



Basic CNN Model

Stanford CS231N



2026.01.13

Overview

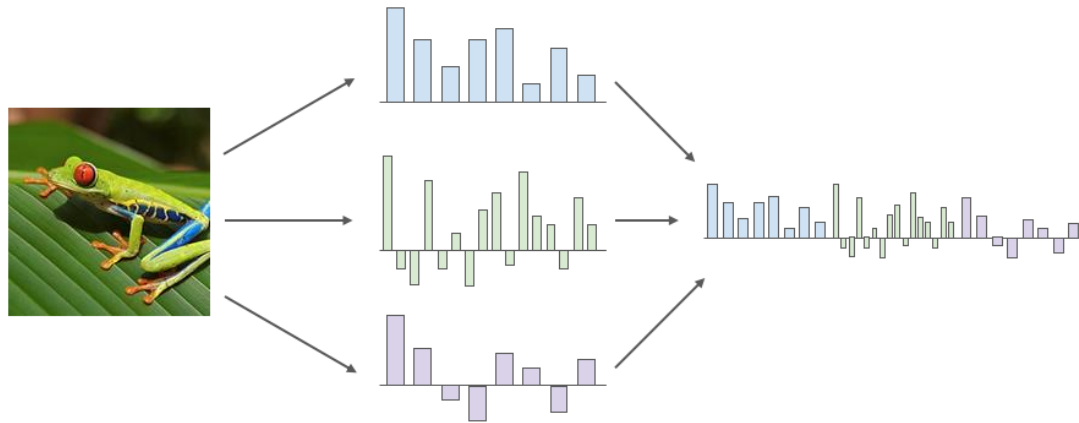


01 **CNN**

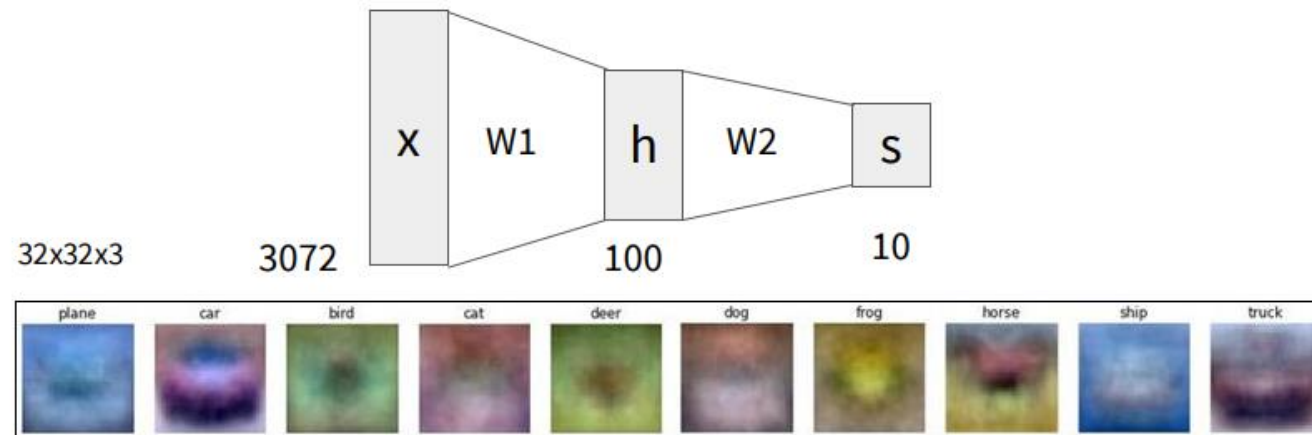
02 **VGG**

03 **ResNet**

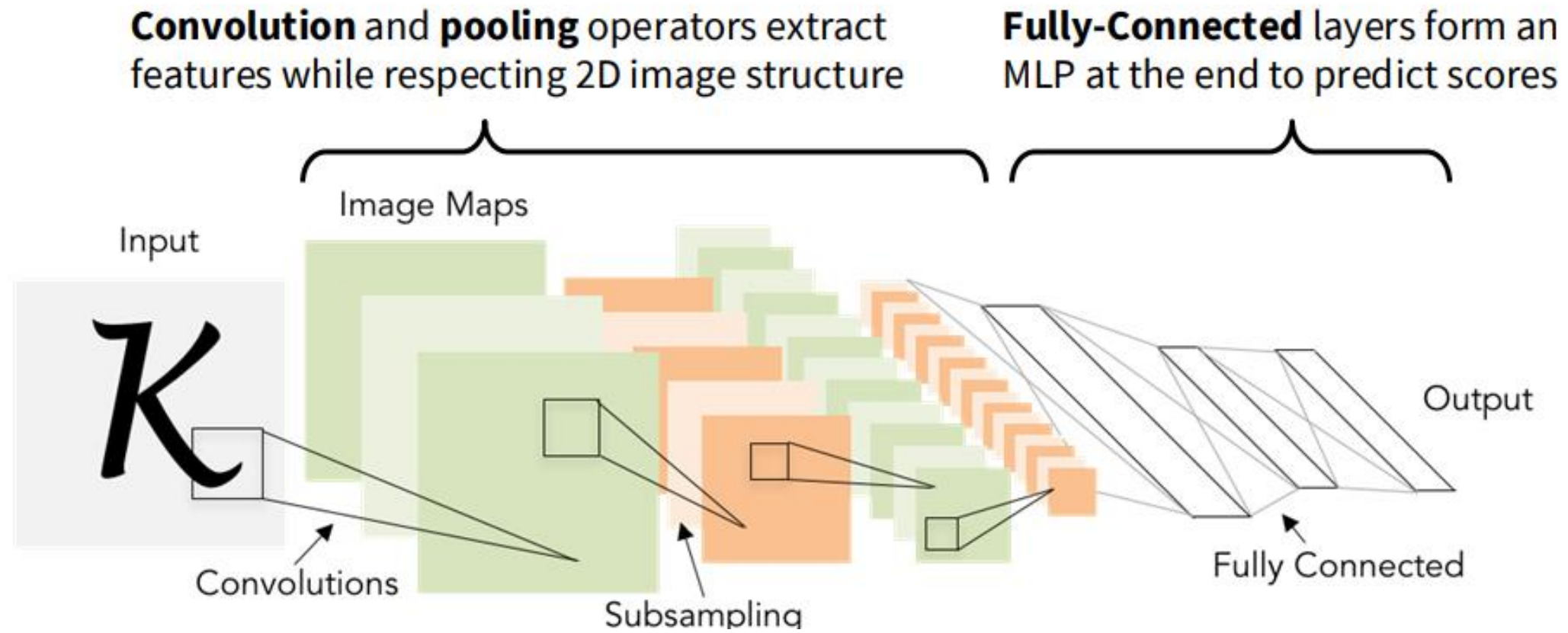
- Feature Extract



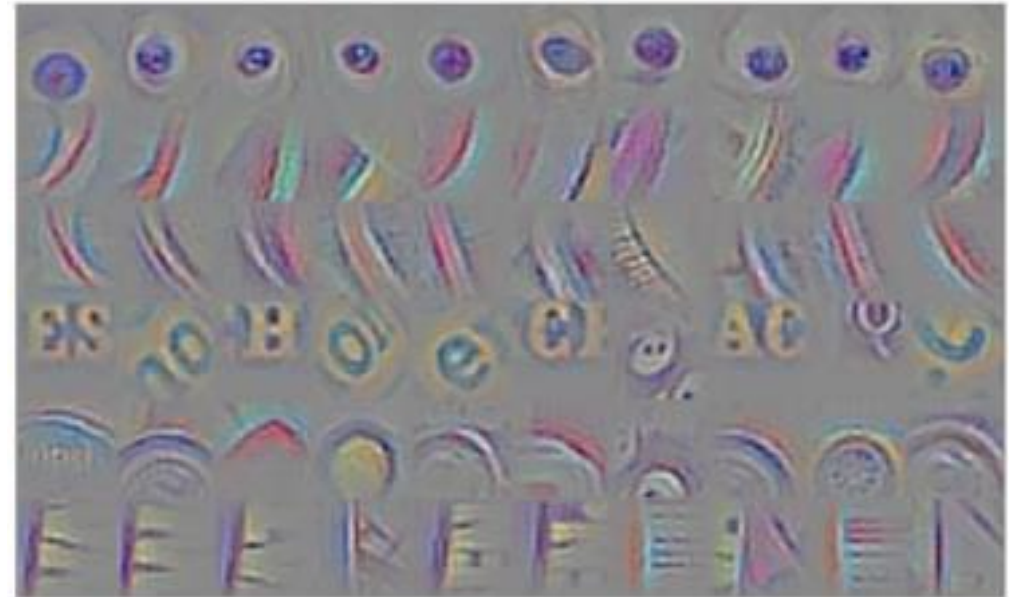
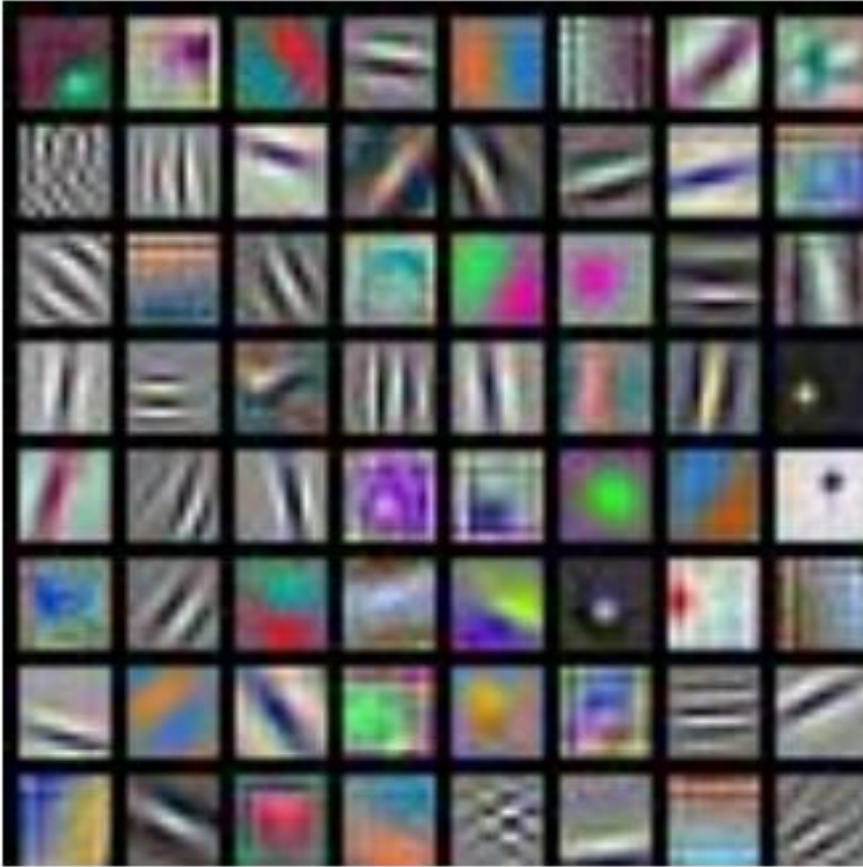
- Fully Connected Neural Network



- Convolution Neural Network

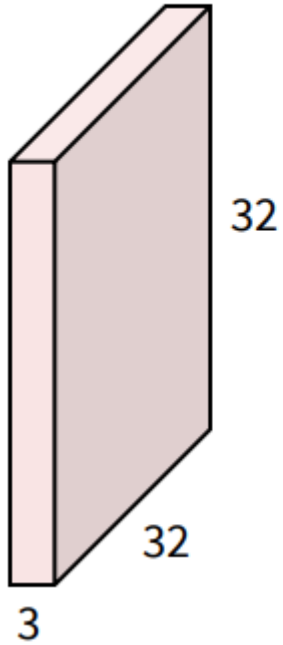


01 CNN : convolution layer



- Filter

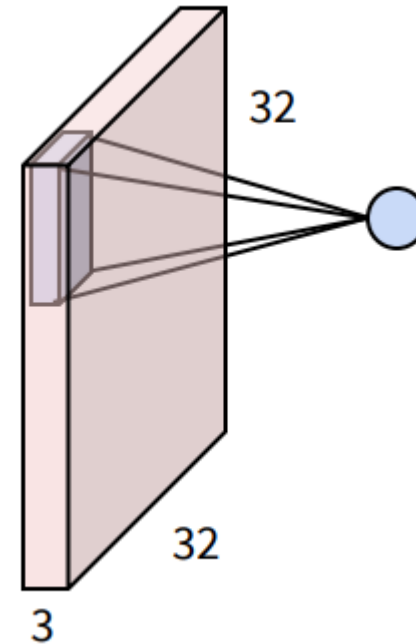
32x32x3 image



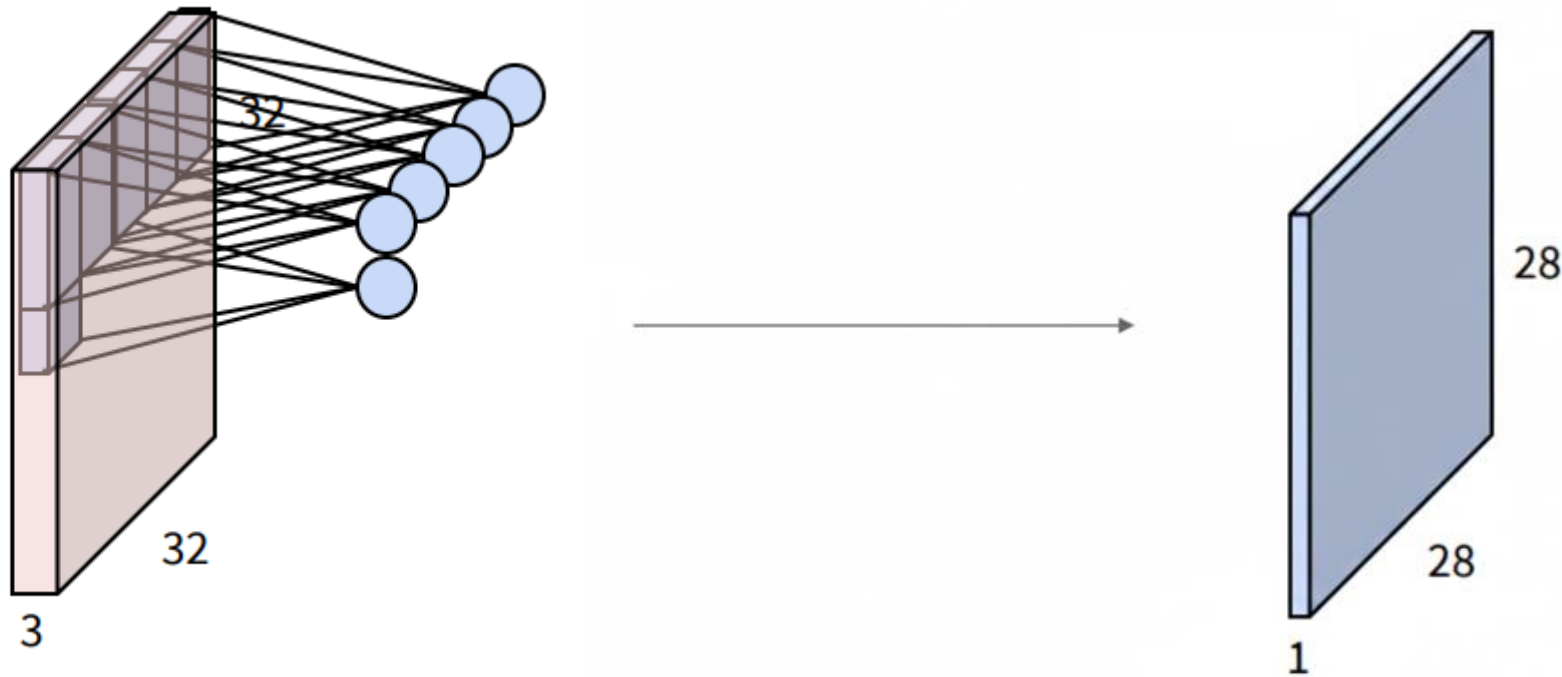
5x5x3 filter



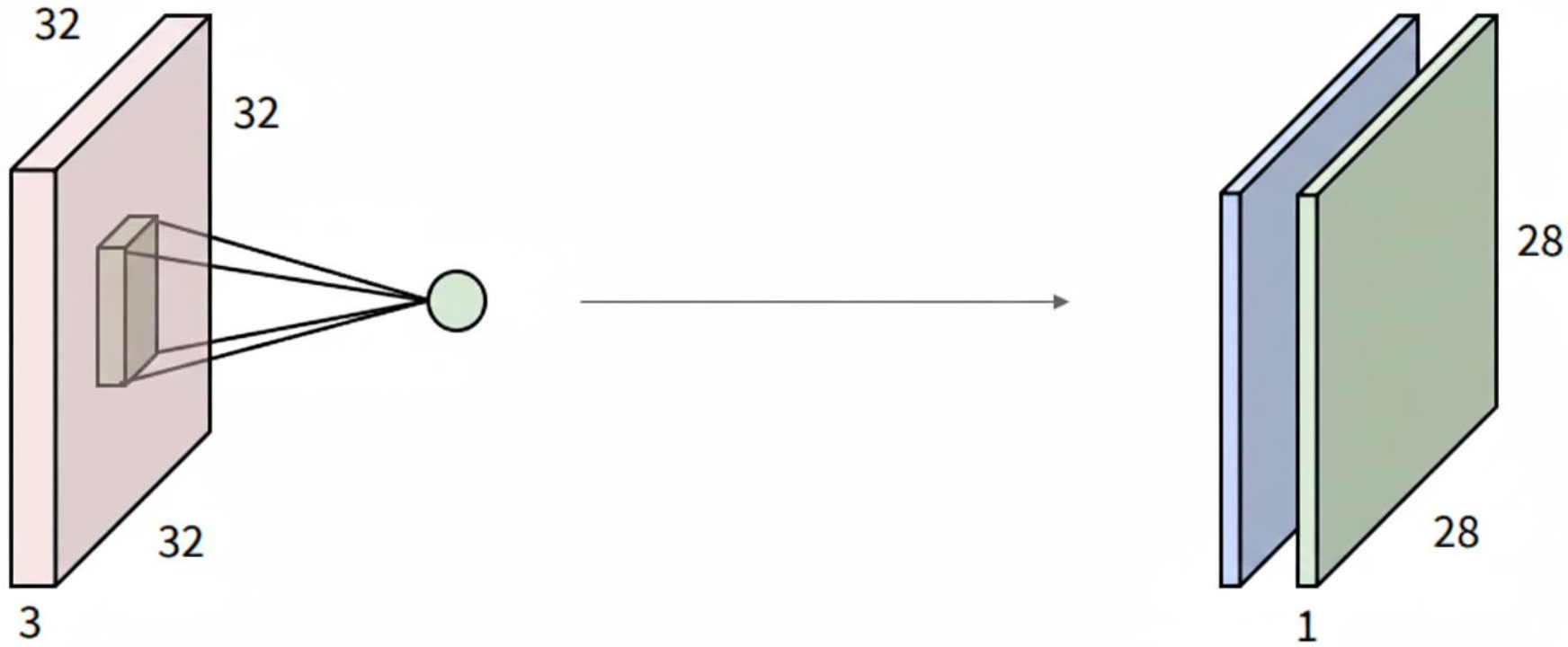
$$w^T x + b$$



- Filter

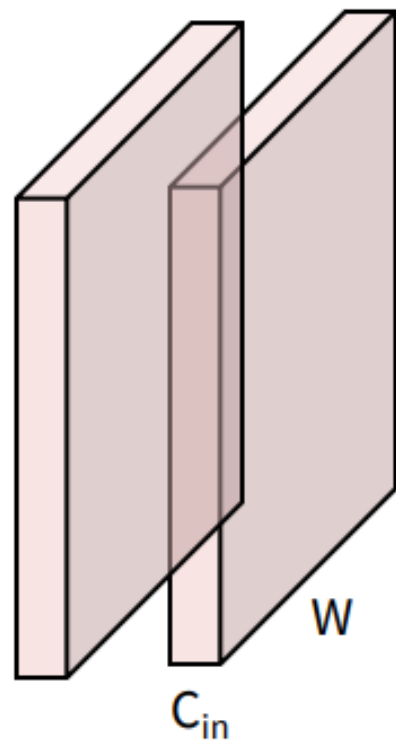


- Filter

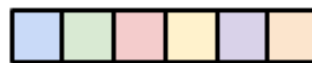


Convolution Layer

$N \times C_{in} \times H \times W$
Batch of images



Also C_{out} -dim bias vector:



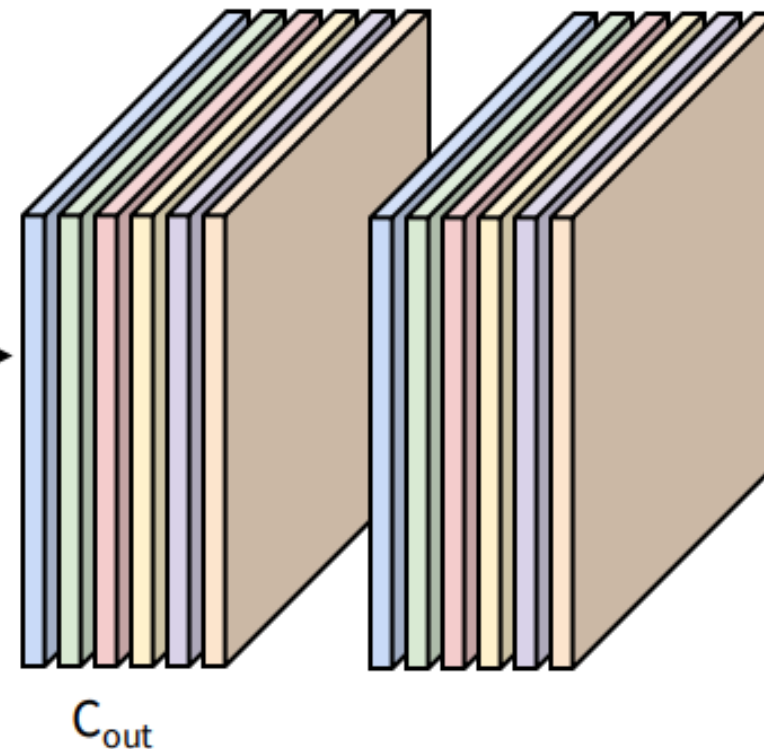
Convolution
Layer

H

$C_{out} \times C_{in} \times K_w \times K_h$
filters



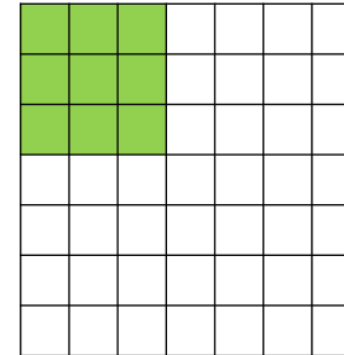
$N \times C_{out} \times H' \times W'$
Batch of outputs



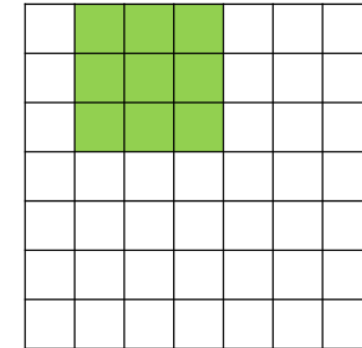
- Padding

0	0	0	0	0	0	0	0	0
0								0
0								0
0								0
0								0
0								0
0								0
0								0
0	0	0	0	0	0	0	0	0

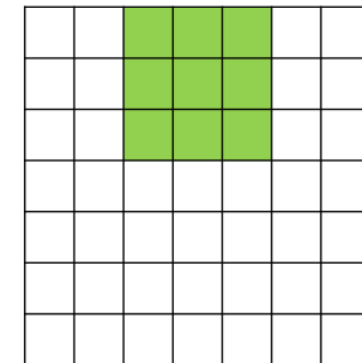
- Stride



stride = 1

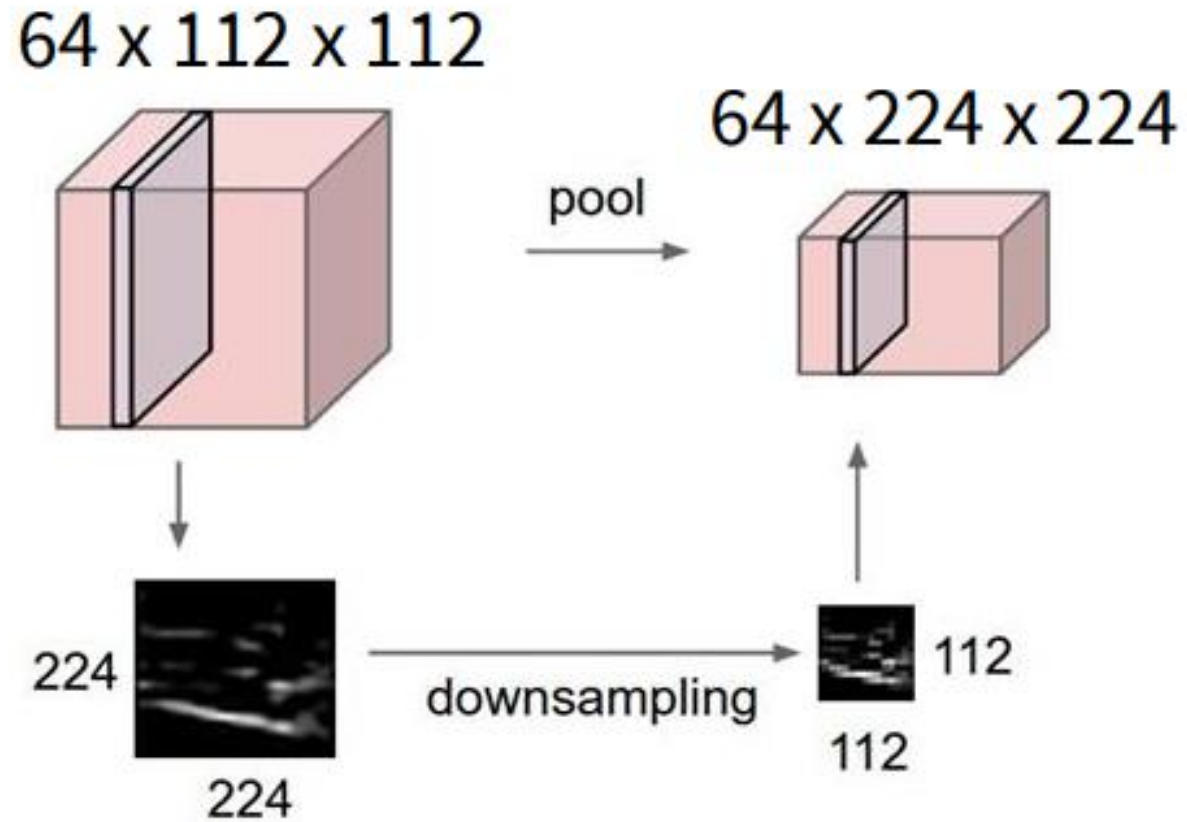


stride = 2



$$\text{OutputSize} = \frac{W - K + 2P}{S} + 1$$

- Pooling



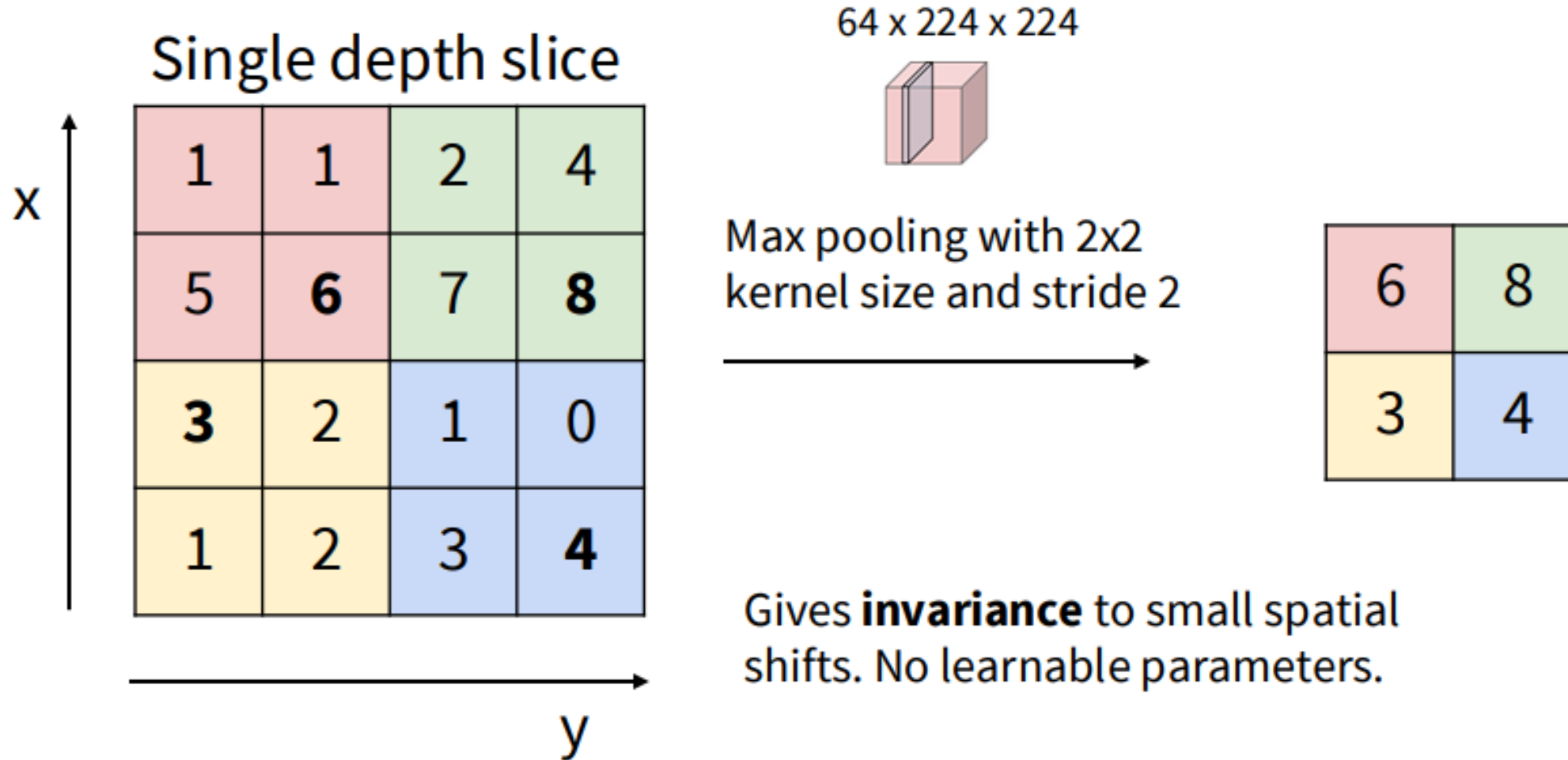
Hyperparameters:

Kernel Size

Stride

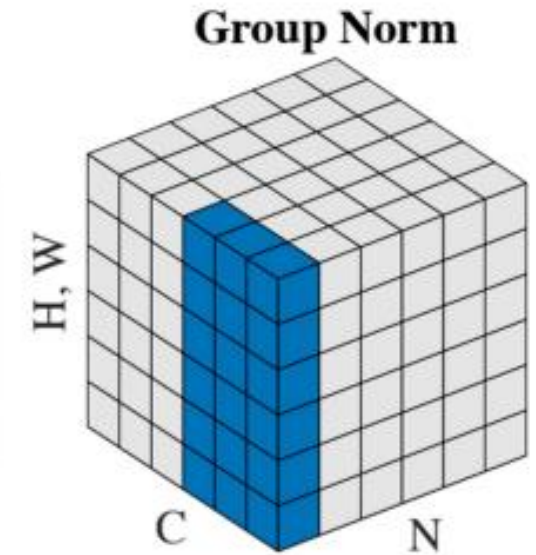
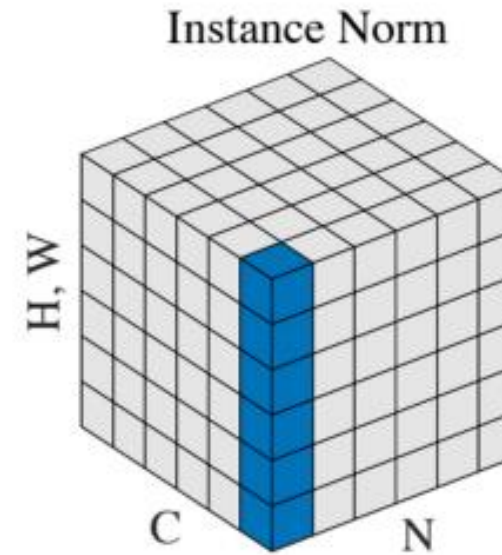
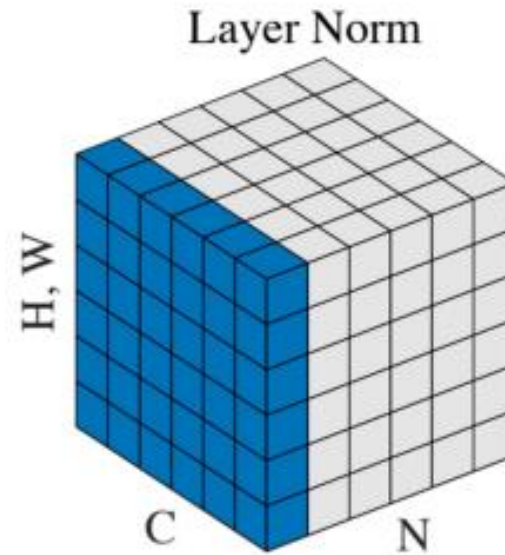
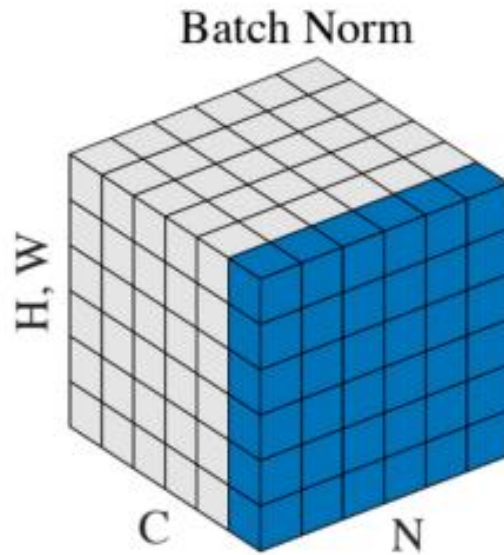
Pooling function

- Example: max pooling

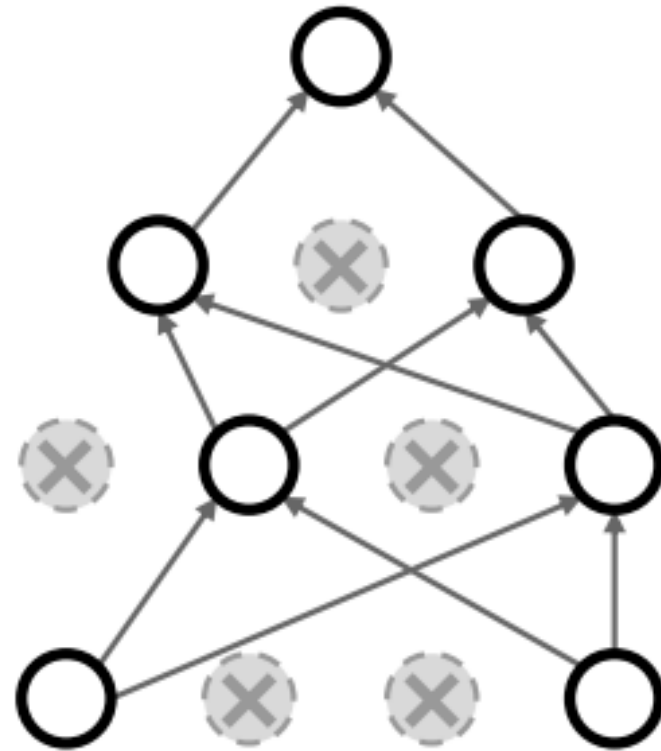
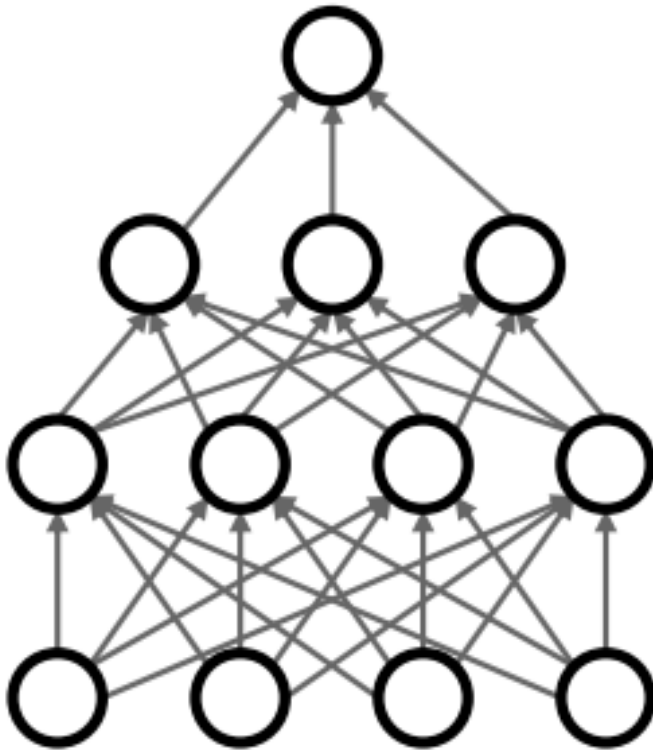


- Normalization

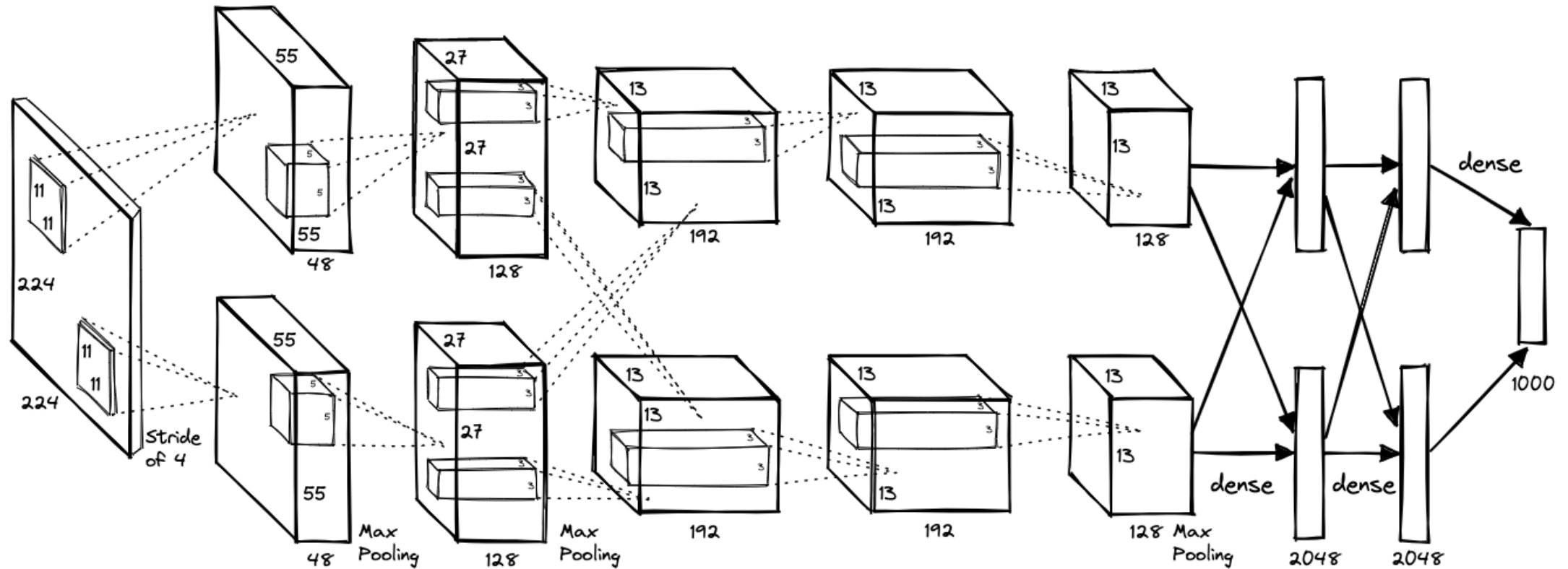
$$y = \gamma (x - \mu) / \sigma + \beta$$



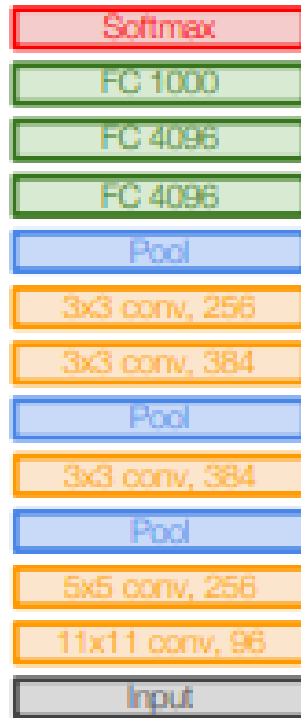
- Drop out



- AlexNet



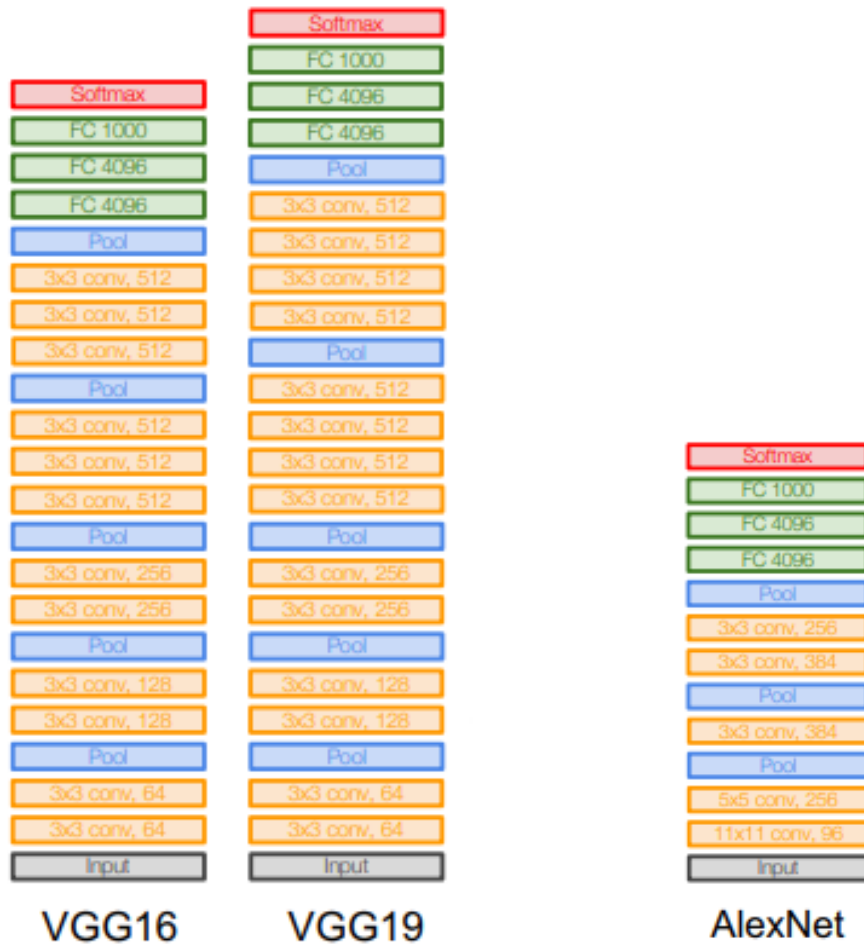
- AlexNet



AlexNet

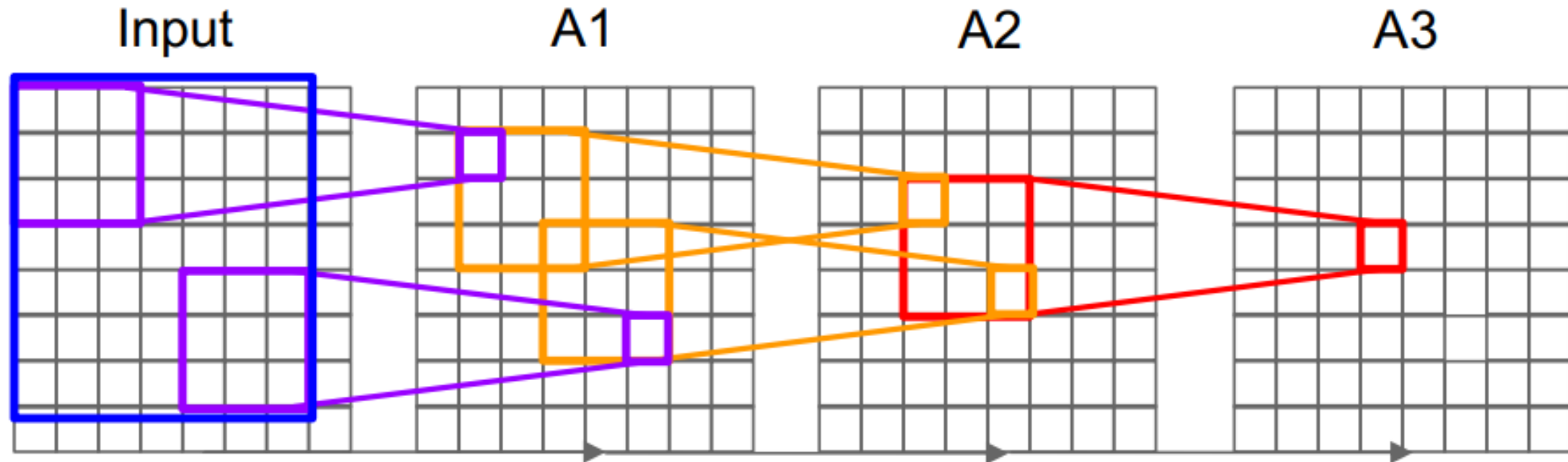
1. Deep layer
2. ReLU
3. GPU
4. Dropout

- VGG



1. Deeper layer
2. Small filter

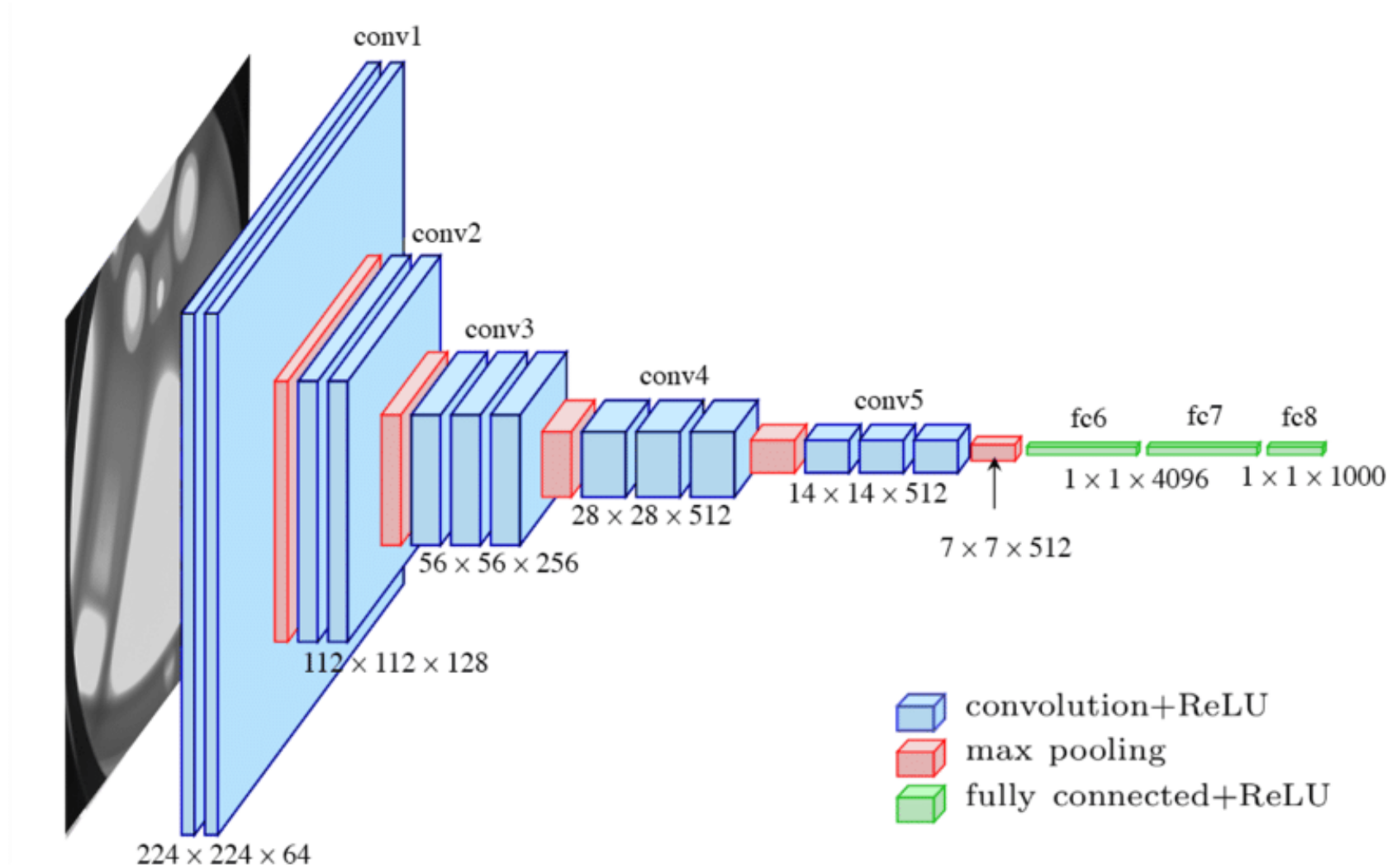
- Receptive Field



$$7 \times 7 \times C^2 = 49C^2$$

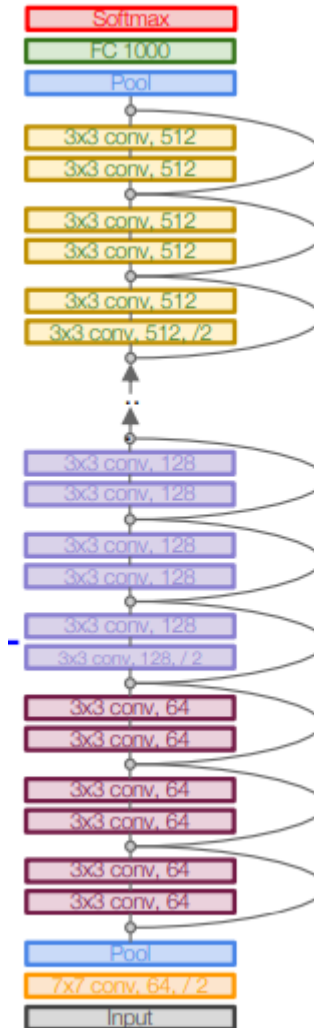
$$3 \times 3 \times 3 \times C^2 = 27C^2$$

- VGG



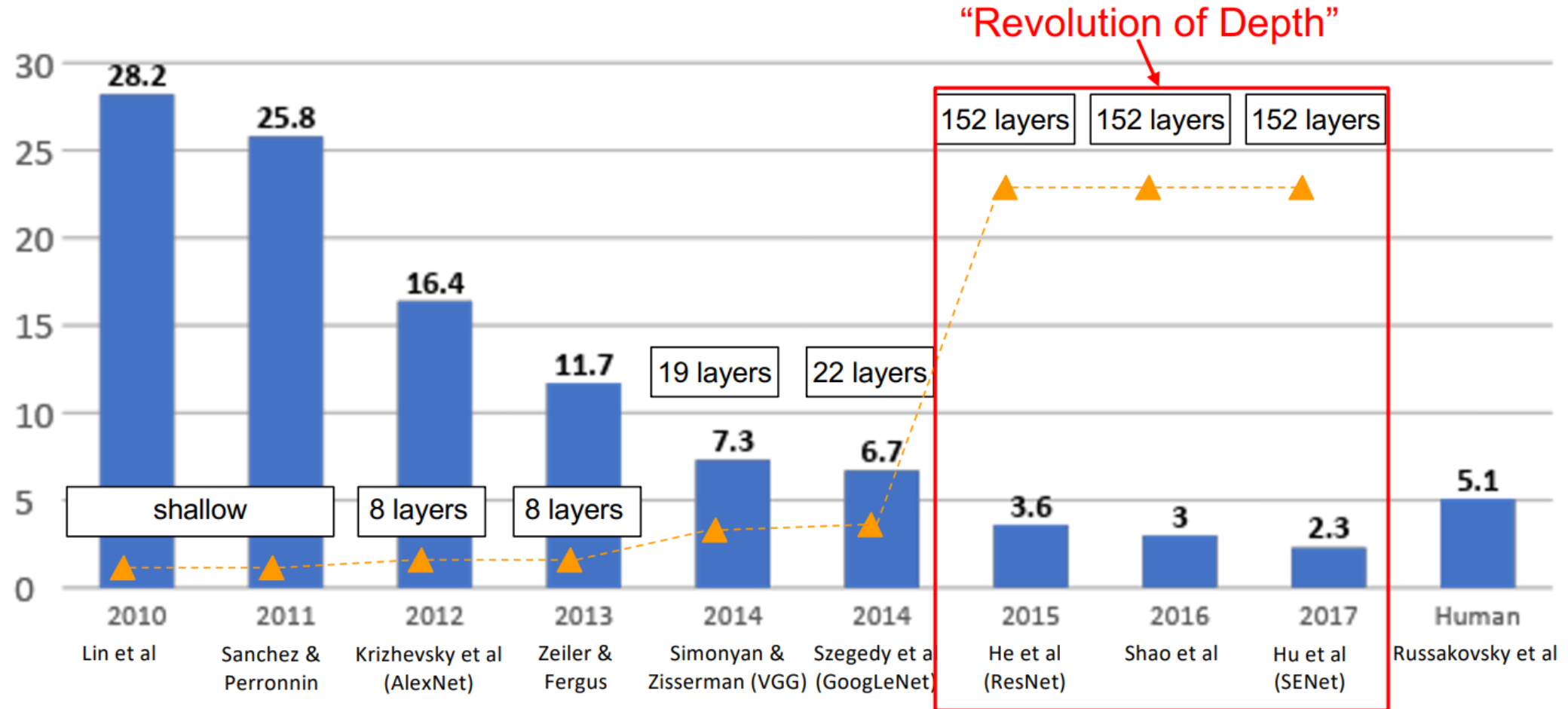
03 ResNet

- ResNet

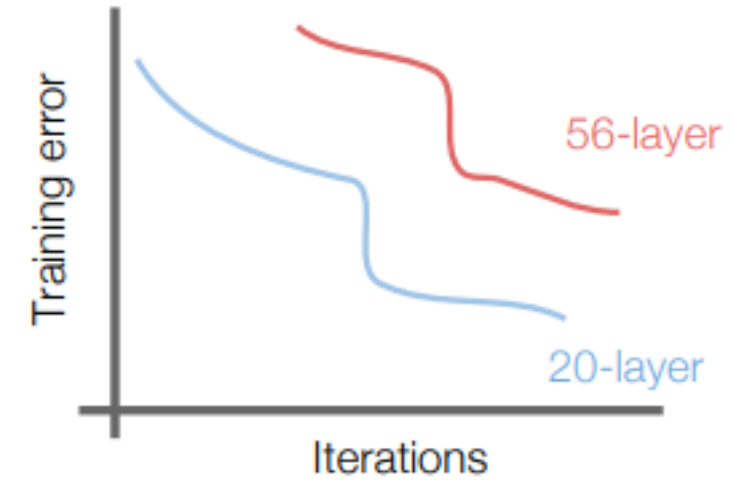
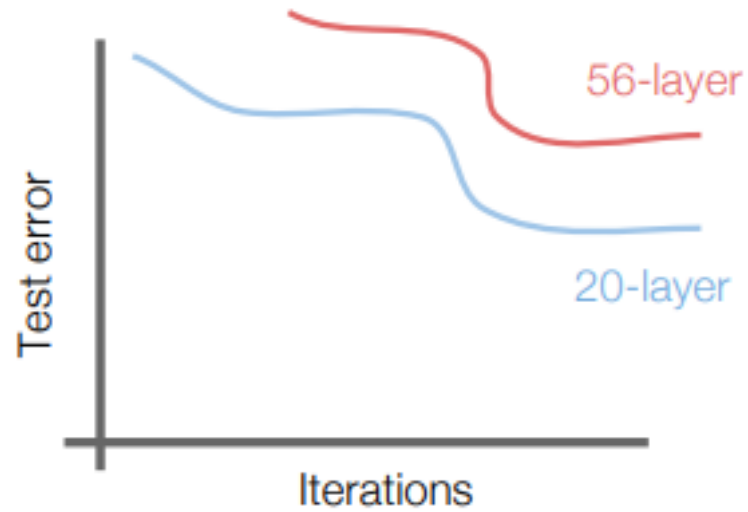


- 152 layers

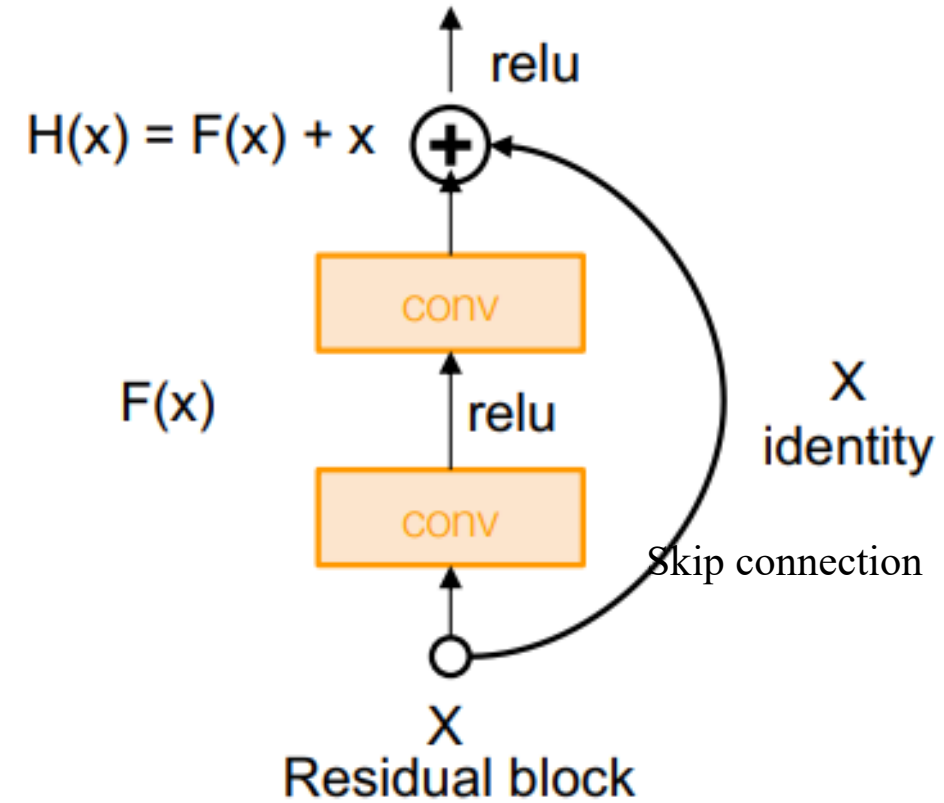
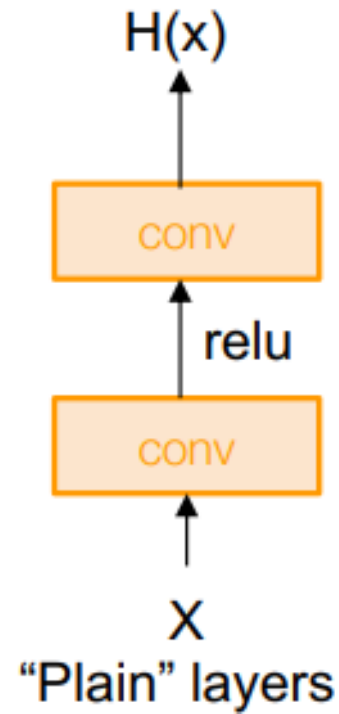
- ImageNet Large Scale Visual Recognition Challenge(ILSVRC) winners



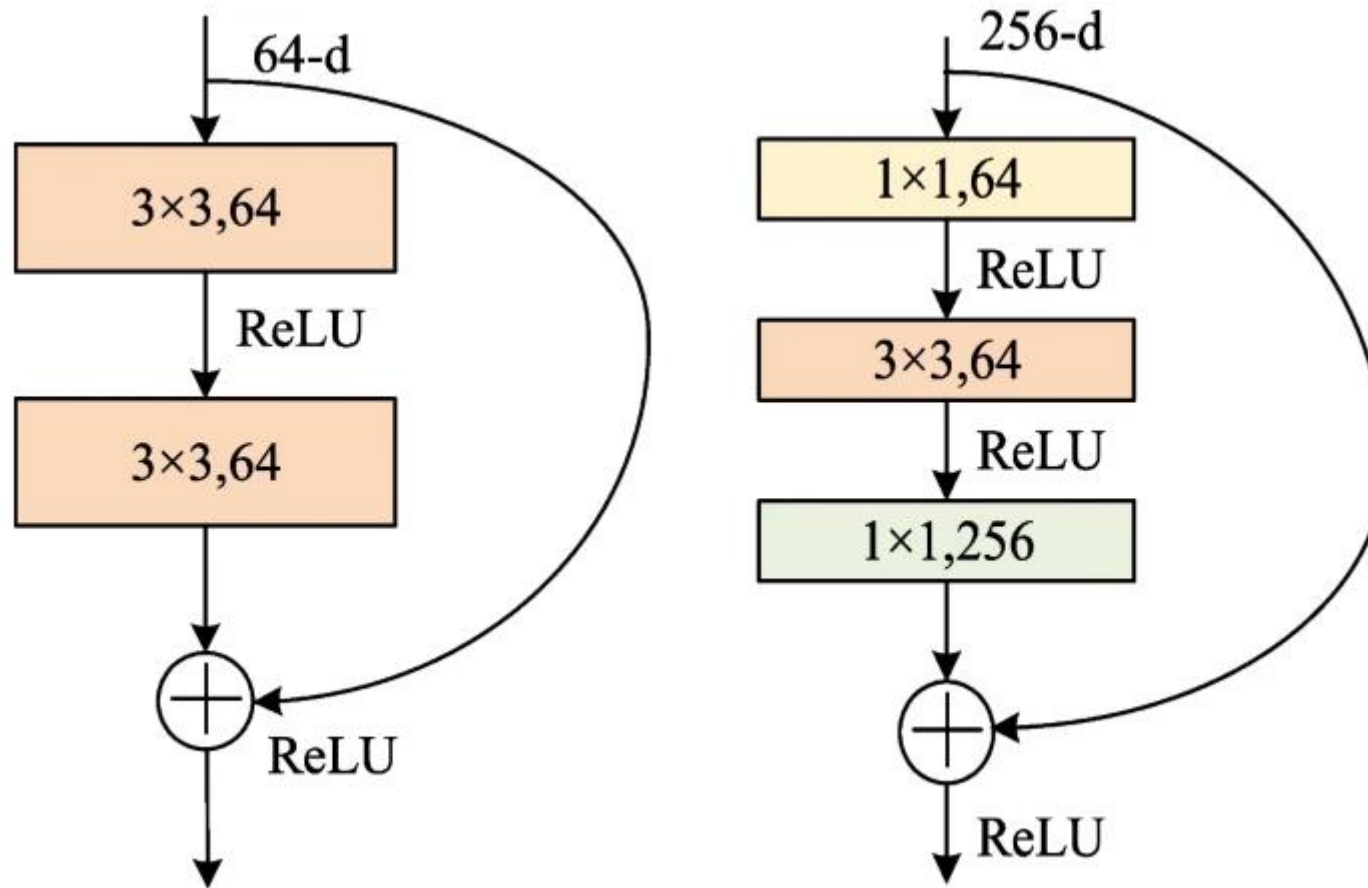
- Deeper layer on a plain convolution neural network



- Residual Learning



- Bottleneck Block



- ResNet



1. Deeper layer (152 layer)
2. Skip connection
3. Bottleneck



Thank You



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BrainLAB Journal Club
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