 6x6 matrix from the input (for

example, you can try the same example above) and then apply the same vertical filter described

above and get the final matrix. Print for us. The code of this question will not be corrected by Quora and we will check your code manually!

- Exercise is not difficult at all. We just wanted it to be a little practical and for you to learn some things. A very small implementation.
- If you have any questions, ask them here so that we can answer them.

    - I got all the photos from Mr. Andrew Ng's course.

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