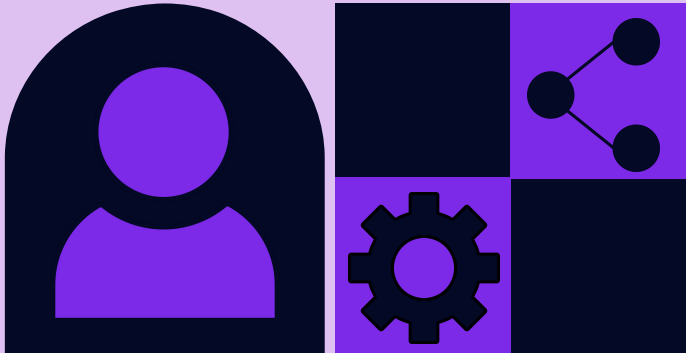
AI Alignment Cohort

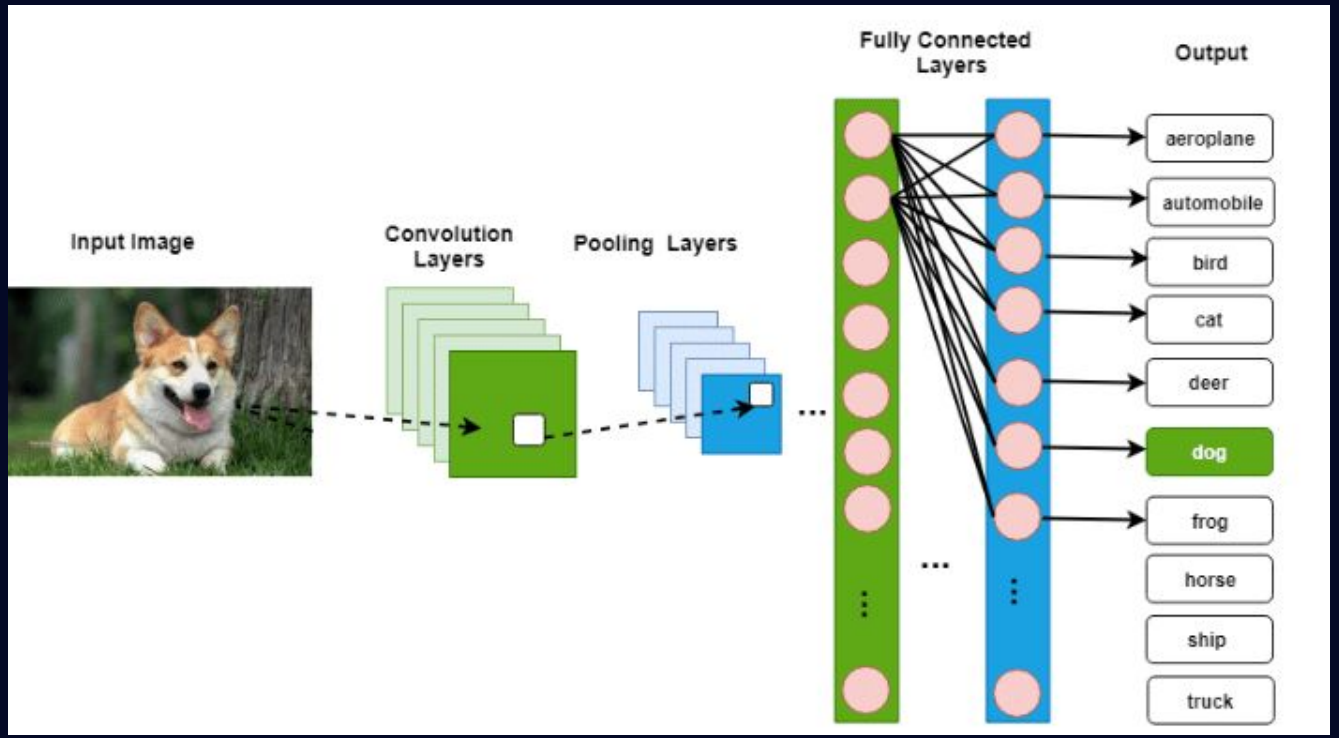
Session 4

Ray Tracing CNNs and ResNets



Can You Guess What City this is?

Neural Network model's Guesswork



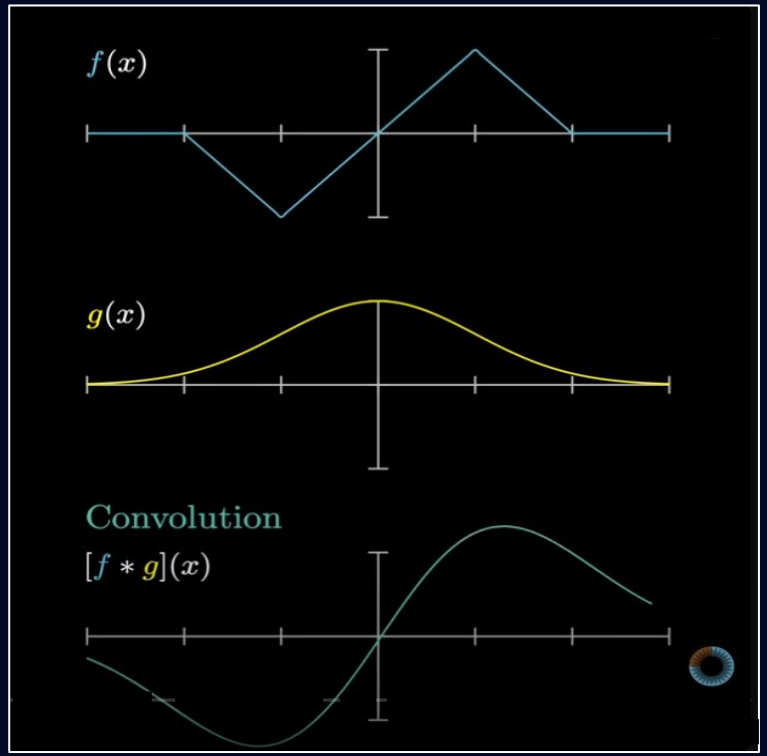
What is Convolution?

$a = [1, 2, 3, 4]$

$b = [5, 6, 7, 8]$

Convolution

$a * b = [5, 16, 34, 60, 61, 52, 32]$



Applications of Convolution

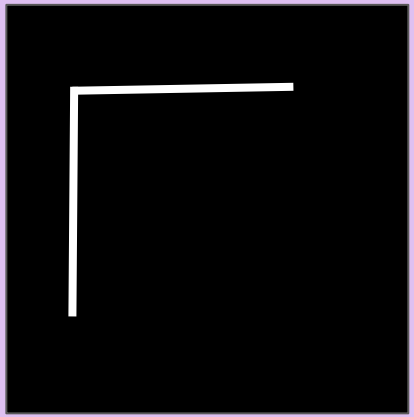
Signal Processing

Mathematical and Physical Models

Image Processing

Convolution in Neural Networks

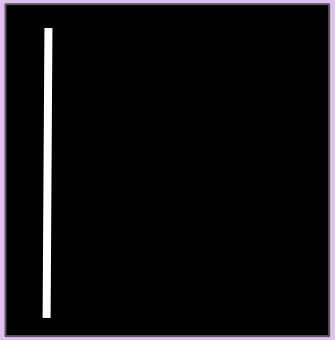
Input Image



Input Image

1	1	1	1	0
1	0	0	0	0
1	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Convolution in Neural Networks



Left Edge Detection Filter

1	0	0
1	0	0
1	0	0

Left Edge Detection Filter

Convolution in Neural Networks

1	1	1	1	0
1	0	0	0	0
1	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Input Image
5x5

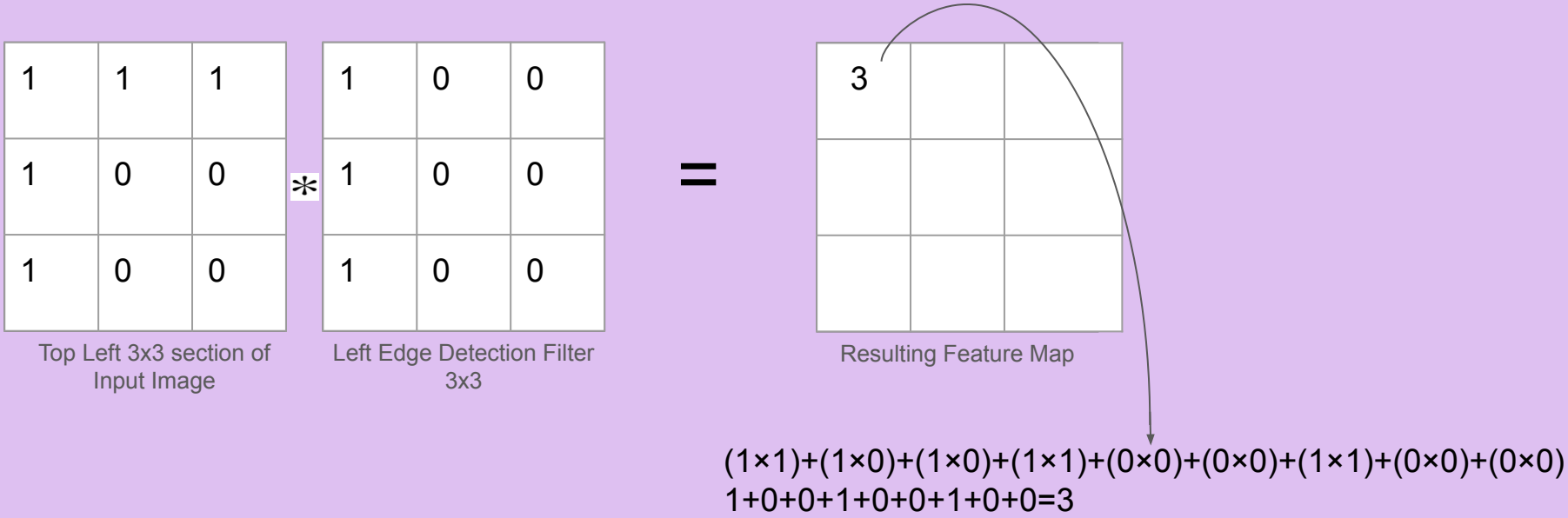
1	0	0
1	0	0
1	0	0

Left Edge Detection Filter
3x3

=

Element-wise Multiplication of the Input Image and Filter by sliding the filter over the input image

Convolution in Neural Networks



Convolution in Neural Networks

1	1	1	1	0
1	0	0	0	0
1	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Input Image
5x5

$*$

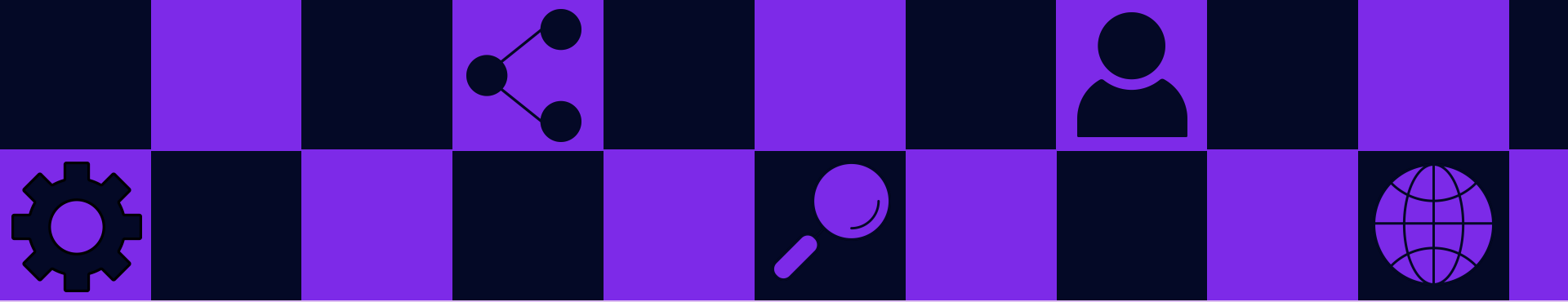
1	0	0
1	0	0
1	0	0

Left Edge Detection Filter
3x3

$=$

3	1	1
3	0	0
2	0	0

Resulting Feature Map

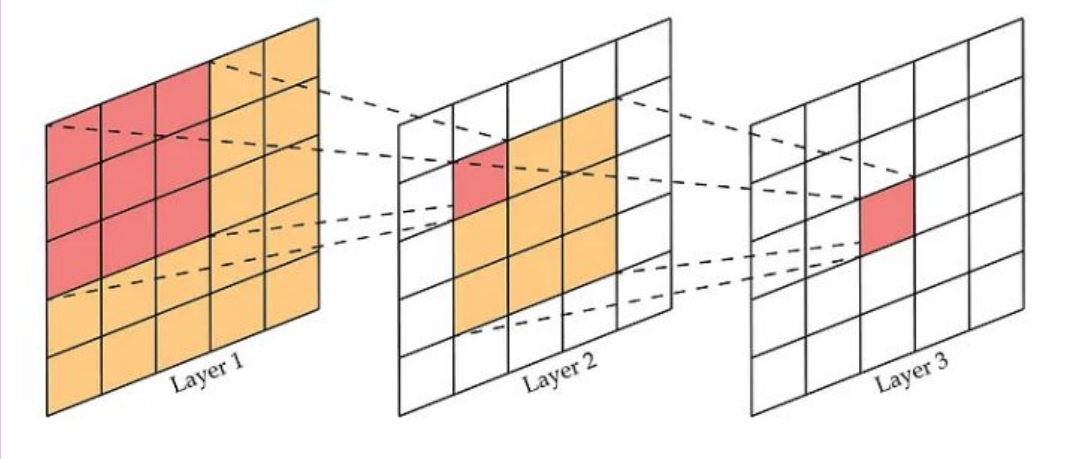


quAIdditch Question

How will you manage the Feature map to be of the size 5x5?

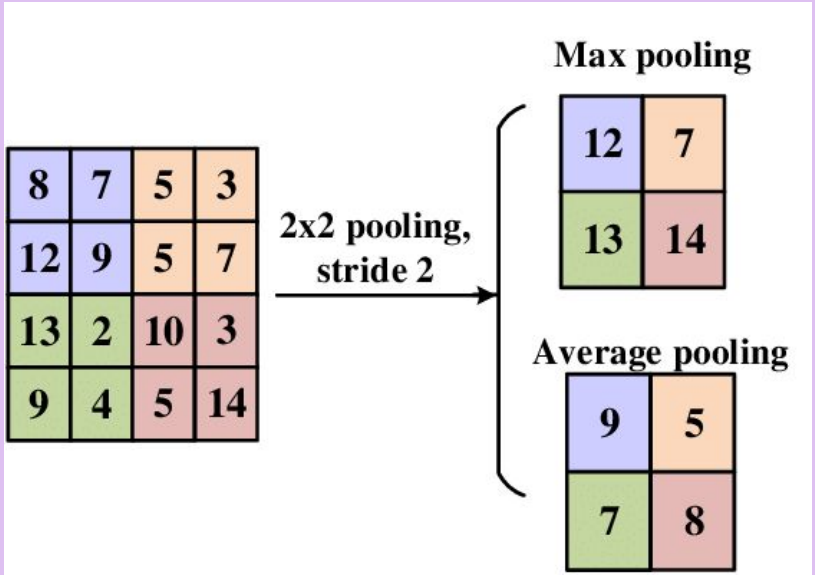
Convolution in Neural Networks

Receptive Field Expansion

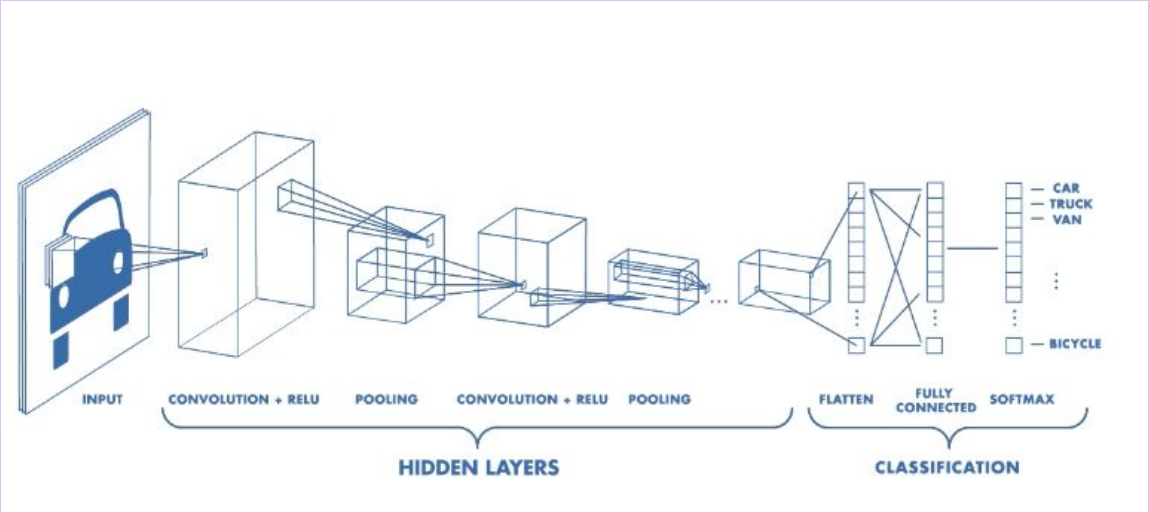


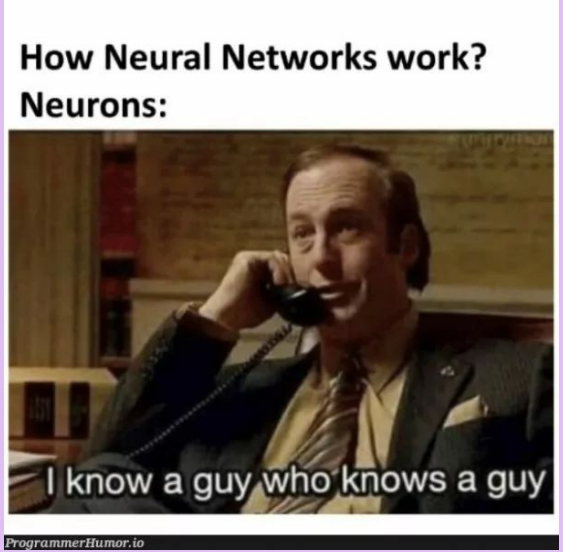
Convolution in Neural Networks

Pooling Layers

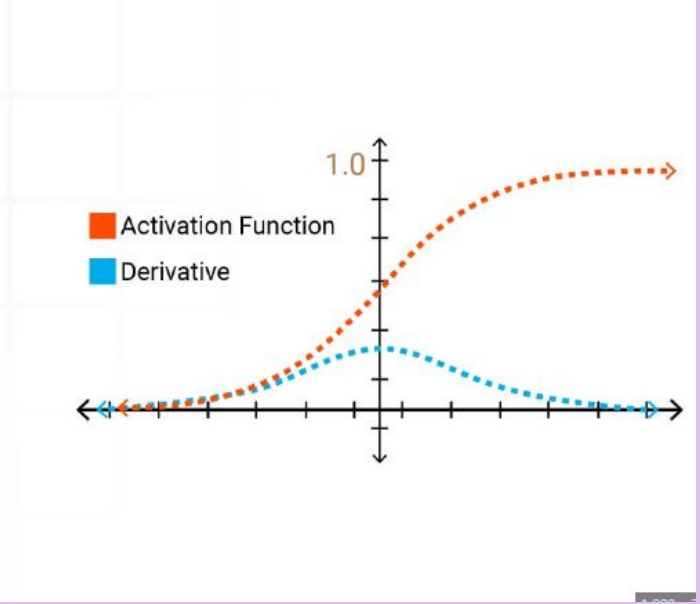


Convolution in Neural Networks

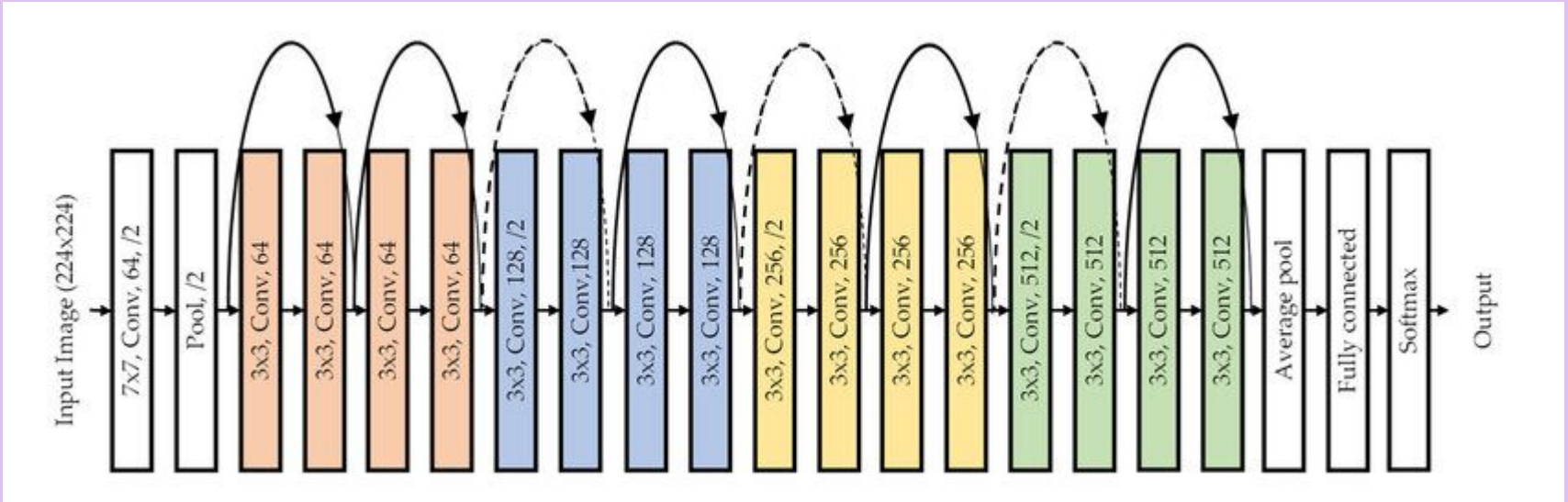




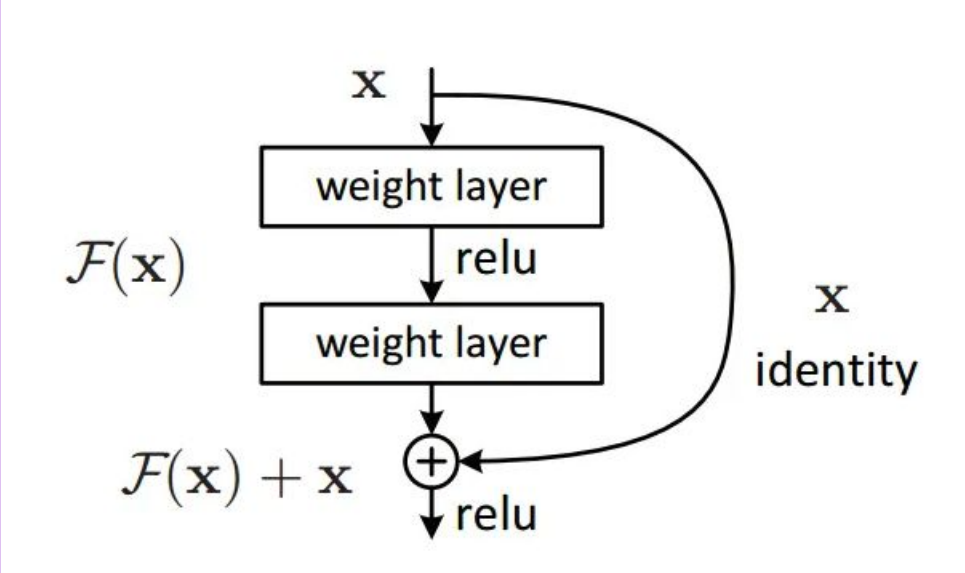
Vanishing Gradient



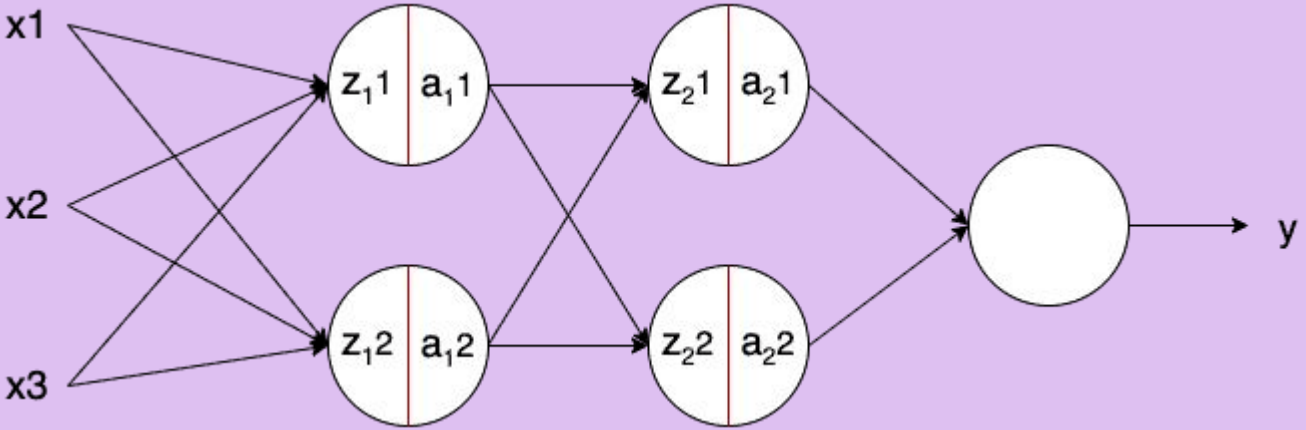
ResNets


Input Image (224x224)
7x7, Conv, 64, /2
Pool, /2
3x3, Conv, 64
3x3, Conv, 64
3x3, Conv, 64
3x3, Conv, 64
3x3, Conv, 128, /2
3x3, Conv,128
3x3, Conv, 128
3x3, Conv, 128
3x3, Conv, 256, /2
3x3, Conv, 256
3x3, Conv, 256
3x3, Conv, 256
3x3, Conv, 512, /2
3x3, Conv, 512
3x3, Conv, 512
3x3, Conv, 512
Average pool
Fully connected
Softmax
Output

Residual Block



Batch Normalization



$$z = g(w, x) + b; \qquad a = f(z)$$