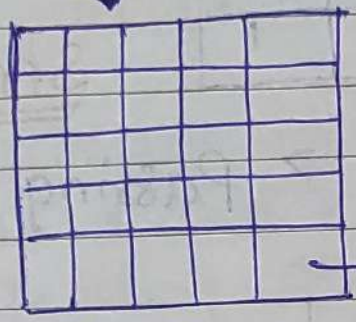
* What is Convolution.

Convolution

Images : There are two types of images B & W & RGB.

Black & White → 1 Channel



→ Pixel range between 0-255

5 x 5 pixel Image.

0 = Black.

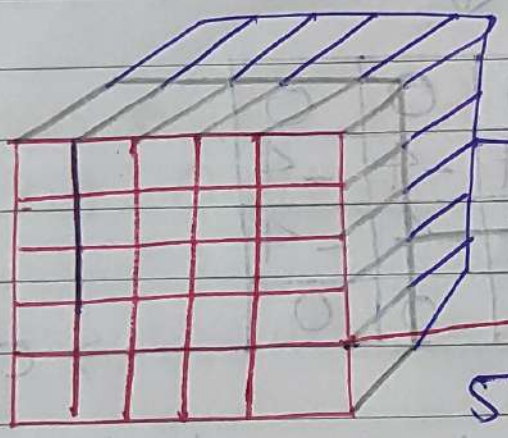
255 = White.

* RGB Image

■ - Red Image

■ - Blue Image

■ - Green Image



B Channel.

G Channel.

R Channel.

5 x 5 x 3

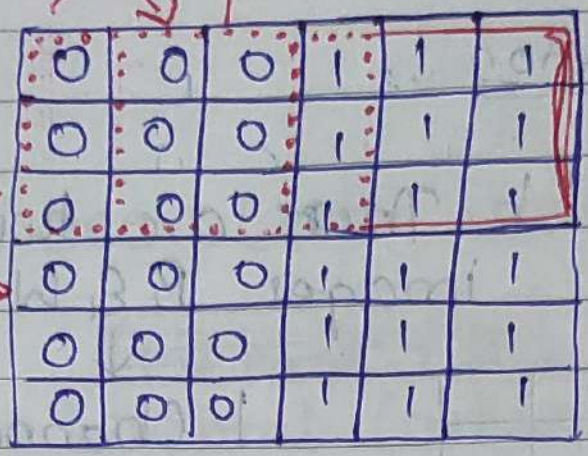
When we combine all the 3 channel Green, Red, Blue then the combination that we'll getting it in different colours.

→ Placing the filter.

* Convolution Operation

① Step

Min
Max
Scaling.



→ 6x6.

Jump

Stride = 1

↓ → Passing

It is also called

↓

Horizontal edge filter

1	2	1
0	0	0
-1	-2	-1

→ filter / kernal

→ 3x3

↓

② 0+0+0+0 = 0 →

① 0+0+0+1 to ..... = 0 ↑

0	0	0	0
-4	-4	-4	-4
-4	-4	-4	-4
0	0	0	0

→ O/P

↑ Adding filter to the first 6x6 Image and multiples the values from filter & 6x6 image and whatever we'll get the final output we'll place in the Output Image.

* Whenever we are performing convolution neural network. we can have multiple filters and we'll getting multiple outputs.

* Important

whenever we pass 6 x 6 Image in a 3 x 3 filter i am getting the output as 4 x 4

↑

How this is happening?

→ n = Size of Image.
f = filters

When n = 6 and f = 3 what is the Output ?

Here we use a mathematical formula.

$$= n - f + 1$$
$$= 6 - 3 + 1$$
$$= 3 + 1$$
$$= 4,$$

→ finally getting a 4 x 4 output.

* What filters can actually do?

→ Filters can take out the information from the specific Image.

* Here we are getting 4 x 4 output it means our image size is decreasing.

↑

It should not happen

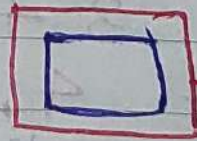
→ If our image size is decreasing that means we are losing some kind of information

↑

How to prevent this loss?

→ We can prevent this loss by using Padding

Padding is building a compound around the images

Just like layers  → Padding

* When we add padding to the 6 x 6 Image then it will become a 8 x 8 image.

* After Padding

$n = 8$, $f = 3$. $o/p = ?$

$$n - f + 1$$
$$= 8 - 3 + 1$$
$$= 5 + 1$$
$$= 6_{//} \longrightarrow o/p = 6_{//}$$

* Update formula.

p = padding.

$$= n + 2p - f + 1$$
$$= 6 + 2 - 3 + 1$$
$$= 6_{//}$$

$n = 6$.
$p = 1$
$f = 3_{//}$

* Interview Question

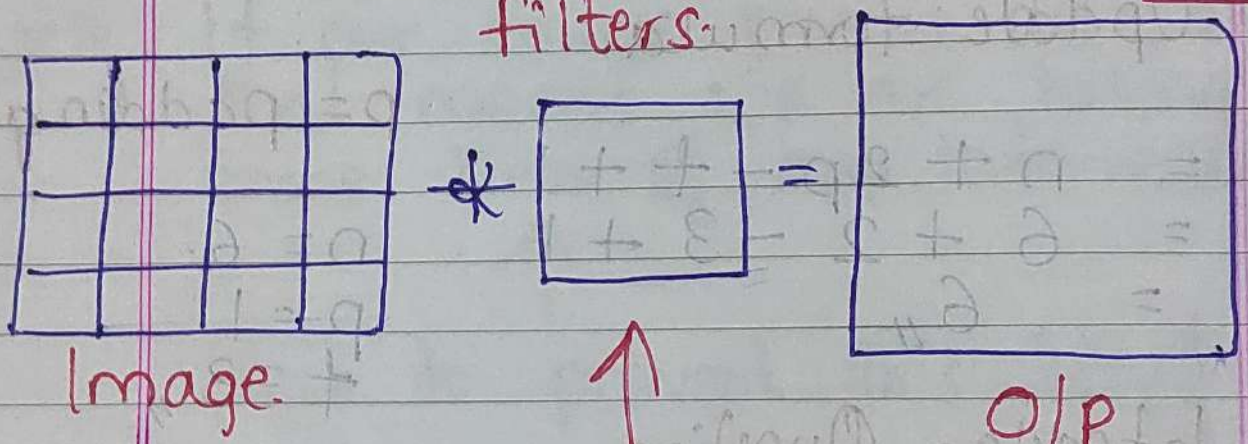
Q. What is the Importance of padding?

→ To prevent the information loss of the image we apply different kind of padding

* In ANN we update the weights in backward propagation.

* In CNN we update the filters in backward propagation. Based on the Input Image. because every Image will be different.

* Convolution Operation:



we can have Any number of filters.

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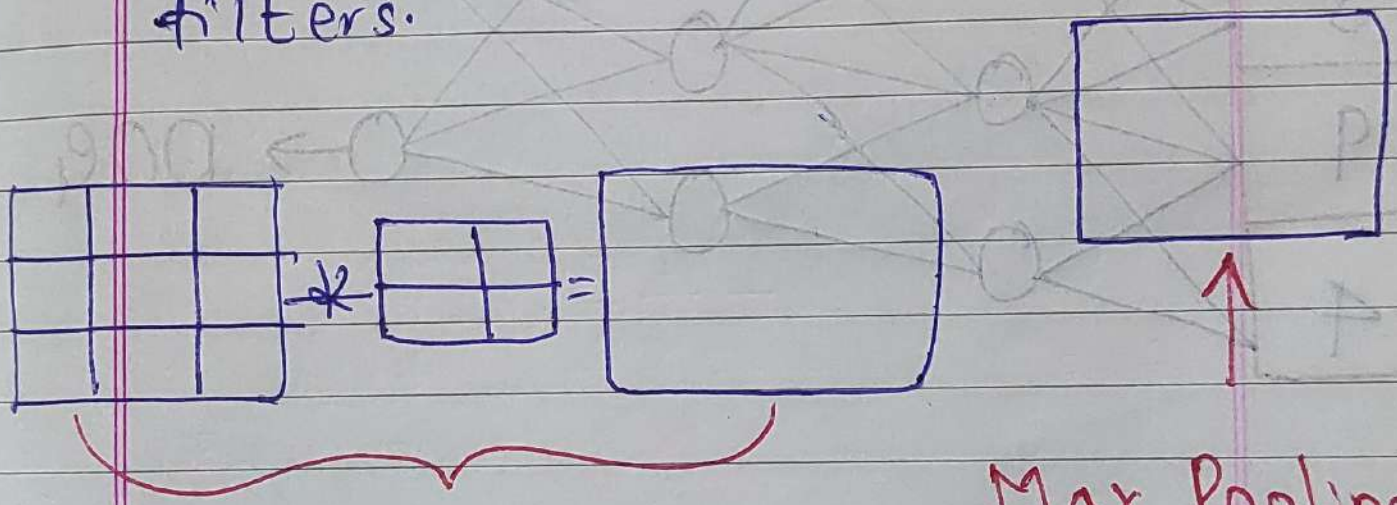
* Our main aim in the Convolution operation we need to learn from the filters and update based on the Image.

* ## Max Pooling

Max Pooling is a pooling operation that selects the maximum element from the filters.



Convolution Operation.

Max Pooling.

* In max pooling the ~~stride~~ step size of stride will be 2.

④ Flatening layer.

→ It is similar like Dense layer in ANN.