CNN Parameters Calculation:
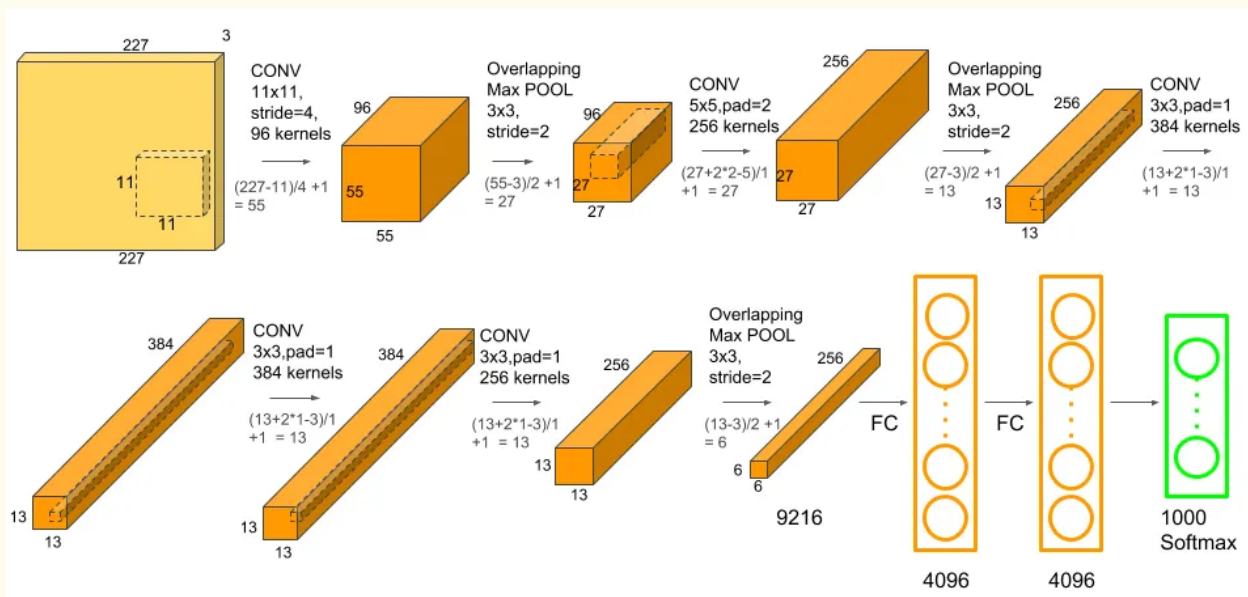
Input_shape=(10,10,1) Number of filters=1 Output_shape=(8,8,1)
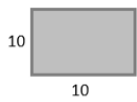
Output is a feature map. Number of channels =1 [Since only one filter is used]

$$output\_shape = \frac{n-f+2p}{s} + 1$$

SL.No		Activation Shape	Activation Size	# Parameters
1.	Input Layer:	(32, 32, 3)	3072	0
2.	CONV1 (f=5, s=1)	(28, 28, 8)	6272	608
3.	POOL1	(14, 14, 8)	1568	0
4.	CONV2 (f=5, s=1)	(10, 10, 16)	1600	3216
5.	POOL2	(5, 5, 16)	400	0
6.	FC3	(120, 1)	120	48120
7.	FC4	(84, 1)	84	10164
8.	Softmax	(10, 1)	10	850

1. Convolution layer:

- say filter size = $m \times n$
- input channels / feature maps = l
- output feature maps = k

- total parameters = $(m \times n \times l + 1) * k$

2. FC Layer:

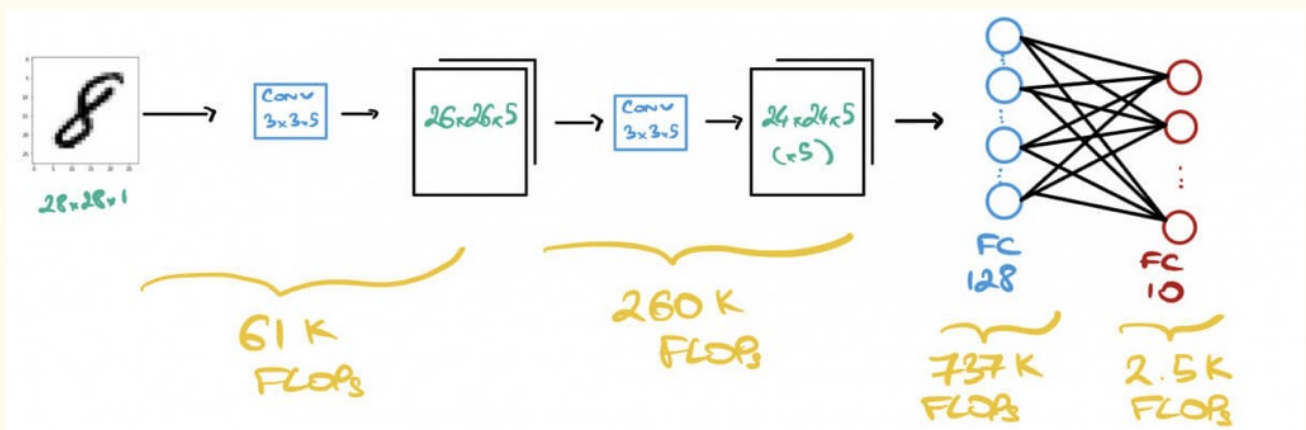- input = n
- output = m
- total parameters = $(n+1) * m$

3. Pooling Layer:

- # of parameters = 0

💡 CNN Flops and MACs:

1. MAC: Multiply - Accumulate Calculations.

$$1 \text{ MAC} = 2 \text{ FLOPS}$$

2. FLOPS:

input channel *
output channel *
kernel size ($k \times k$) *
output size ($m \times m$)

a) Convolution:

$$\text{flops} = 2 * \# \text{ of kernels} * \text{kernel shape} * \text{output shape}$$

b) FC:

$$\text{flops} = 2 * \text{input size} * \text{output size}$$

❧ Pooling Layer:

$$\text{flops} = \left(\frac{\text{Height}}{\text{Stride}}\right) * \left(\frac{\text{width}}{\text{Stride}}\right) * \text{depth}$$

First Convolution - 2x5x(3x3)x26x26 = **60,840 FLOPs**

Second Convolution -2x5x(3x3x5)x24x24 = **259,200 FLOPs**

First FC Layer - 2x(24x24x5)x128 = **737,280 FLOPs**

Second FC Layer - 2x128x10 = **2,560 FLOPs**

👉 The model will do **FLOPs = 60,840 + 259,200 + 737,280 + 2,560 = 1,060,400 operations**