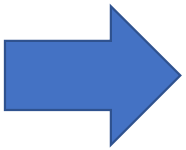
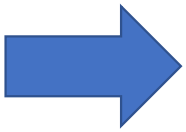
So what is Convolution

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

$5x5\ Matrix$



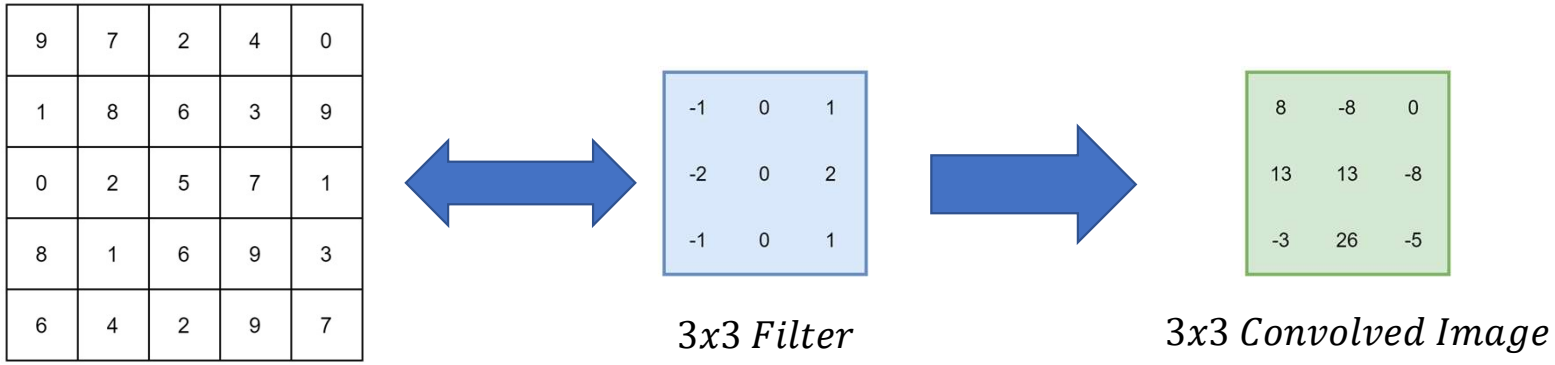
$Filters\ or\ Kernels\ or\ Feature\ Detectors$

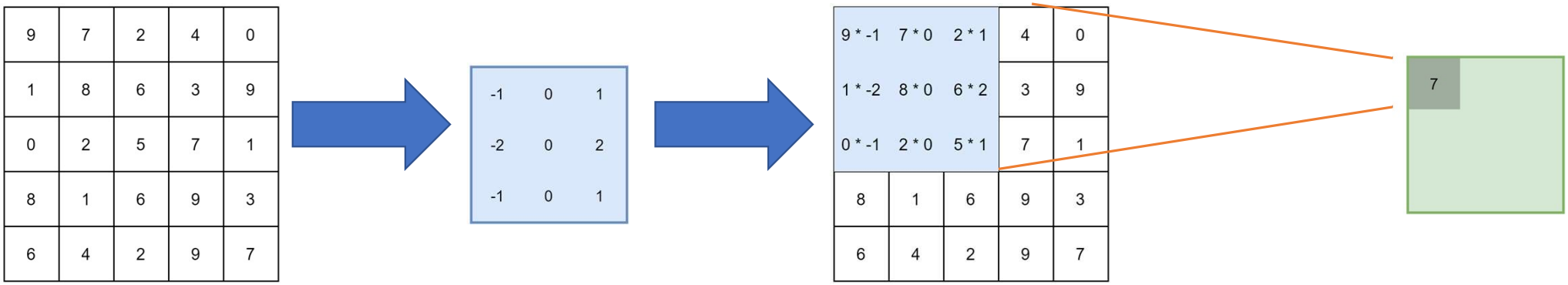


$Extracted\ Information$

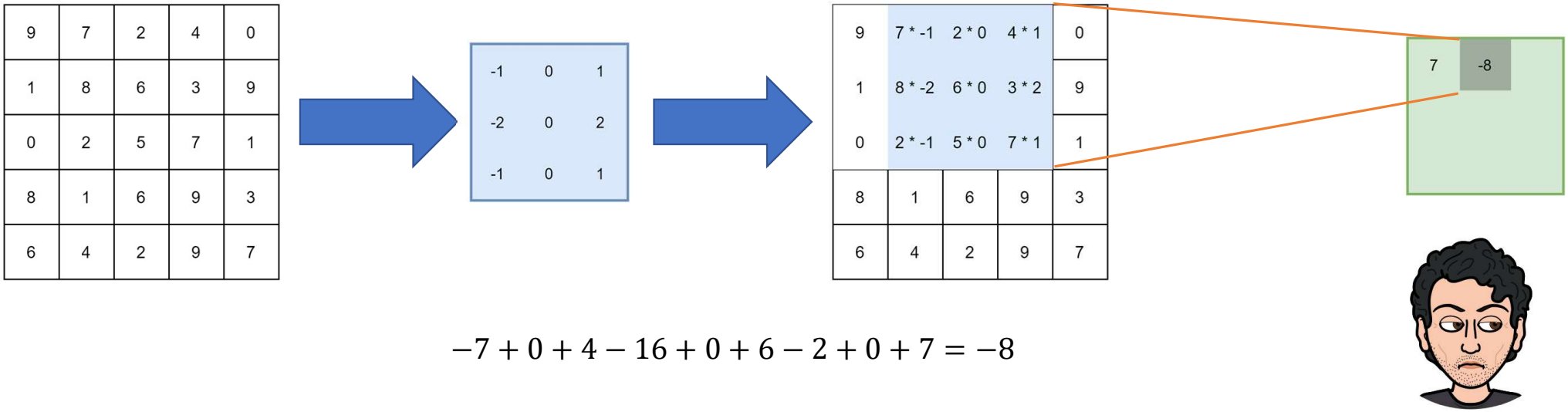
What are these filters useful for ?

Source : https://towardsdatascience.com/canny-edge-detection-step-by-step-in-python-computer-vision-b49c3a2d8123

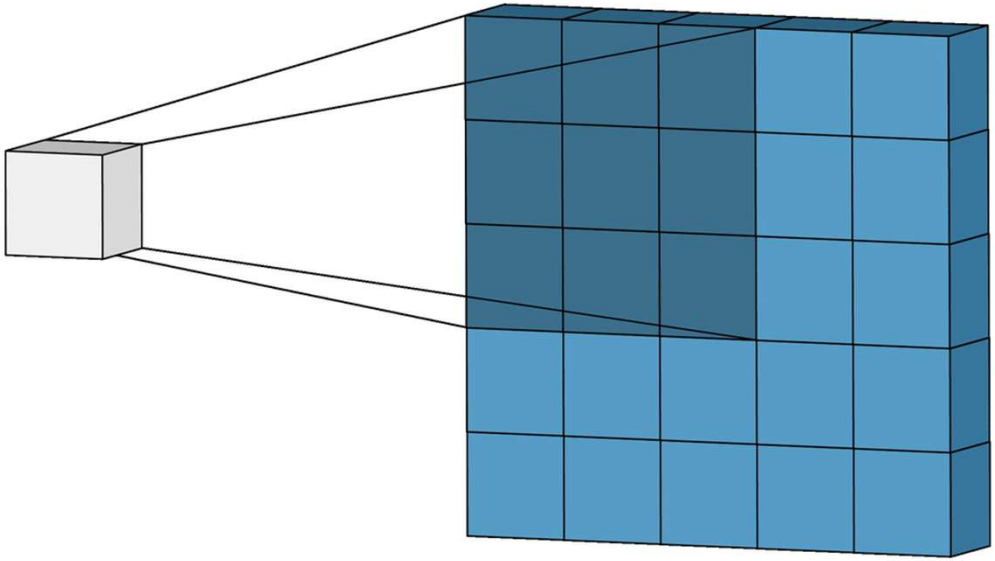

9 7 2 4 0
1 8 6 3 9
0 2 5 7 1
8 1 6 9 3
6 4 2 9 7
5x5 Matrix
-1 0 1
-2 0 2
-1 0 1
3x3 Filter
8 -8 0
13 13 -8
-3 26 -5
3x3 Convolved Image



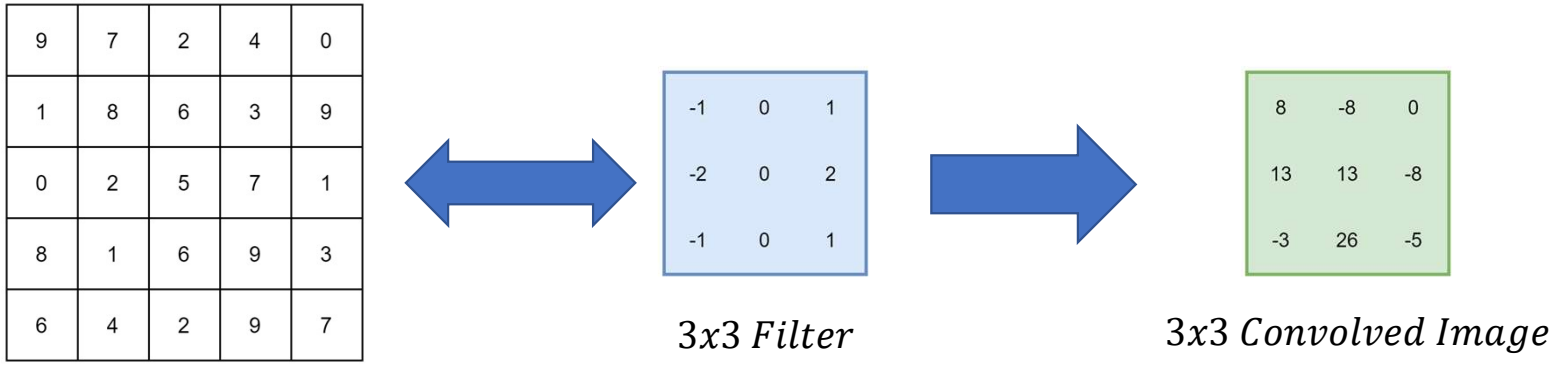
$$-9 + 0 + 2 - 2 + 0 + 12 - 1 + 0 + 5 = 7$$



$$-7 + 0 + 4 - 16 + 0 + 6 - 2 + 0 + 7 = -8$$



Source : https://towardsdatascience.com/intuitively-understanding-convolutions-for-deep-learning-1f6f42faee1



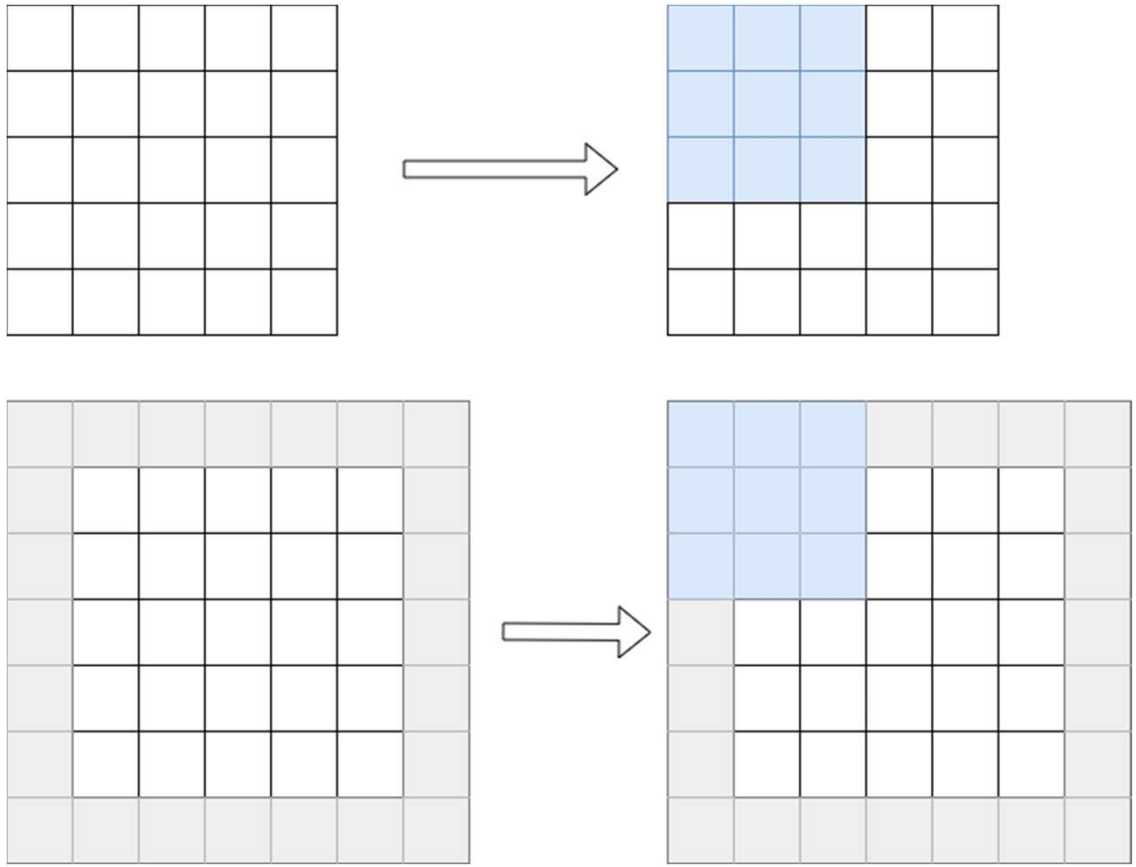
$5x5\ Matrix$

$3x3\ Filter$

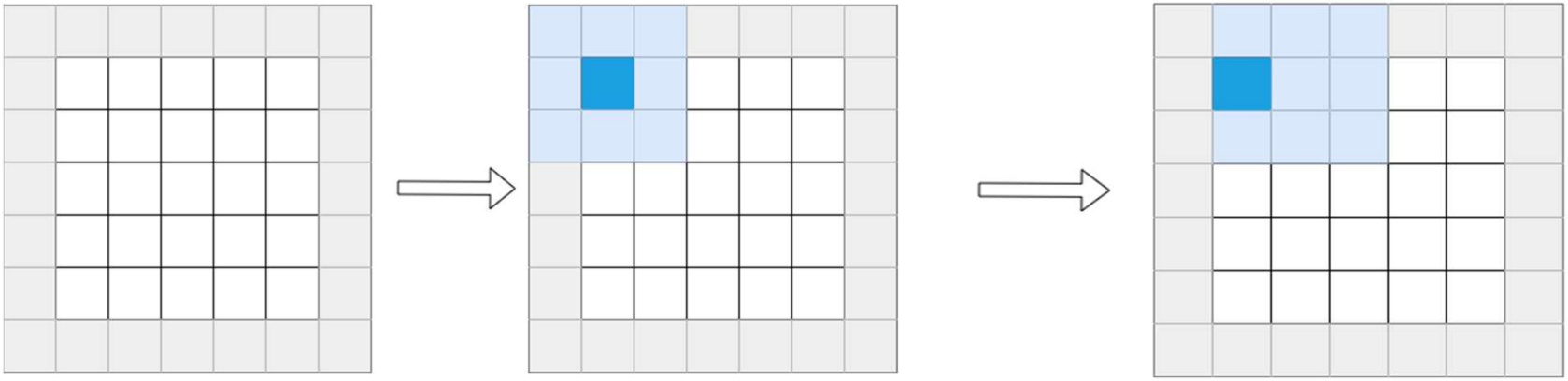
$3x3\ Convolved\ Image$

$$Convolved\ Image\ Dimensions = \left[\frac{Dimension\ of\ Image\ - Size\ of\ filter}{Strides}\right] + 1$$

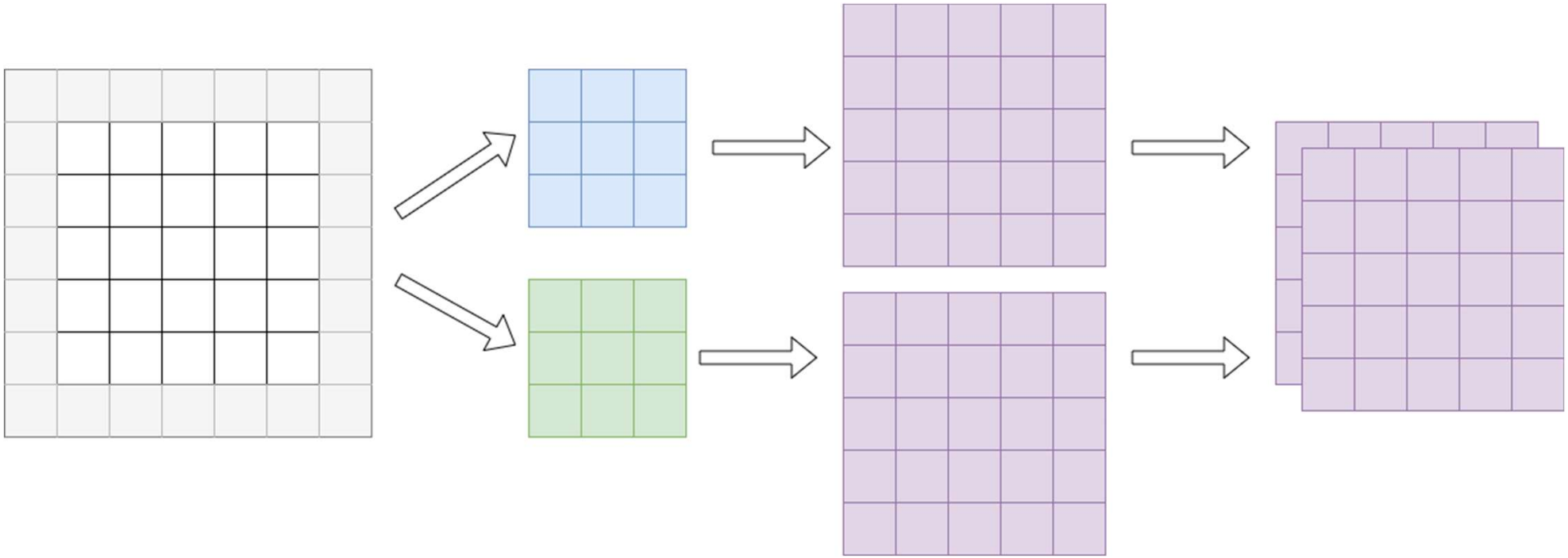
$$Convolved\ Image\ Dimensions = \left[\frac{5\ - 3}{1}\right] + 1 = 3$$



$$Convolved\ Image\ Dimensions = \left[\frac{Dimension\ of\ Image\ - Size\ of\ filter + (2 * padding)}{Strides}\right] + 1$$

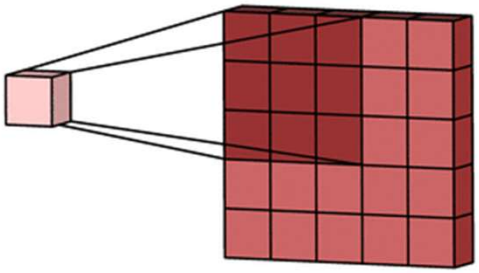


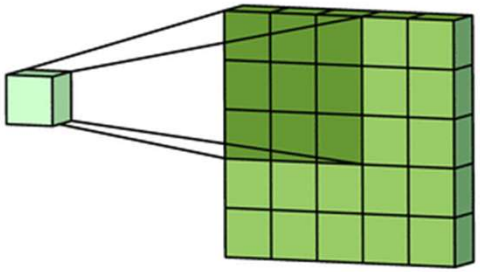
$$Convolved\ Image\ Dimensions = \left[\frac{Dimension\ of\ Image\ - Size\ of\ filter + (2 * padding)}{Strides}\right] + 1$$

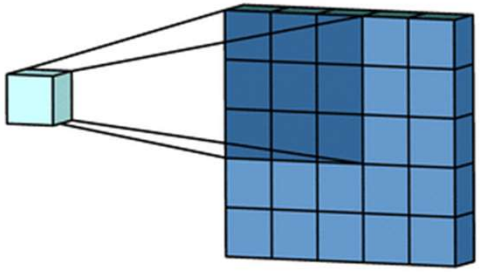


$$Convolved\ Image\ Dimensions = \left[\frac{5\ -3+(2*1)}{1}\right]+1=5$$

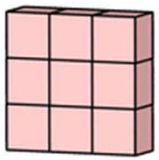
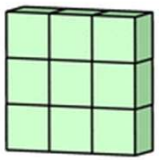
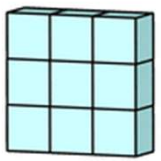
$$Convolved\ Image\ Dimensions = \left[\frac{Dimension\ of\ Image\ -Size\ of\ filter+(2*padding)}{Strides}\right]+1$$



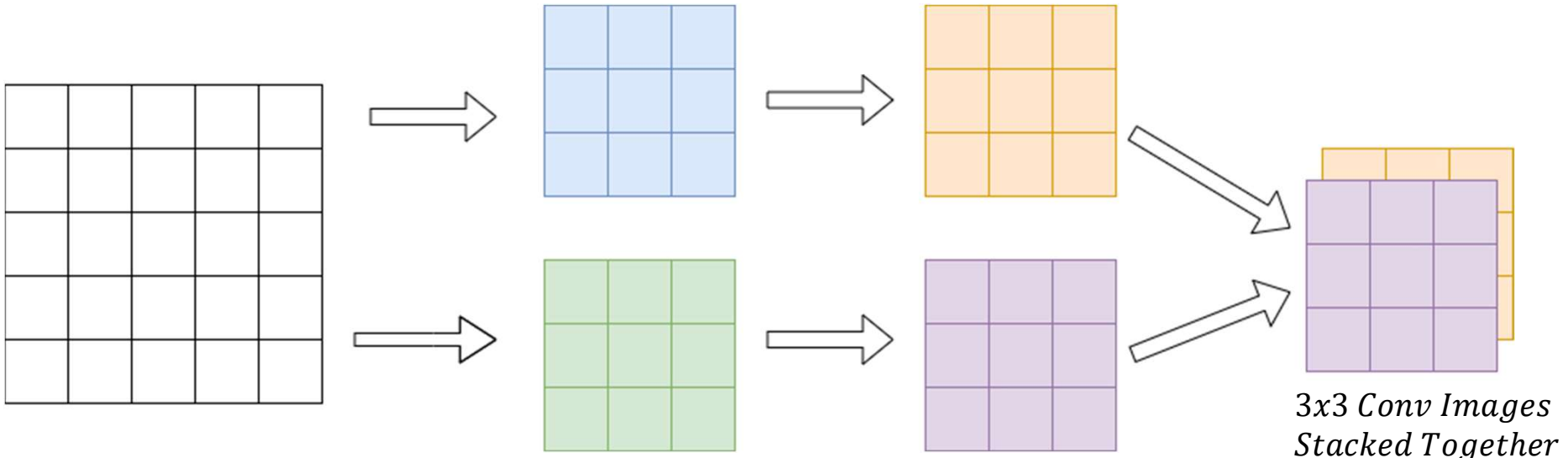




Source : https://towardsdatascience.com/intuitively-understanding-convolutions-for-deep-learning-1f6f42faee1

Source : https://towardsdatascience.com/intuitively-understanding-convolutions-for-deep-learning-1f6f42faee1



5x5 *Input Image*

(5x5x1)

3x3 *Two Filters*

(3x3x2)

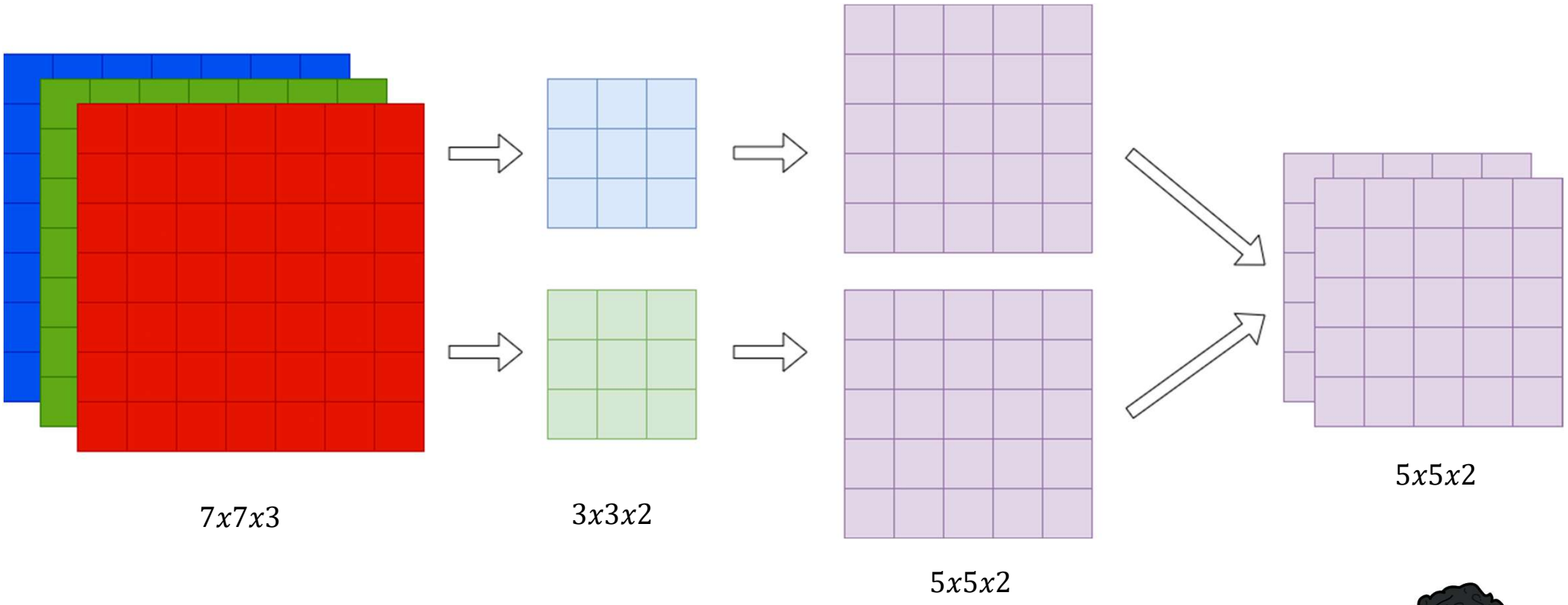
3x3 *Two Convolved Images*

(3x3x2)

3x3 *Conv Images Stacked Together*

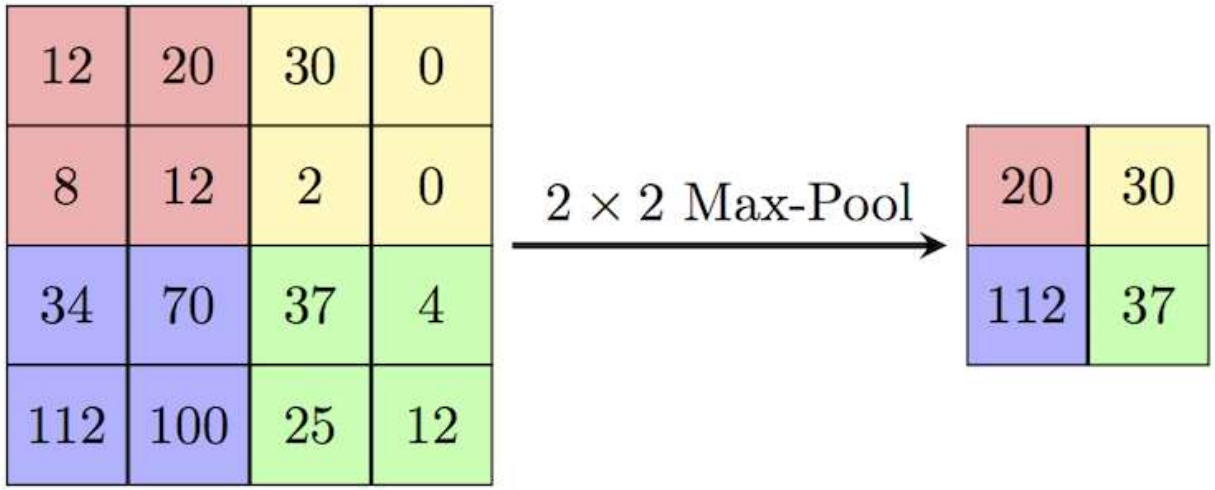
(3x3x2)

(*Height of the Image x Width of the Image x Channels of Image*)



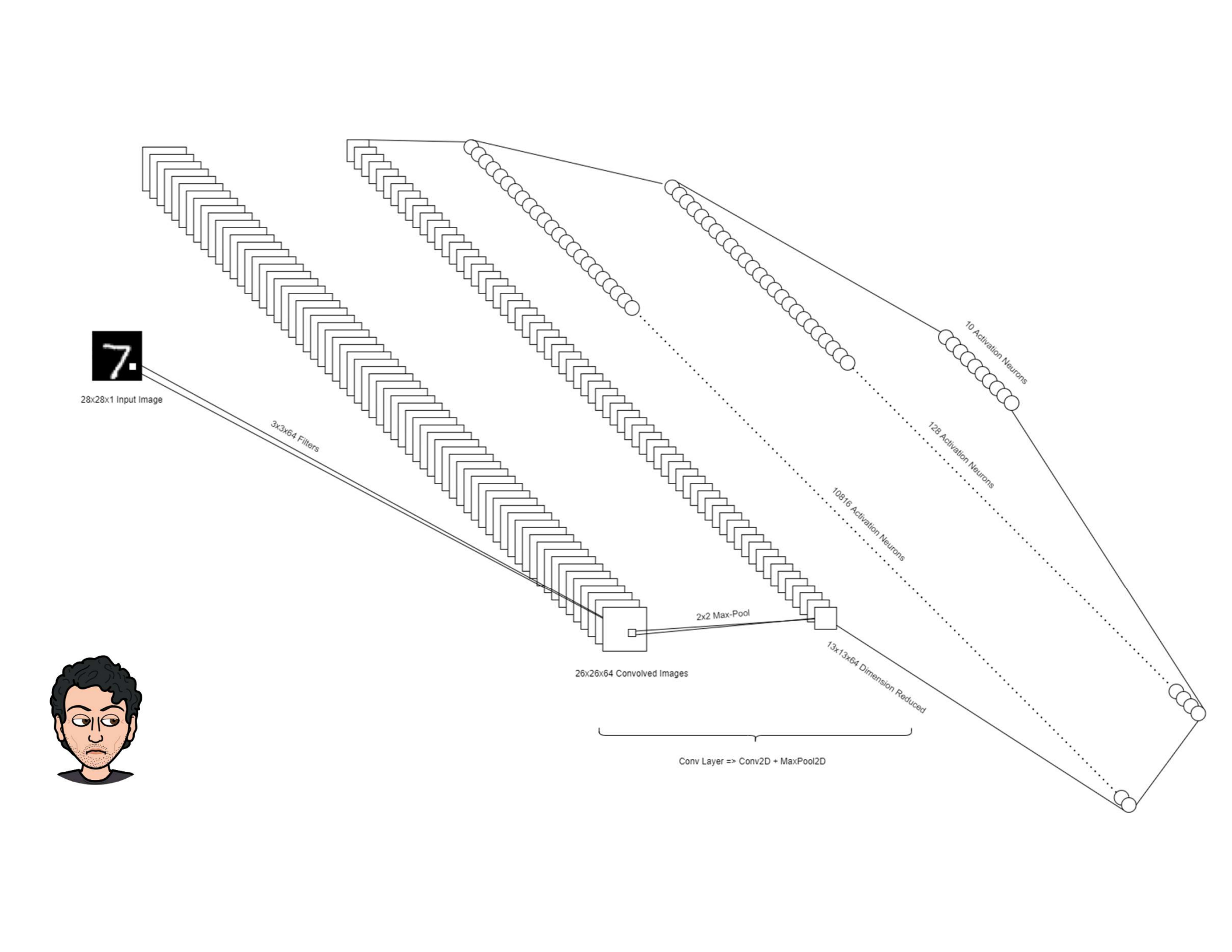
(*Height of the Image x Width of the Image x Channels of Image*)

Max-Pooling



Source : https://computersciencewiki.org/index.php/Max-pooling_/_Pooling

$$Dimensions\ after\ Max-Pooling = \left[\frac{Dimension\ of\ Image\ - Size\ of\ filter + (2 * padding)}{Strides}\right] + 1$$


28x28x1 Input Image
3x3x64 Filters
26x26x64 Convolved Images
2x2 Max-Pool
13x13x64 Dimension Reduced
10816 Activation Neurons
128 Activation Neurons
10 Activation Neurons
Conv Layer => Conv2D + MaxPool2D