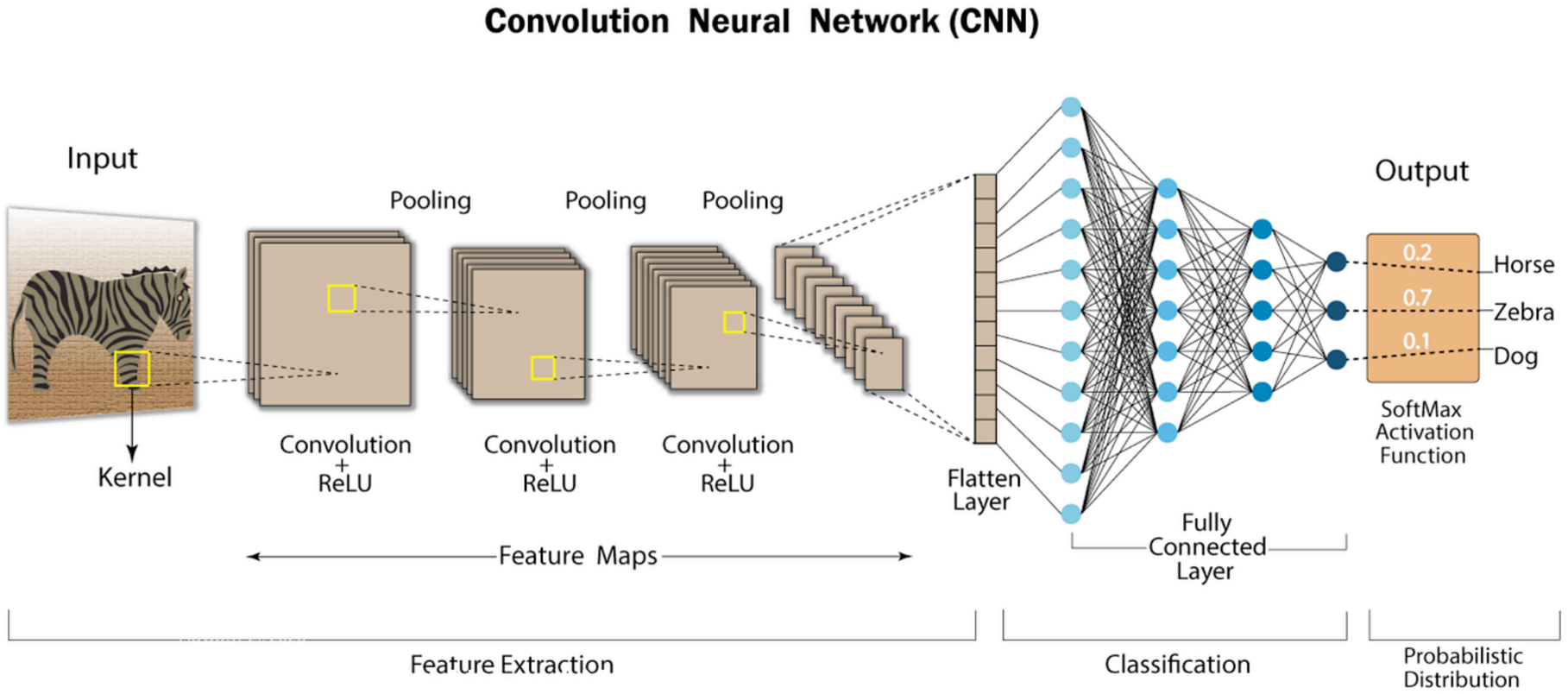
CNN recap

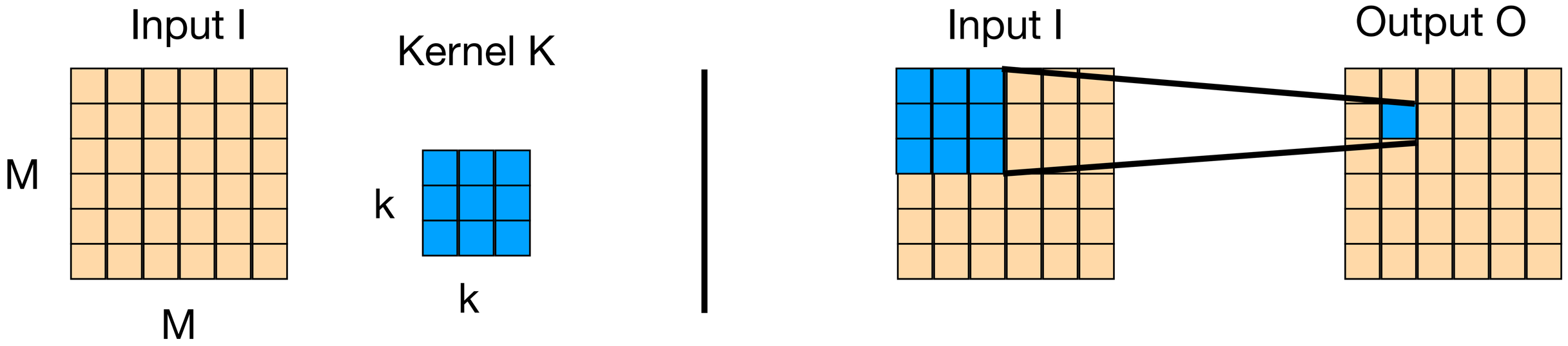
CNNs for classification - general structure



source: https://nafizshahriar.medium.com/what-is-convolutional-neural-network-cnn-deep-learning-b3921bdd82d5

CNN recap

1 input chanel 1 output chanel

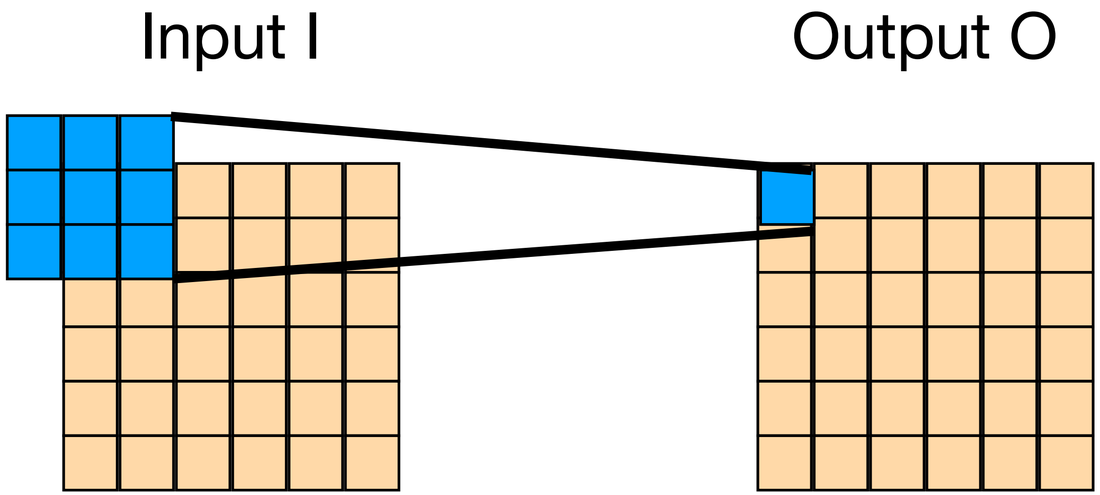


$$O_{i,j} = \sum_{n=0,m=0}^{k-1,k-1} K_{n,m} I_{i-k//2+n,j-k//2+m}$$

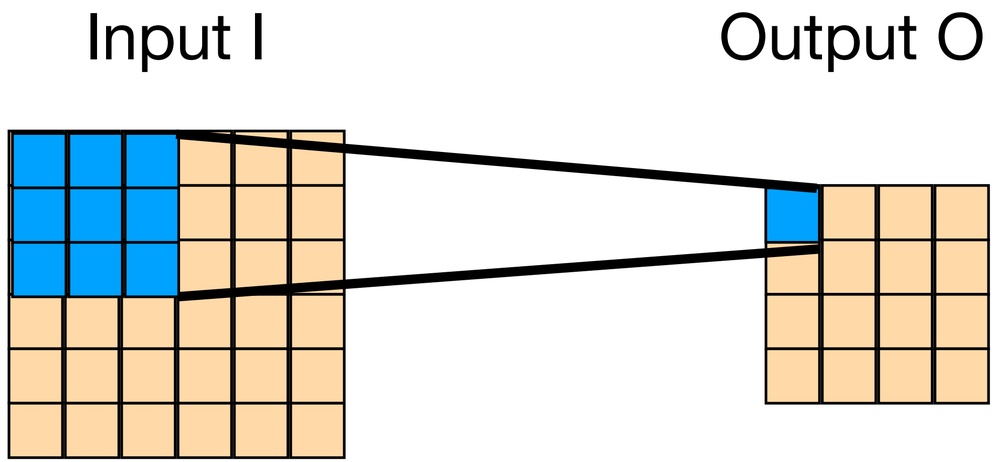
CNN recap

Different paddings

Zero padding



No padding

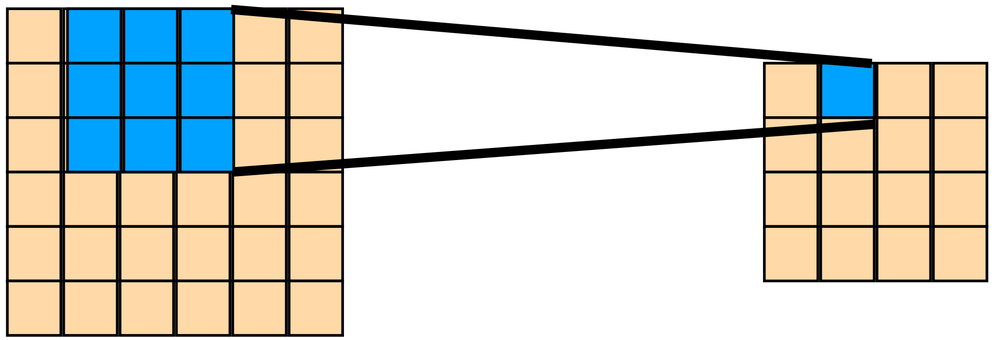


CNN recap

No padding Different strides

Input I

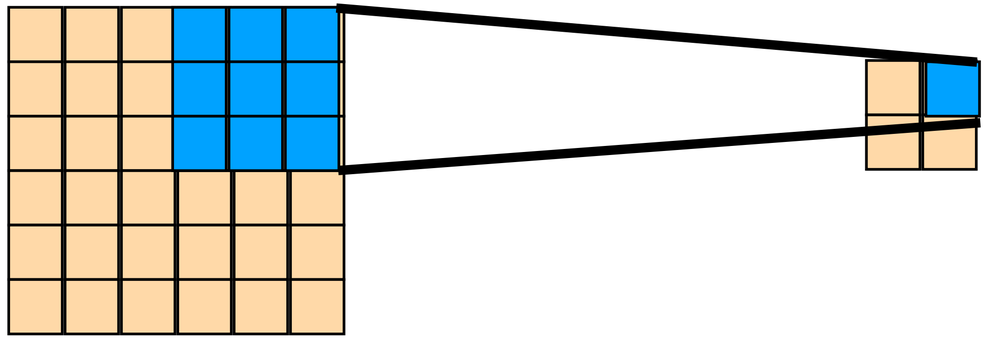
Output O



Stride = 1

Input I

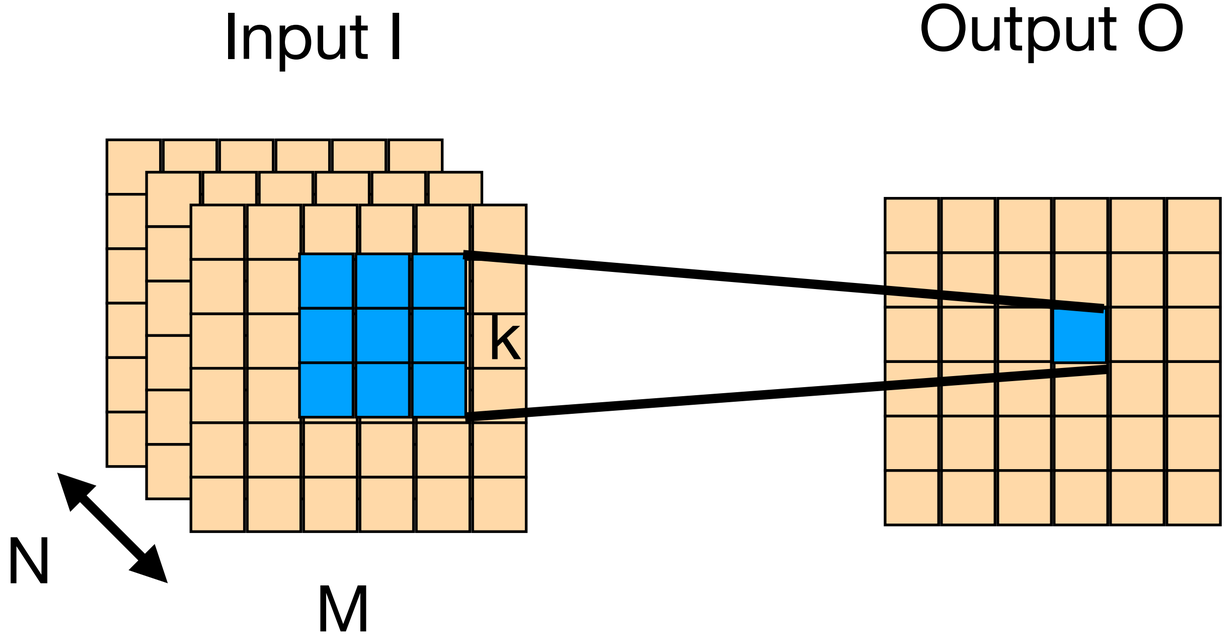
Output O



Stride = 3

CNN recap

Multiple channels: N input channels 1 output chanel



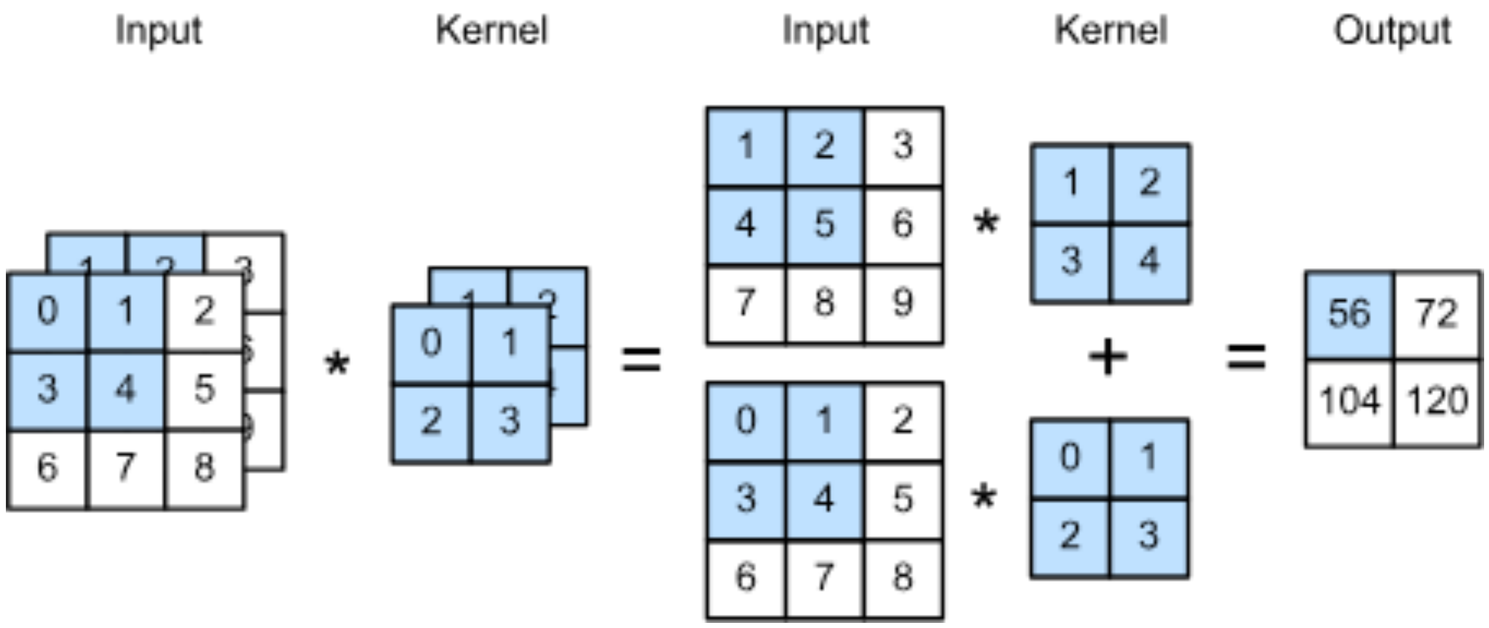
I_{abc} is pixel value of channel a at position (b,c)

$$O_{i,j} = \sum_{c=0}^{N-1} \sum_{n=0,m=0}^{k-1,k-1} K_{c,n,m} I_{c,i-k//2+n,j-k//2+m}$$

CNN recap

Multiple channels: N input channels 1 output chanel

Example with two channels



CNN recap

Multiple channels: N input channels L output chanel

Just take L independent kernels (indexed by *l*)

$$O_{l,i,j} = \sum_{c=0}^{N-1} \sum_{n=0,m=0}^{k-1,k-1} K_{l,c,n,m} I_{c,i-k//2+n,j-k//2+m}$$

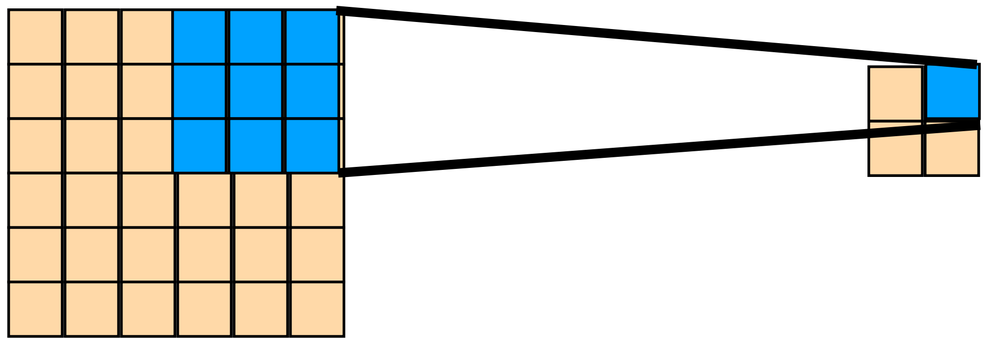
CNN recap

Downsampling

Operation e.g. max or average

Input I

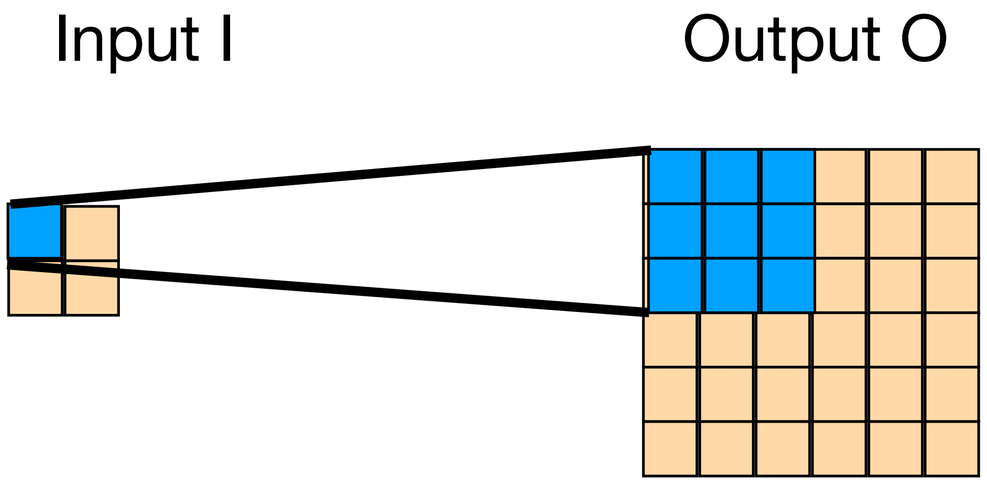
Output O



Stride = 3

CNN recap

Upsampling



E.g. All values equal or transposed convolution

Categorical cross-entropy

$$C = -\sum_j y_j^{\text{target}} \ln y_j^{\text{out}}$$

j goes over all possible labels