Reinforcement Learning

Lab #6: Convolutional Neural Networks

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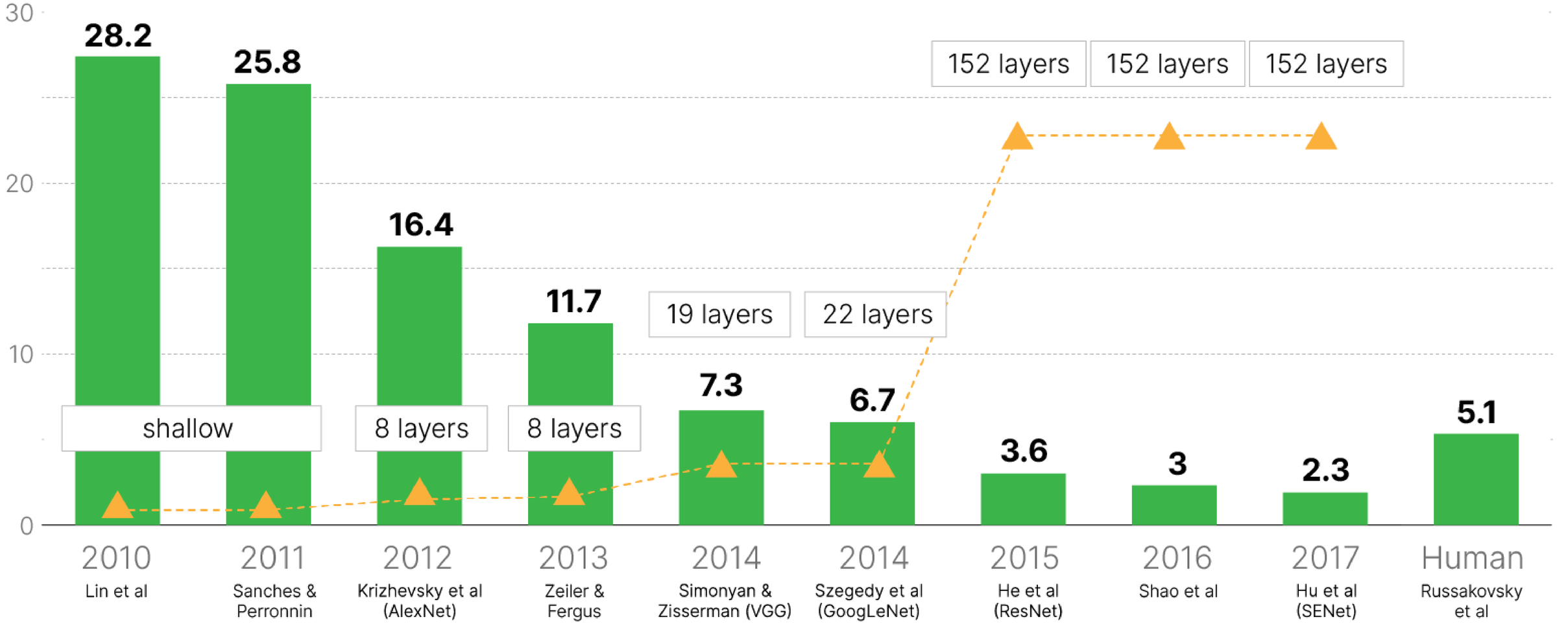
Completely based on msu.ai lectures

Test questions for today (up to 1 point):

1. What is your name?
2. What is TA’s name?
3. How you think, what graded activity will give you the second usual test point?

ImageNet Large Scale Visual Recognition Challenge



ImageNet Large Scale Visual Recognition Challenge (2)

goldfish

scorpion

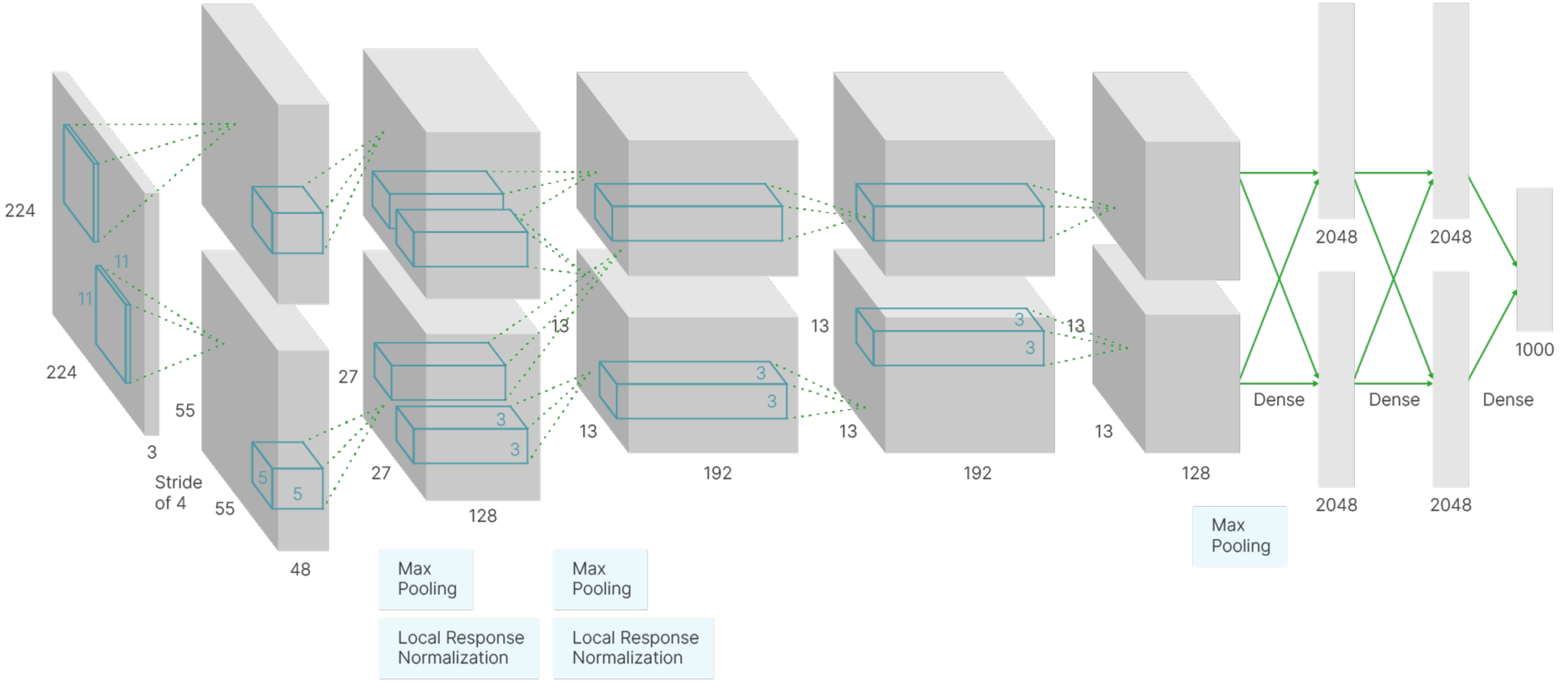
tick

centipede

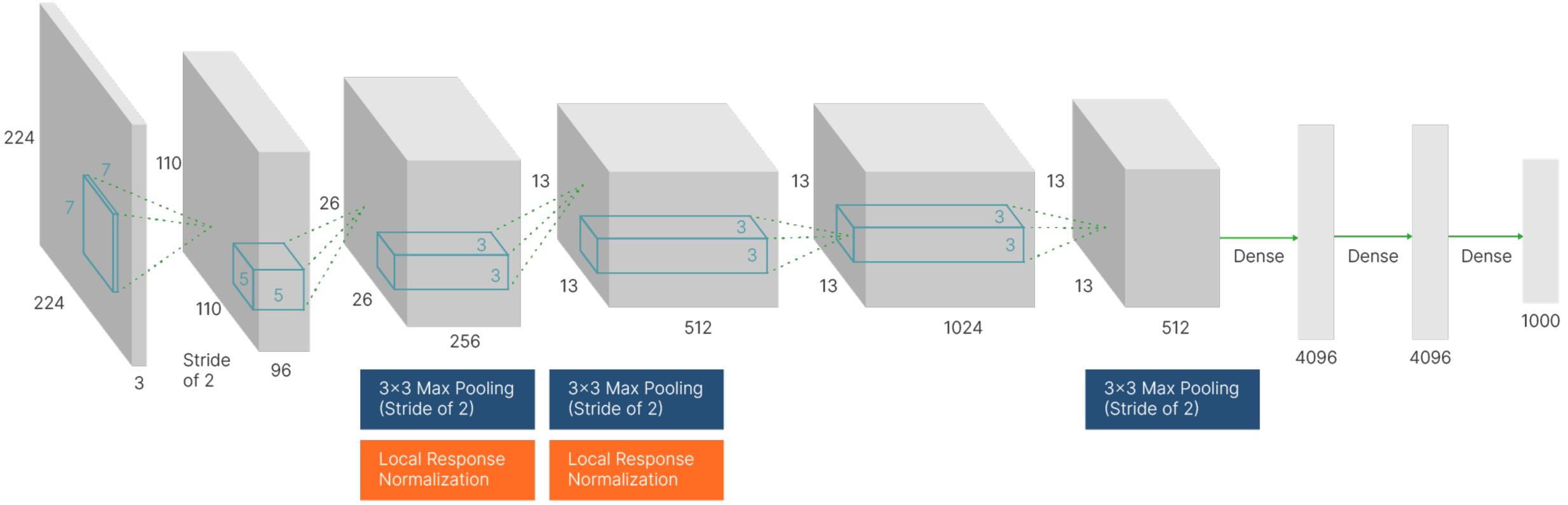
koala

snail

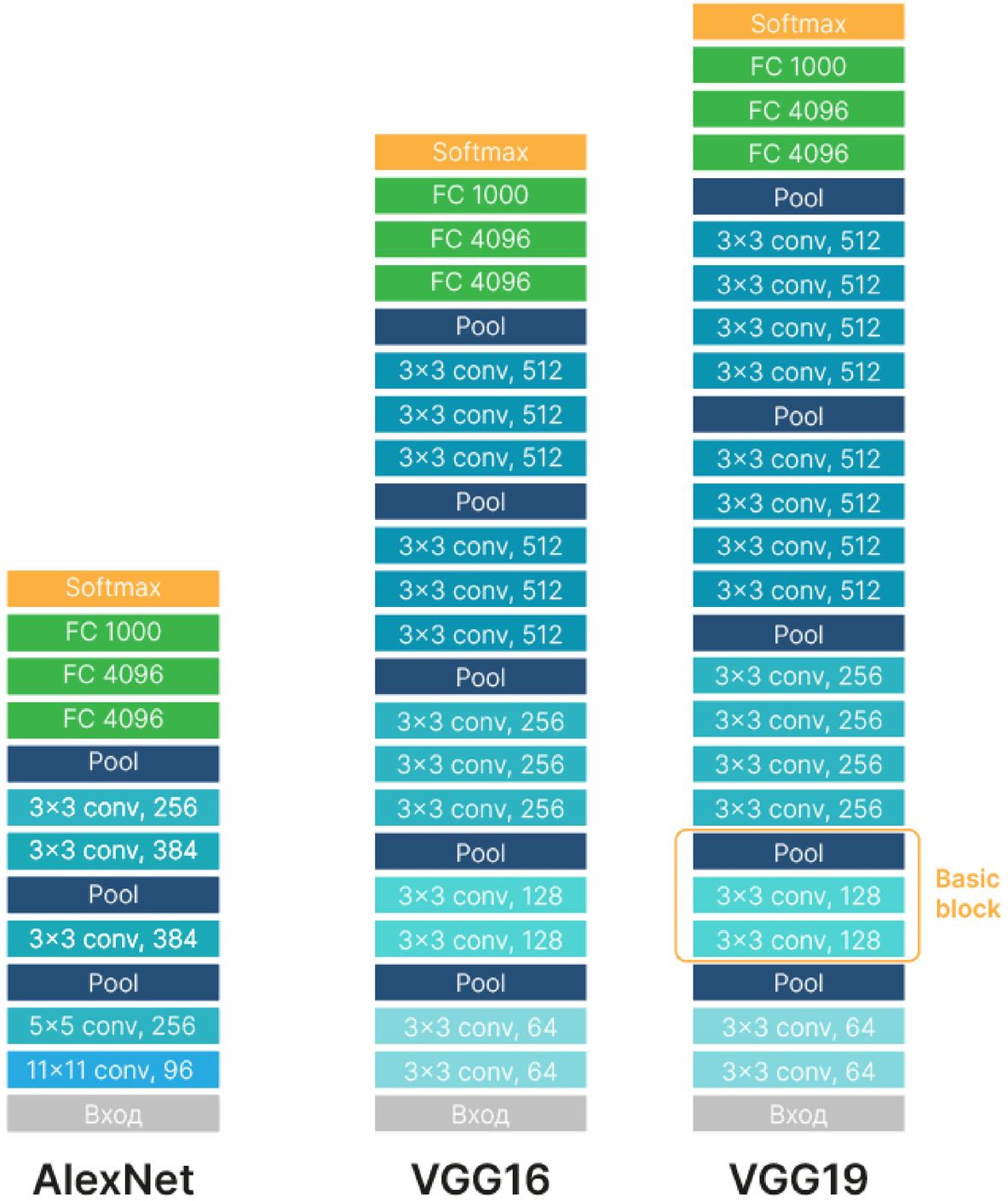
AlexNet (2012)



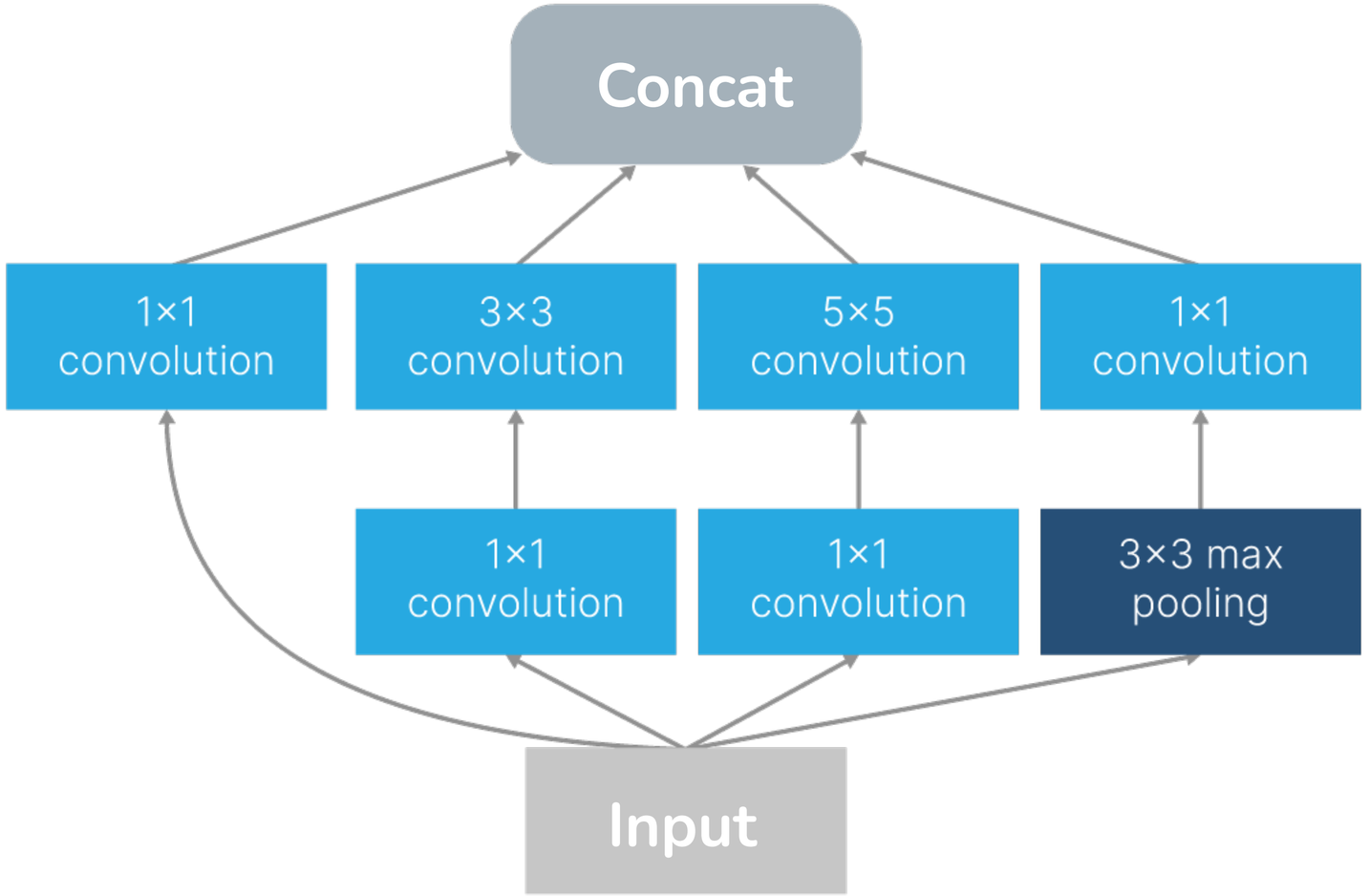
ZFNet (2013)


224
7
7
224
3
110
Stride
of 2
5
5
110
96
26
3
3
26
256
13
3
3
13
512
13
3
3
13
1024
13
13
512
Dense
4096
Dense
4096
Dense
1000
3×3 Max Pooling
(Stride of 2)
3×3 Max Pooling
(Stride of 2)
3×3 Max Pooling
(Stride of 2)
Local Response
Normalization
Local Response
Normalization

VGGNet (2014)

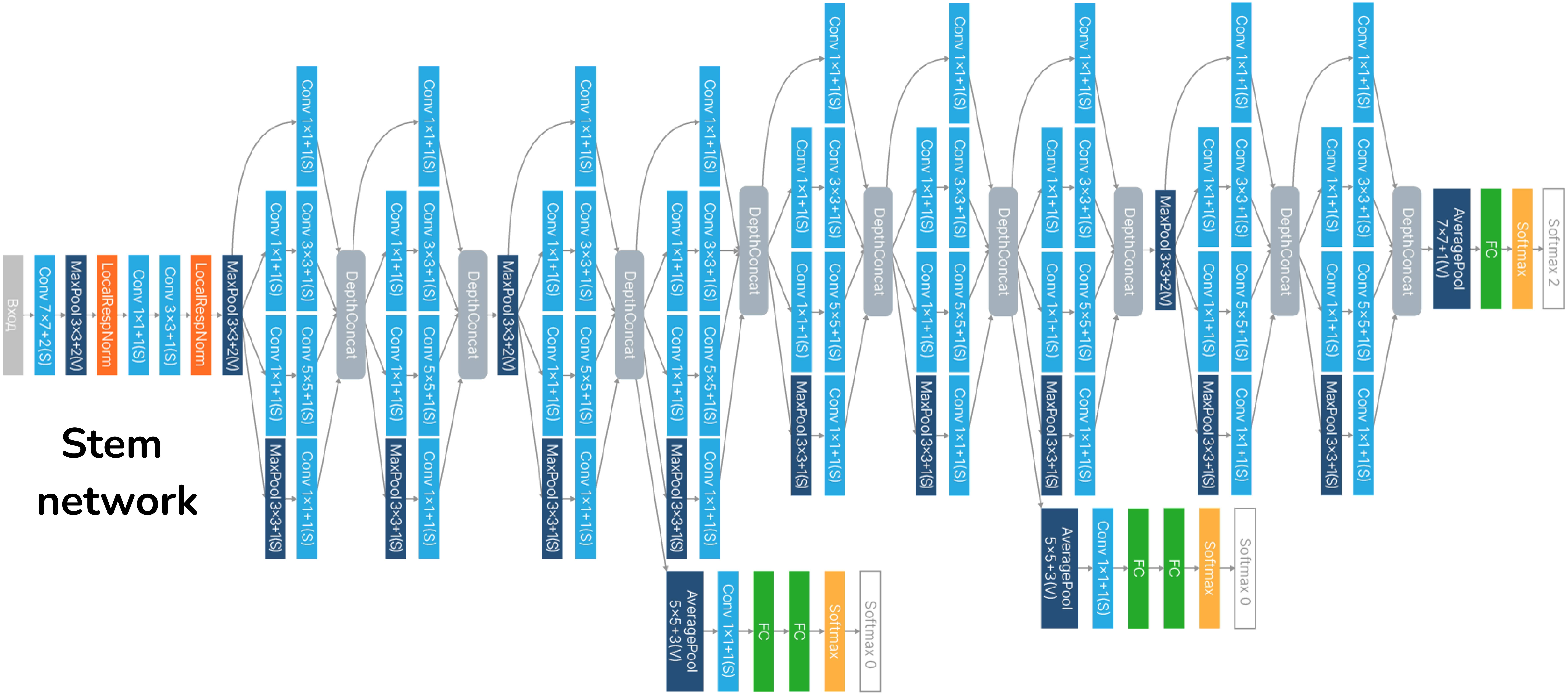

Softmax
FC 1000
FC 4096
FC 4096
Pool
3×3 conv, 256
3×3 conv, 384
Pool
3×3 conv, 384
Pool
5×5 conv, 256
11×11 conv, 96
Вход
AlexNet
Softmax
FC 1000
FC 4096
FC 4096
Pool
3×3 conv, 512
3×3 conv, 512
3×3 conv, 512
Pool
3×3 conv, 512
3×3 conv, 512
3×3 conv, 512
Pool
3×3 conv, 256
3×3 conv, 256
3×3 conv, 256
Pool
3×3 conv, 128
3×3 conv, 128
Pool
3×3 conv, 64
3×3 conv, 64
Вход
VGG16
Softmax
FC 1000
FC 4096
FC 4096
Pool
3×3 conv, 512
3×3 conv, 512
3×3 conv, 512
3×3 conv, 512
Pool
3×3 conv, 512
3×3 conv, 512
3×3 conv, 512
3×3 conv, 512
Pool
3×3 conv, 256
3×3 conv, 256
3×3 conv, 256
3×3 conv, 256
Pool
3×3 conv, 128
3×3 conv, 128
Pool
3×3 conv, 64
3×3 conv, 64
Вход
VGG19
Basic block

GoogLeNet (2014) | Inception module

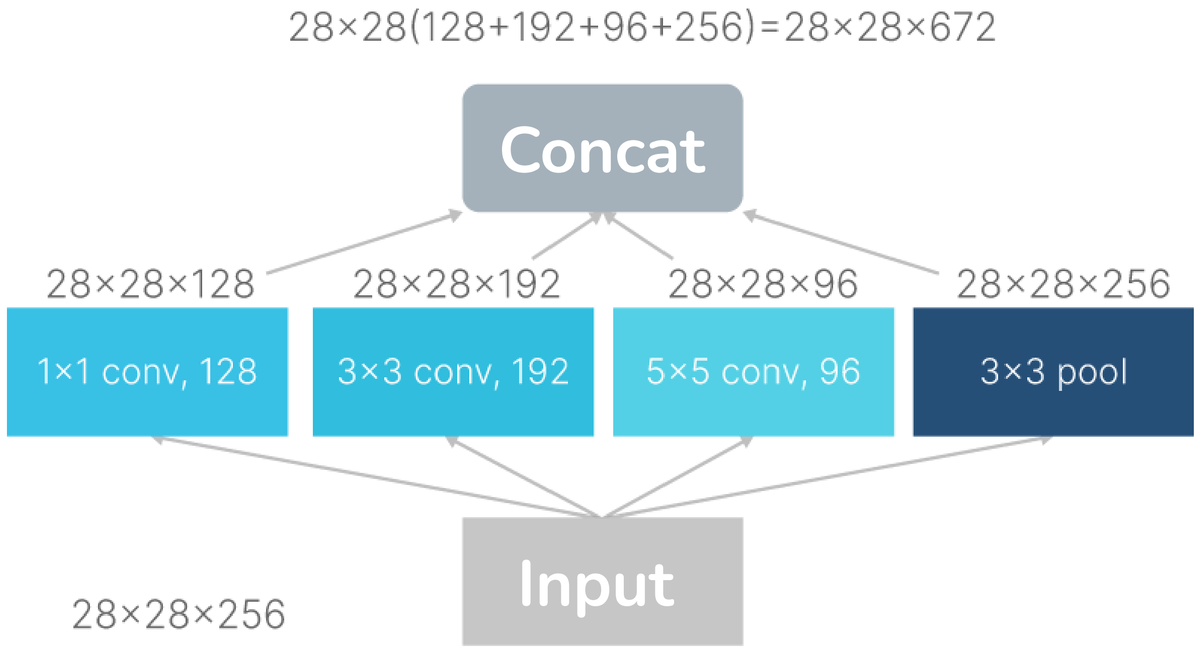


Inception Module

GoogLeNet (2014) | Architecture



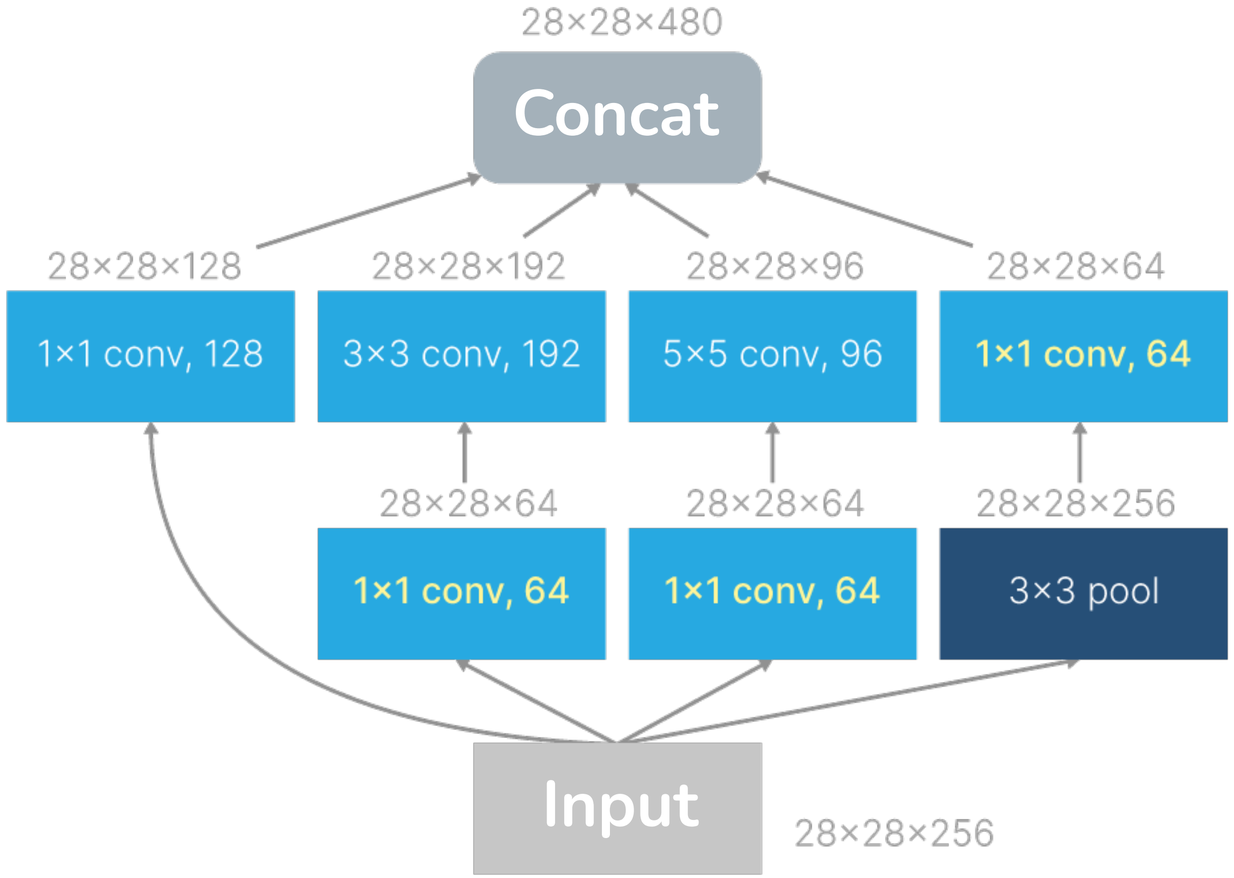
GoogLeNet (2014) | Naïve Inception Module



Naive Inception Module

Conv Ops:
[1×1 conv, 128] 28×28×128×1×1×256
[3×3 conv, 192] 28×28×192×3×3×256
[5×5 conv, 96] 28×28×96×5×5×256
Total: 854M ops

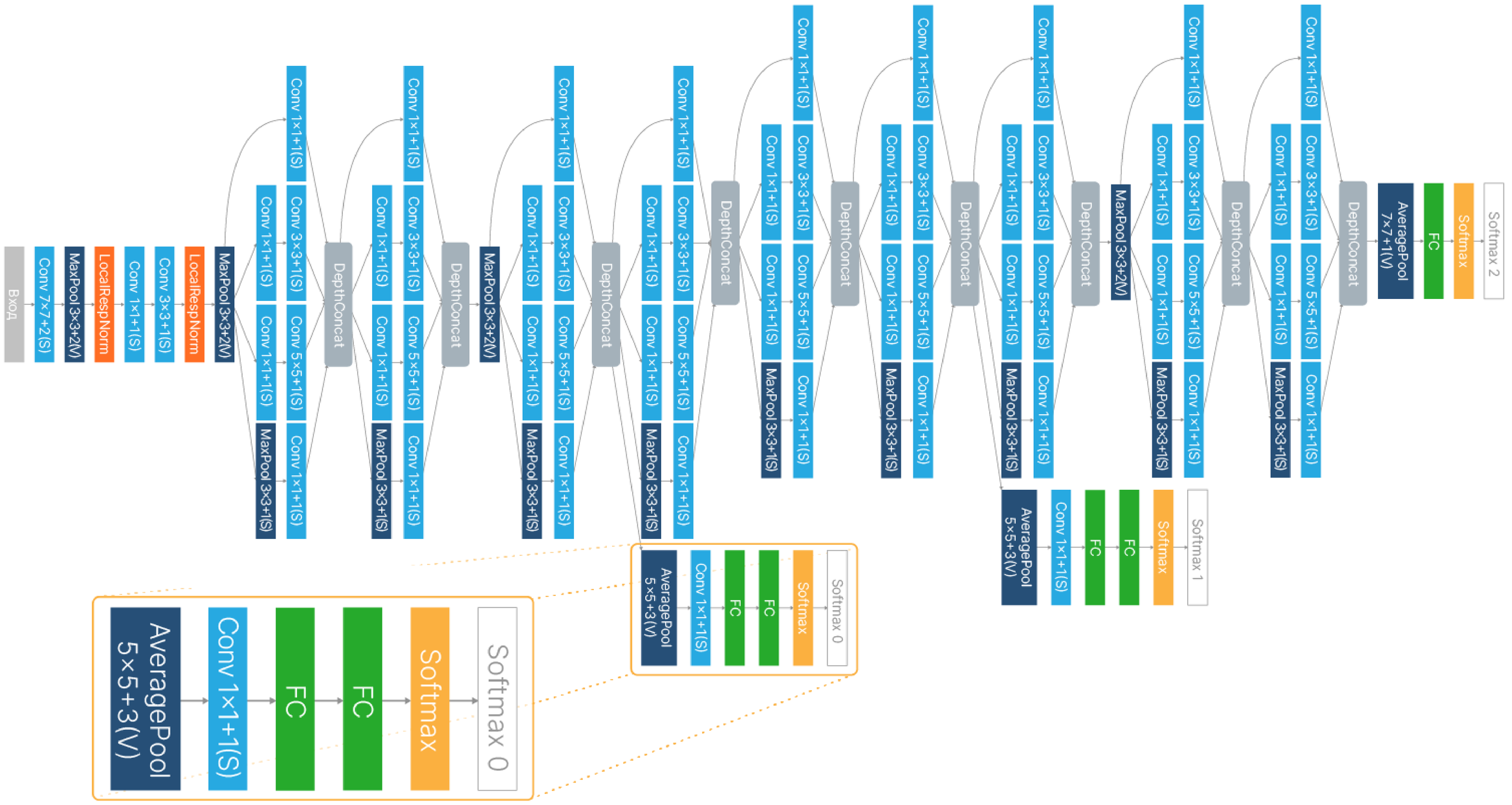
GoogLeNet (2014) | Inception Module



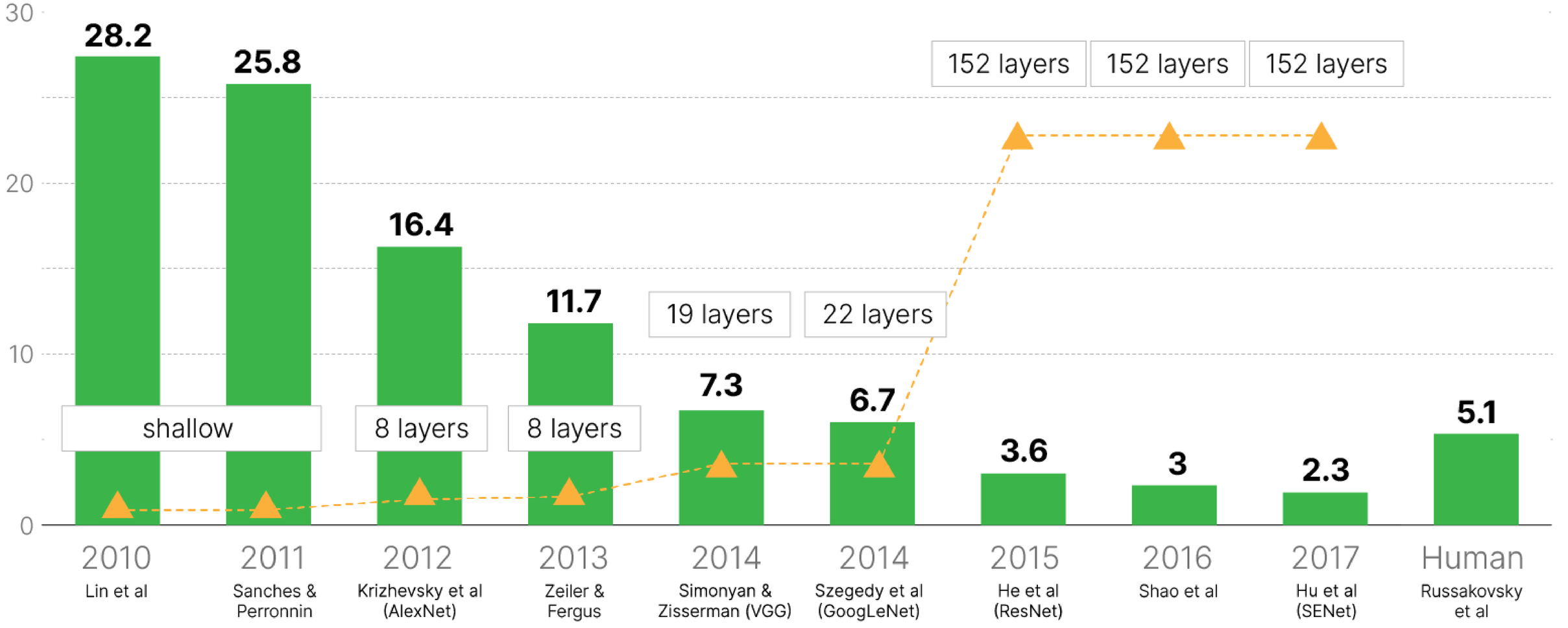
Naive Inception Module with dimension reduction

Conv Ops:
[1×1 conv, 64] 28×28×64×1×1×256
[1×1 conv, 64] 28×28×64×1×1×256
[1×1 conv, 128] 28×28×128×1×1×256
[3×3 conv, 192] 28×28×192×3×3×64
[5×5 conv, 96] 28×28×96×5×5×64
[1×1 conv, 64] 28×28×64×1×1×256
Total: 358M ops

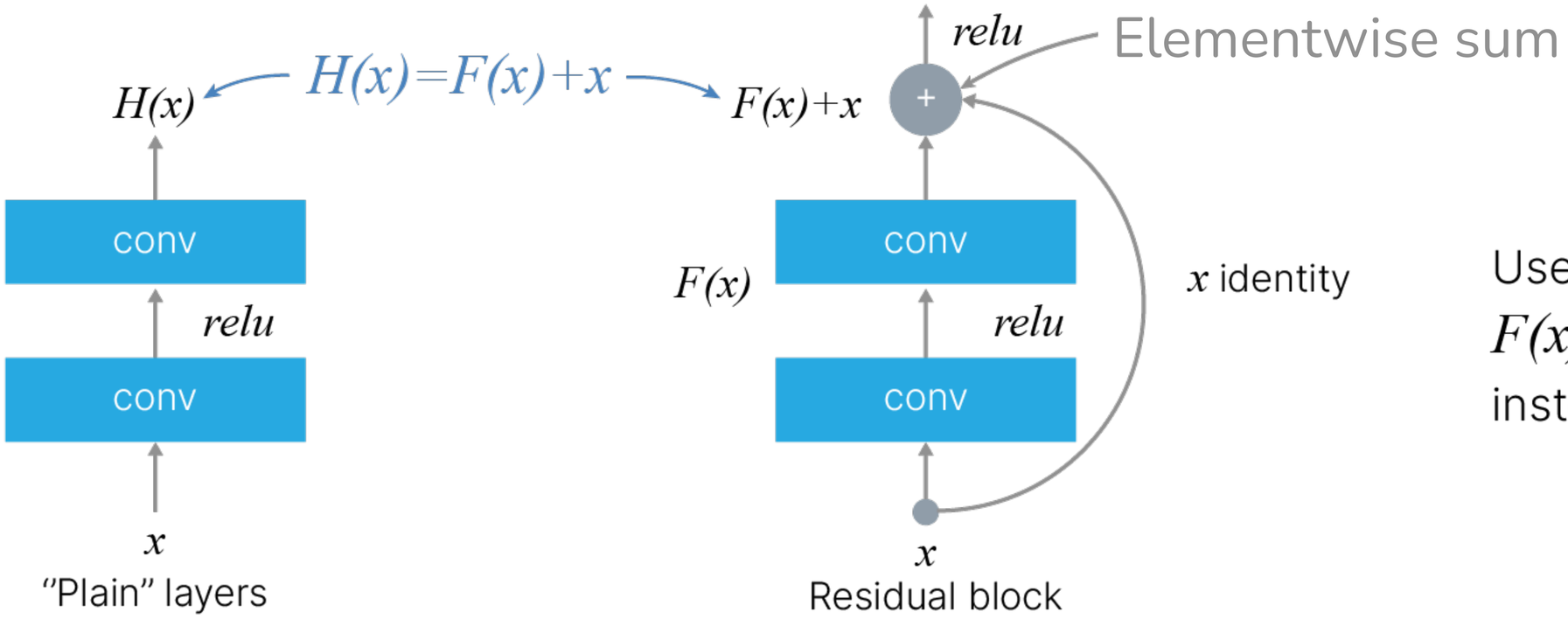
GoogLeNet (2014) | Vanishing gradients



ImageNet Large Scale Visual Recognition Challenge



ResNet (2015) | Residual Connection

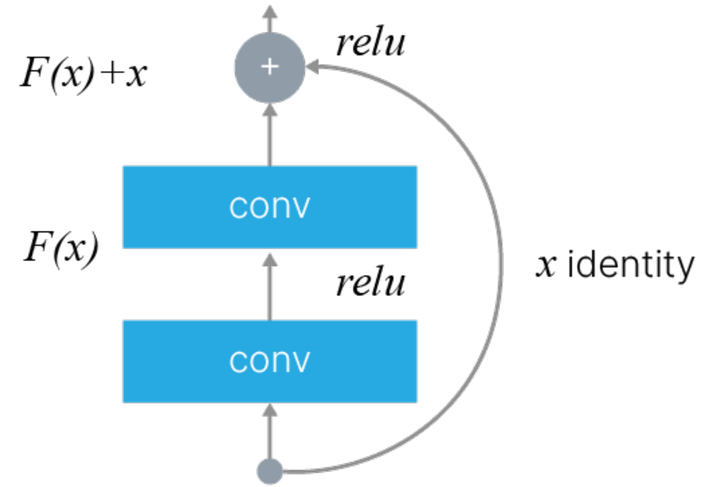


Use layers to fit residual

$F(x) = H(x) - x$

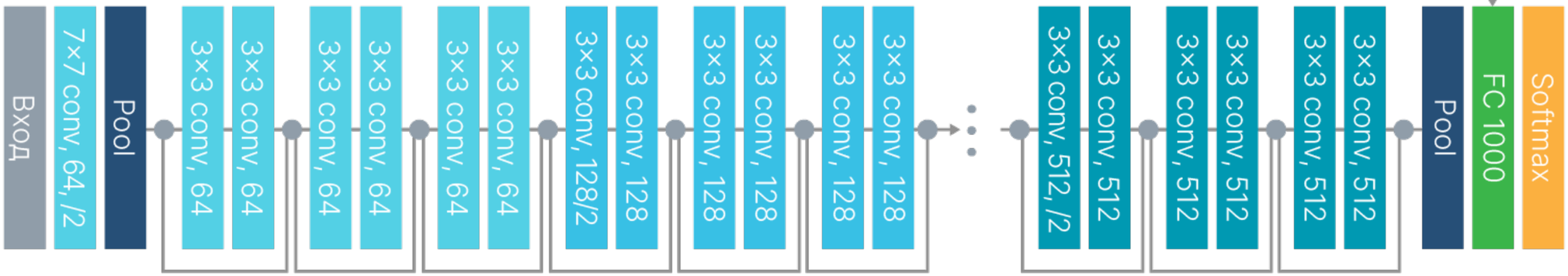
instead of $H(x)$ directly

ResNet (2015) | Architecture

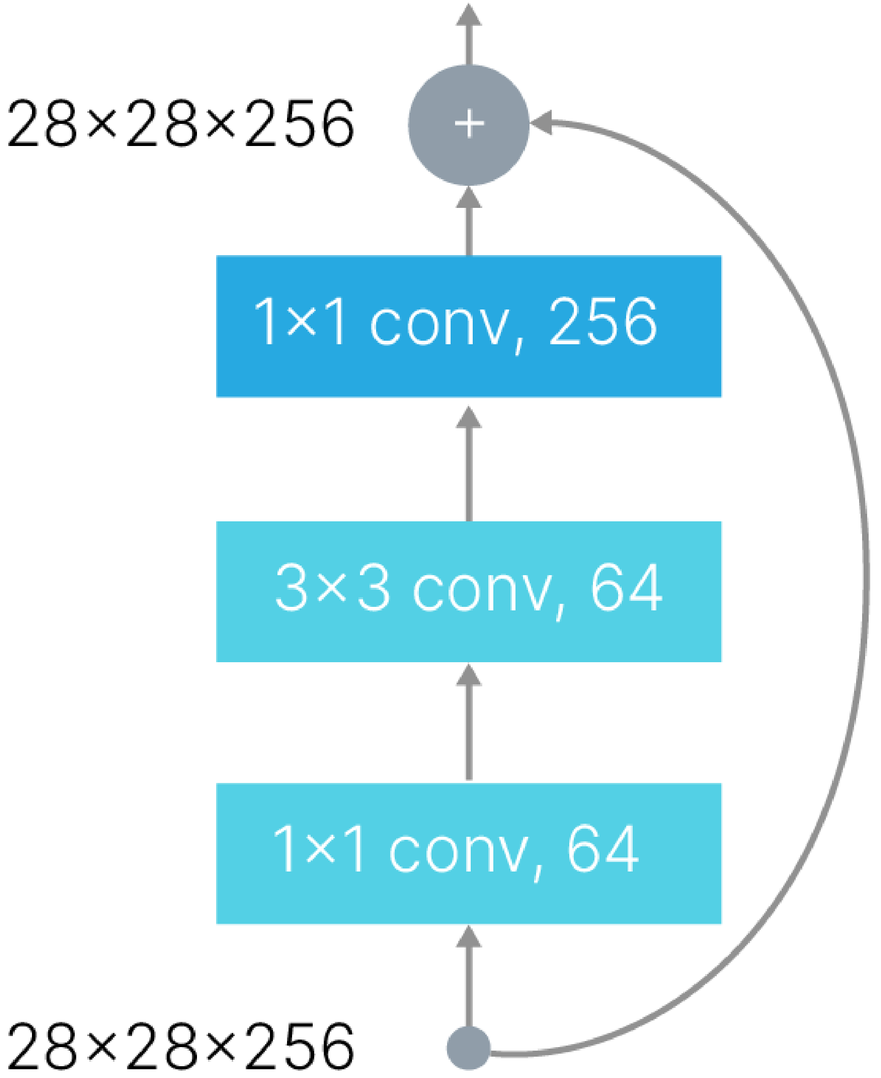


Apply BatchNorm after each conv layer before activation

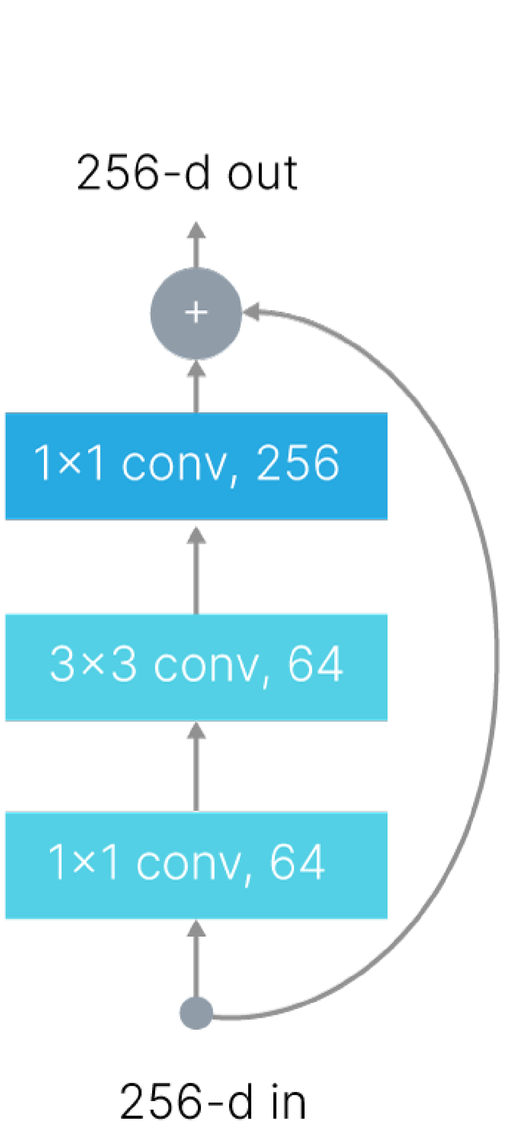
Global Average Pooling instead of FCs

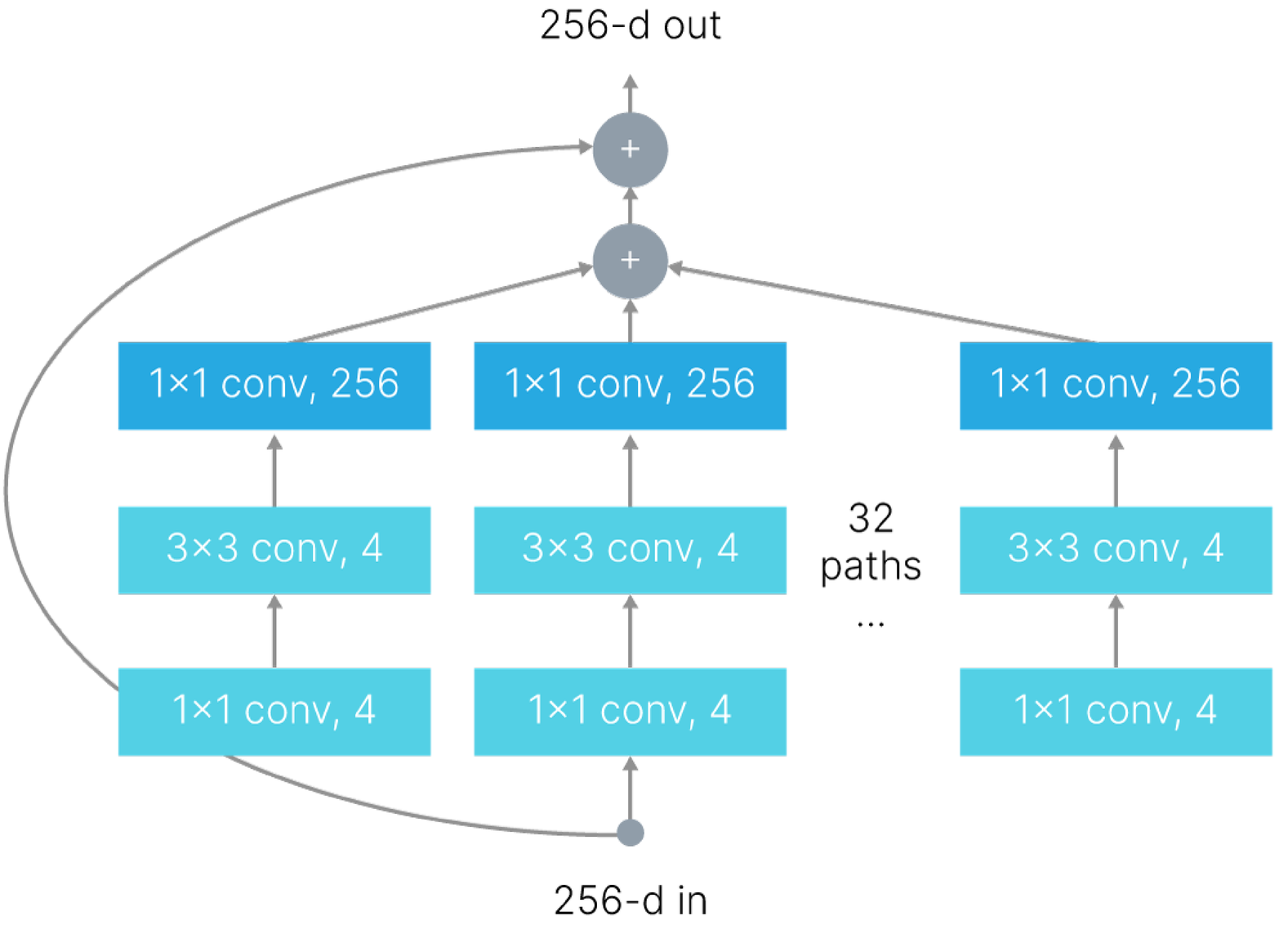


ResNet (2015) | Bottleneck layer

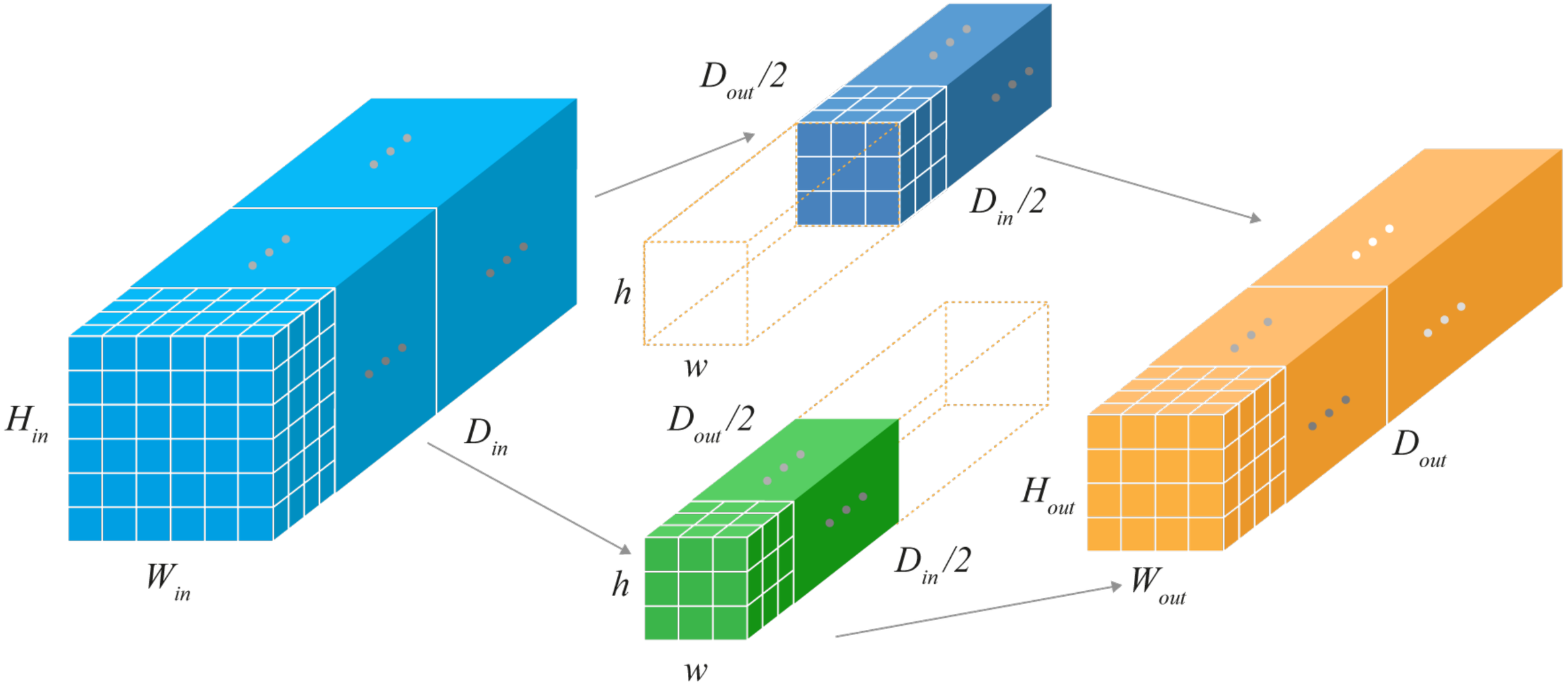


ResNeXt (2015) | Basic Block

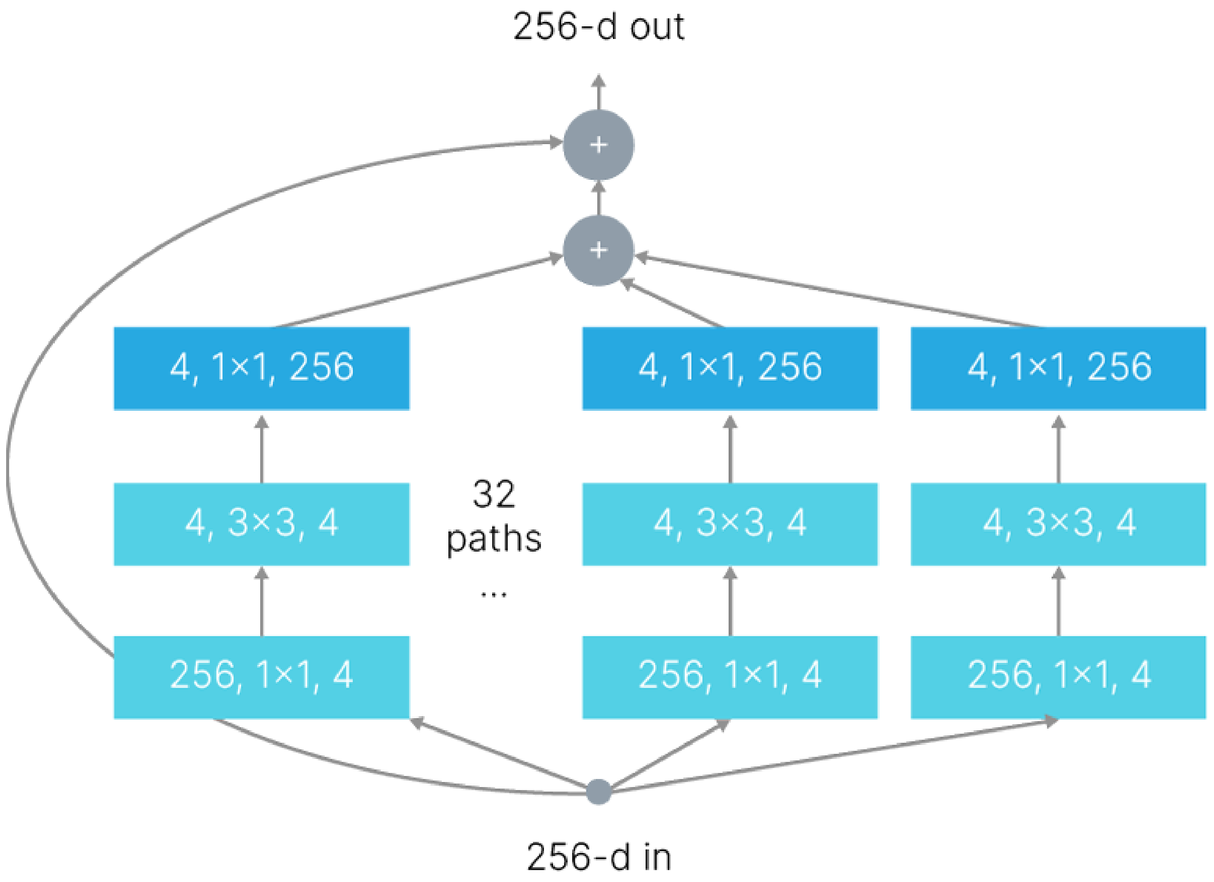




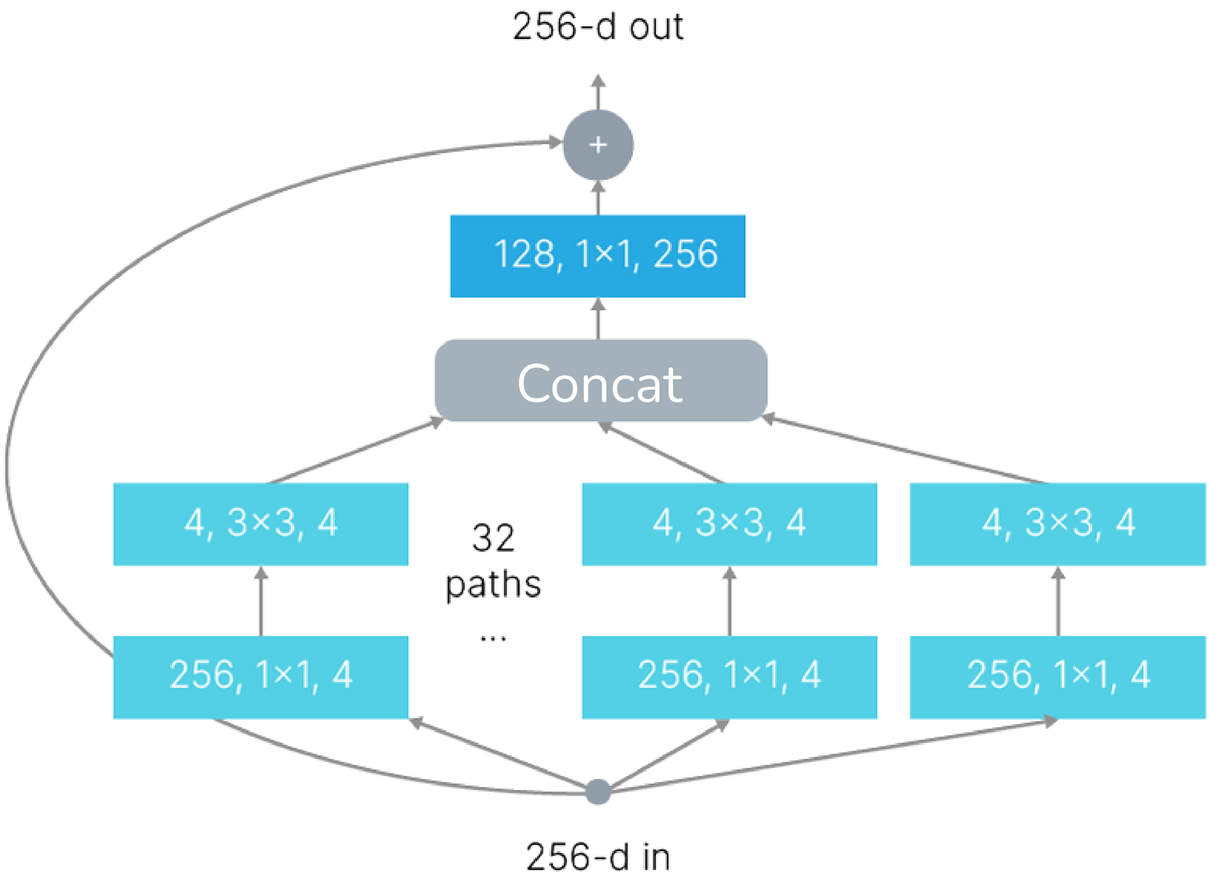
ResNeXt (2015) | Grouped Convolutions



Inception-ResNeXt

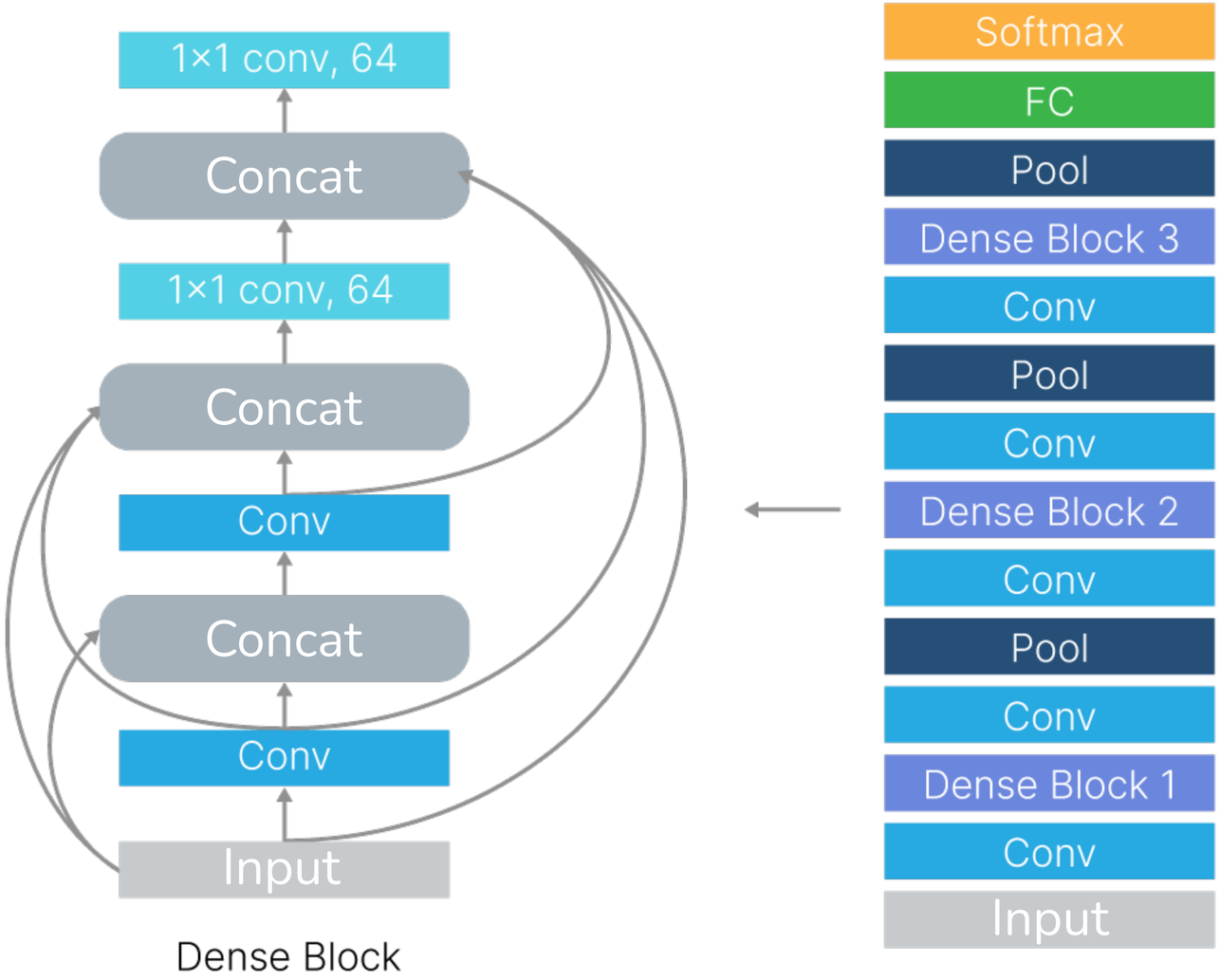


ResNext Block

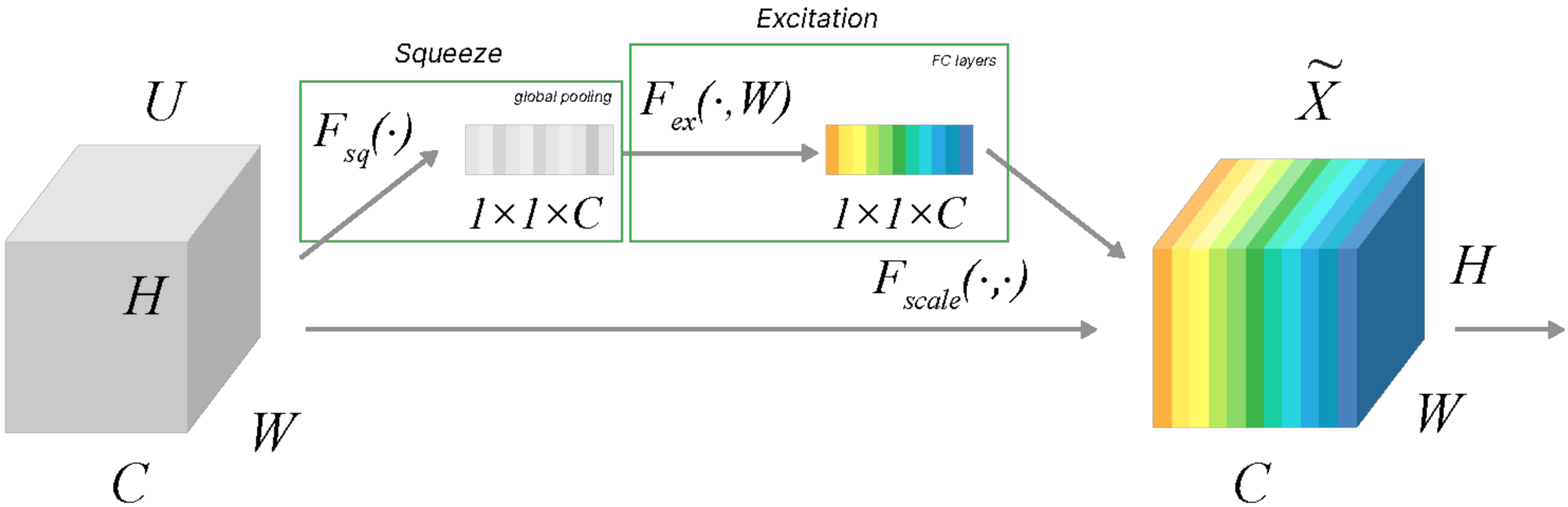


Inception-ResNext Block

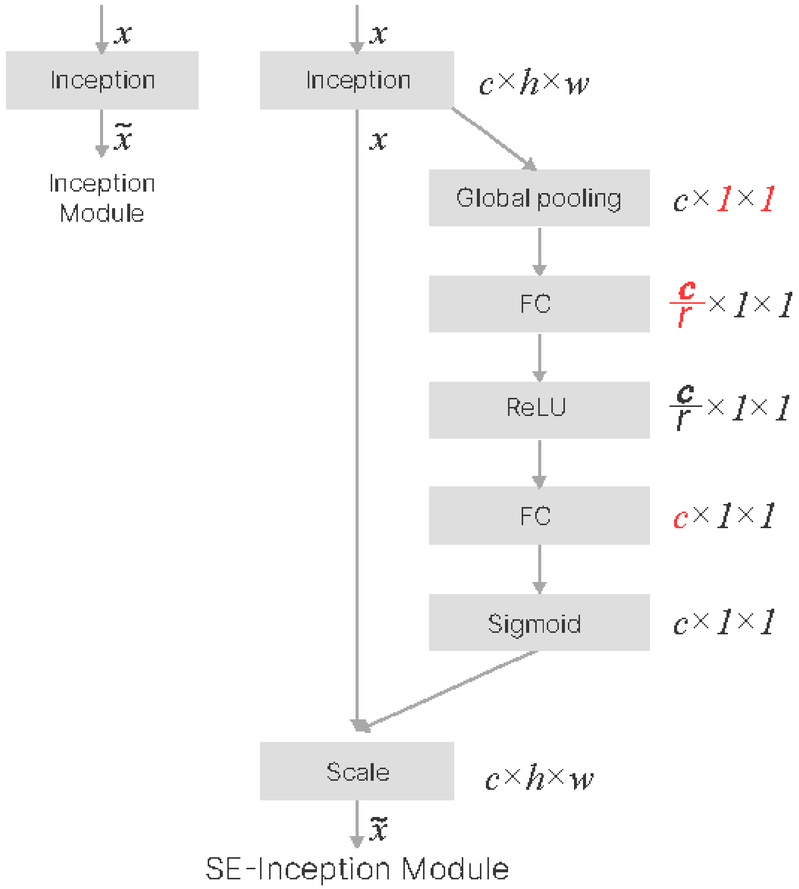
DenseNet (2016) | Architecture

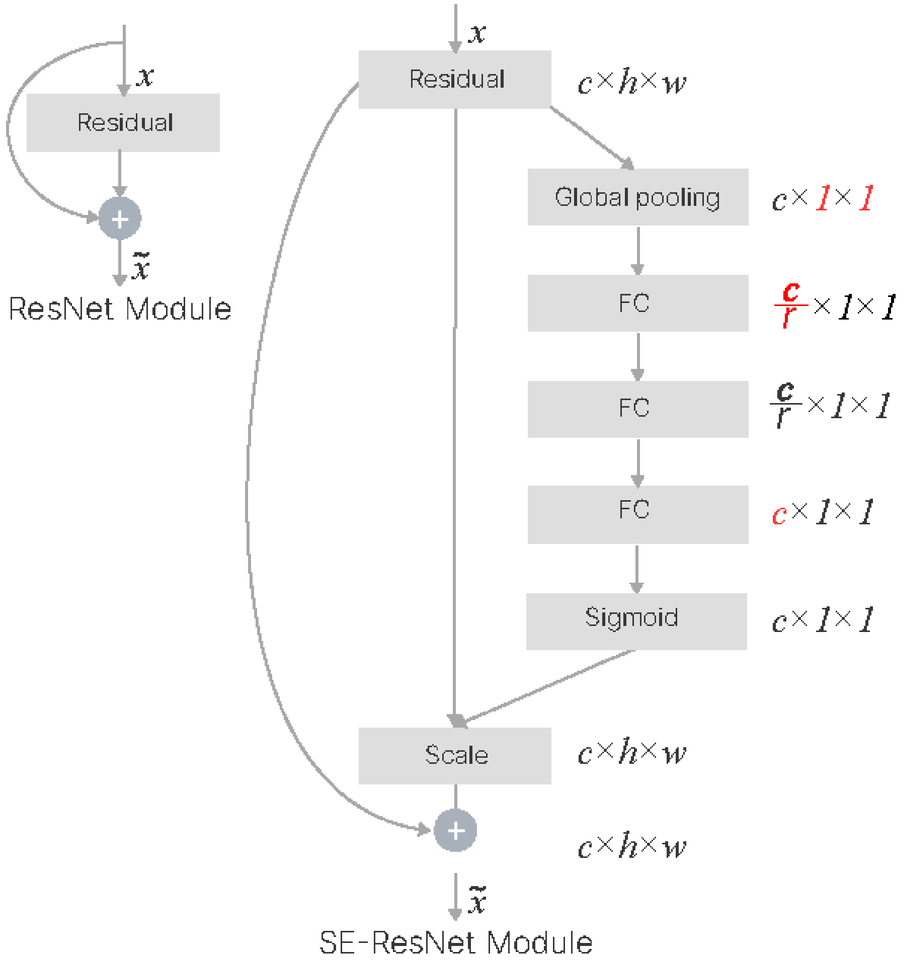


SENet (2017) | Building block



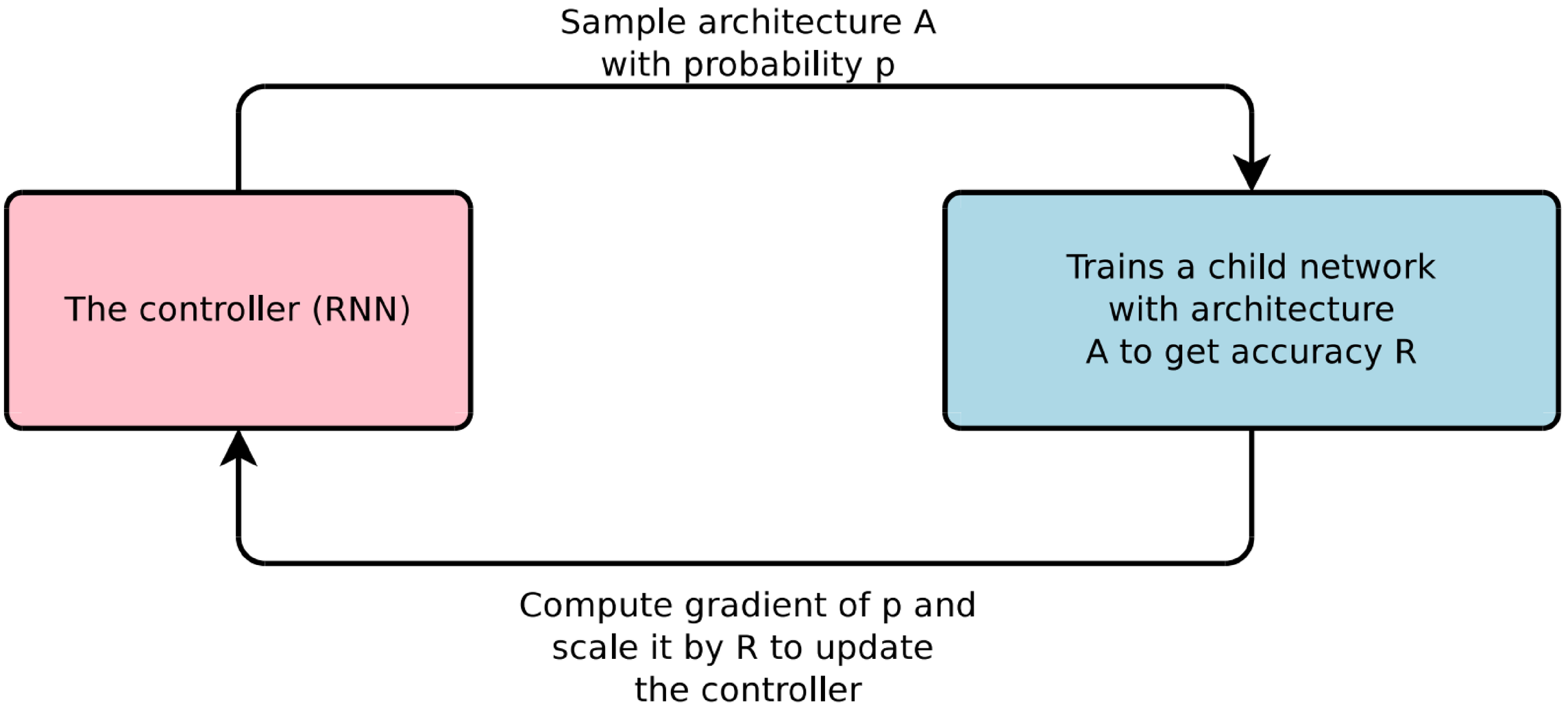
SENet (2017) | General idea implementation





Pre-attention

Neural Architecture Search | Overview



Neural Architecture Search | Example