WOMEN IN DATA SCIENCE

#WiDS2019

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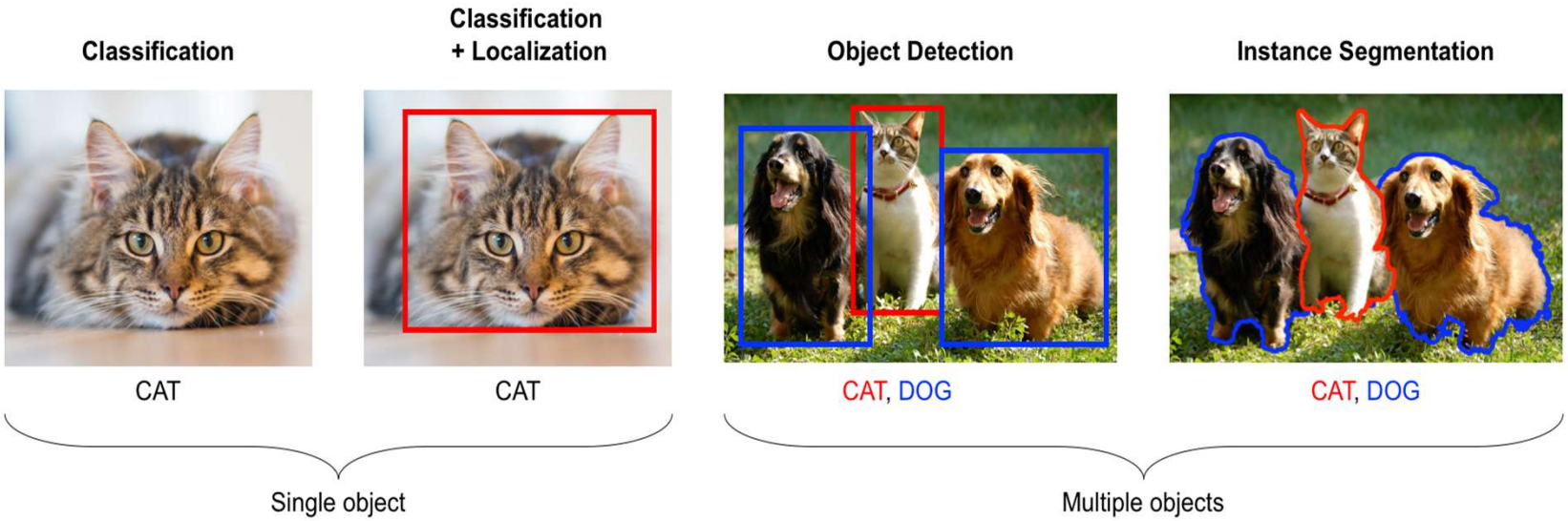
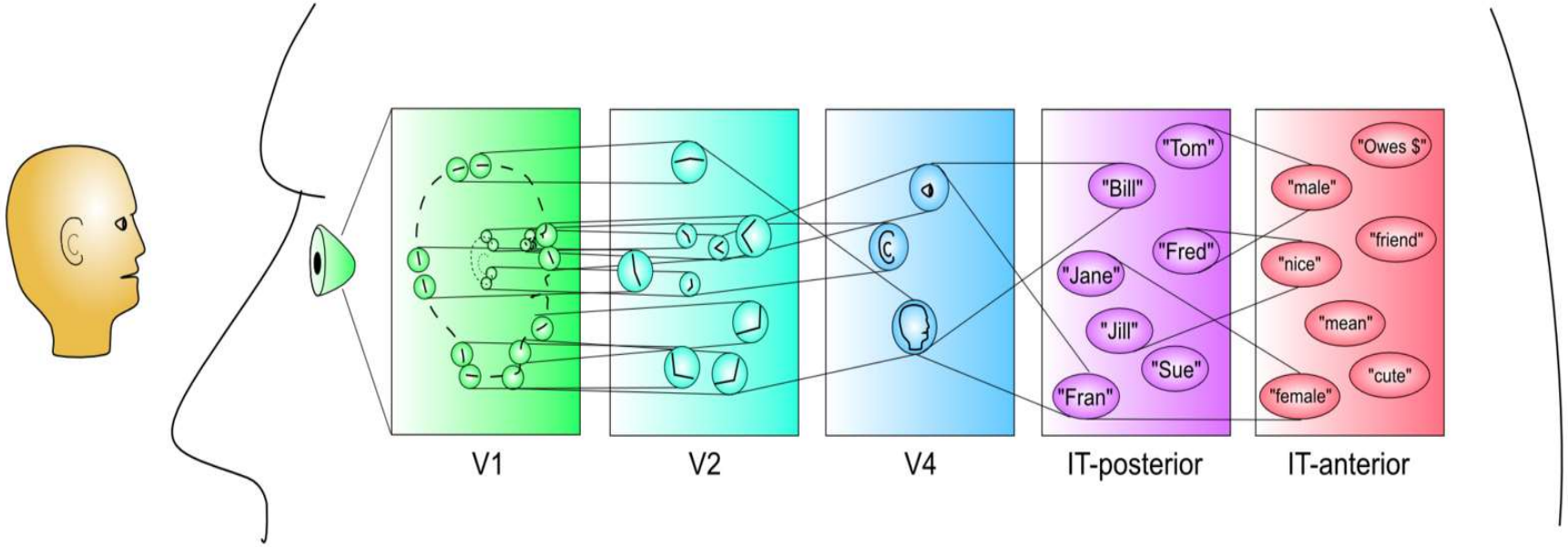
- Post graduate from IITB
- Areas of expertise: Deep learning, Statistical Machine Translation
- Hobbies: Travel, Trekking, Painting

Demystifying Convolutional Neural Networks

Convolutional Neural Network

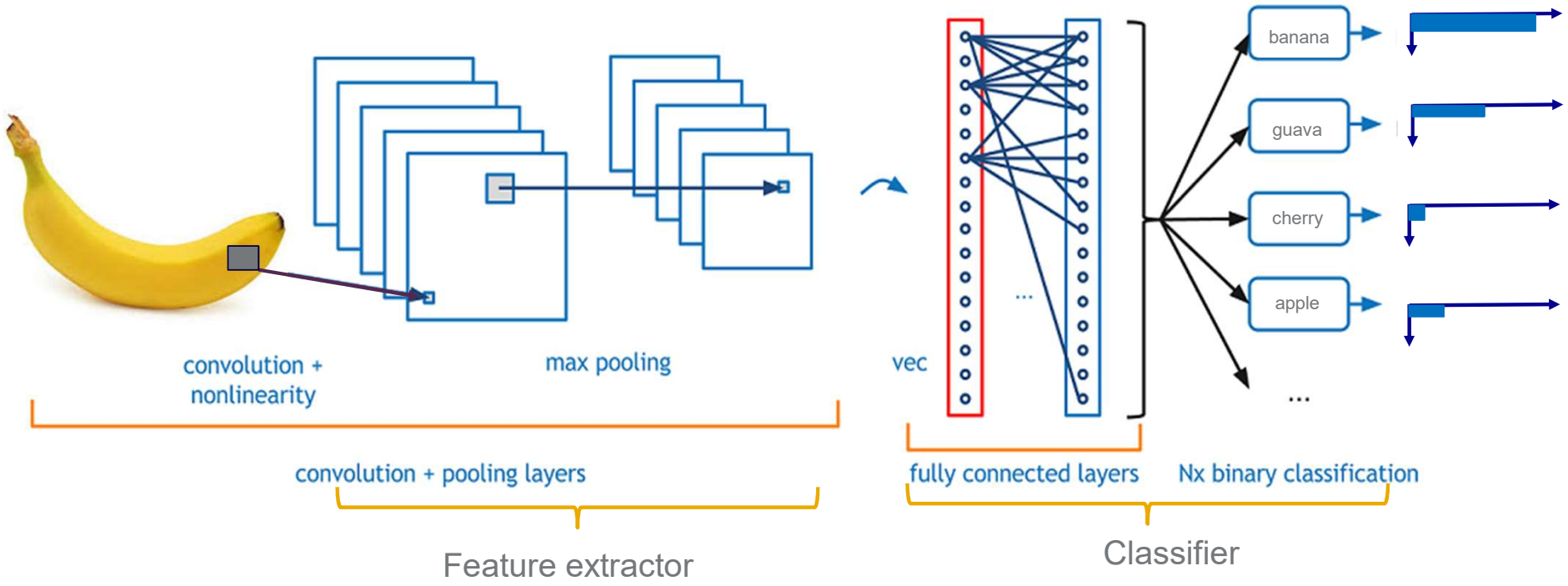


CNN: Biological Motivation

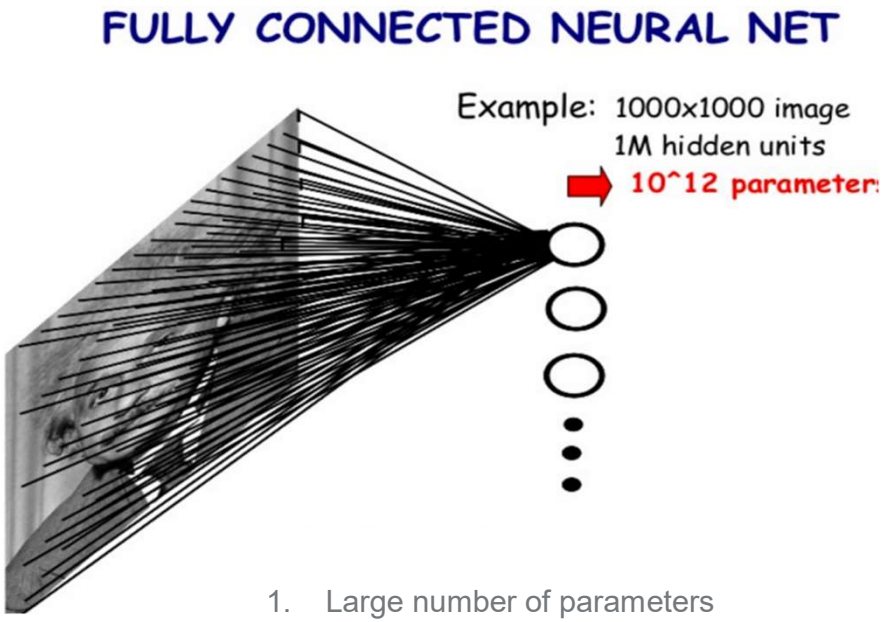


Img src: https://grey.colorado.edu/CompCogNeuro/index.php/CCNBook/Perception

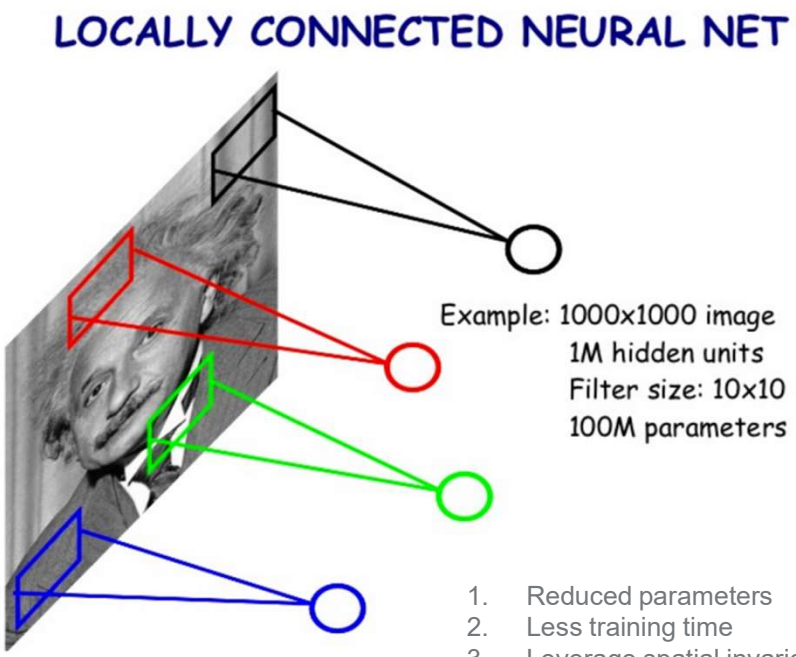
CNN Architecture



Why Convolution?

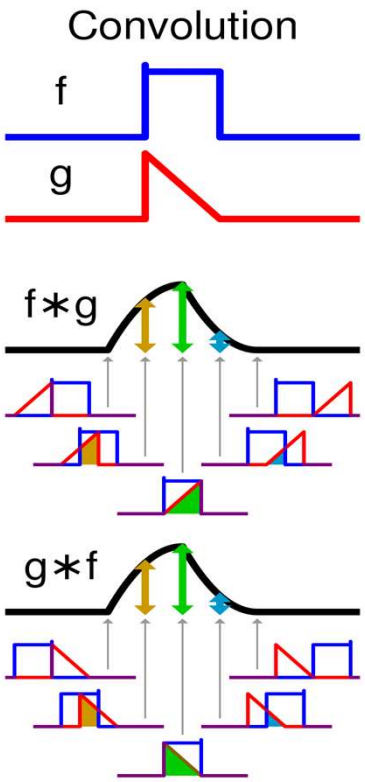


1. Large number of parameters
2. More training time



1. Reduced parameters
2. Less training time
3. Leverage spatial invariance

What is Convolution?



Img source: Wikipedia

Original Image

7	2	3	3	8
4	5	3	8	4
3	3	2	8	4
2	8	7	2	7
5	4	4	5	4

*

Filter

1	0	-1
1	0	-1
1	0	-1

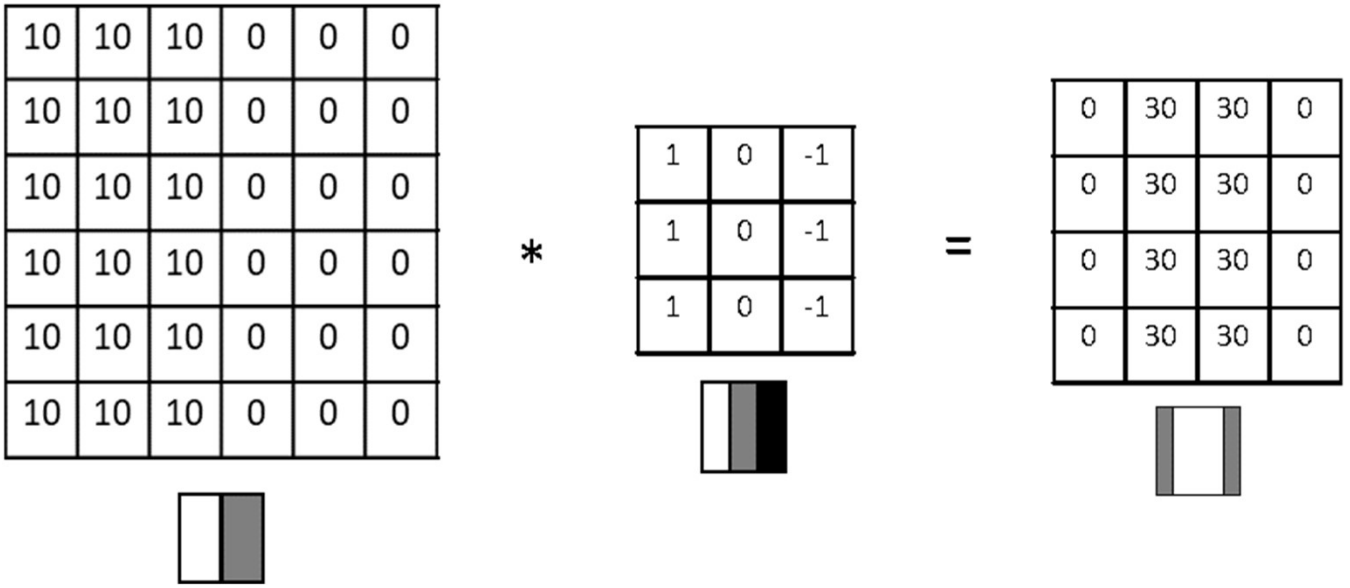
=

Convoluted image

6		

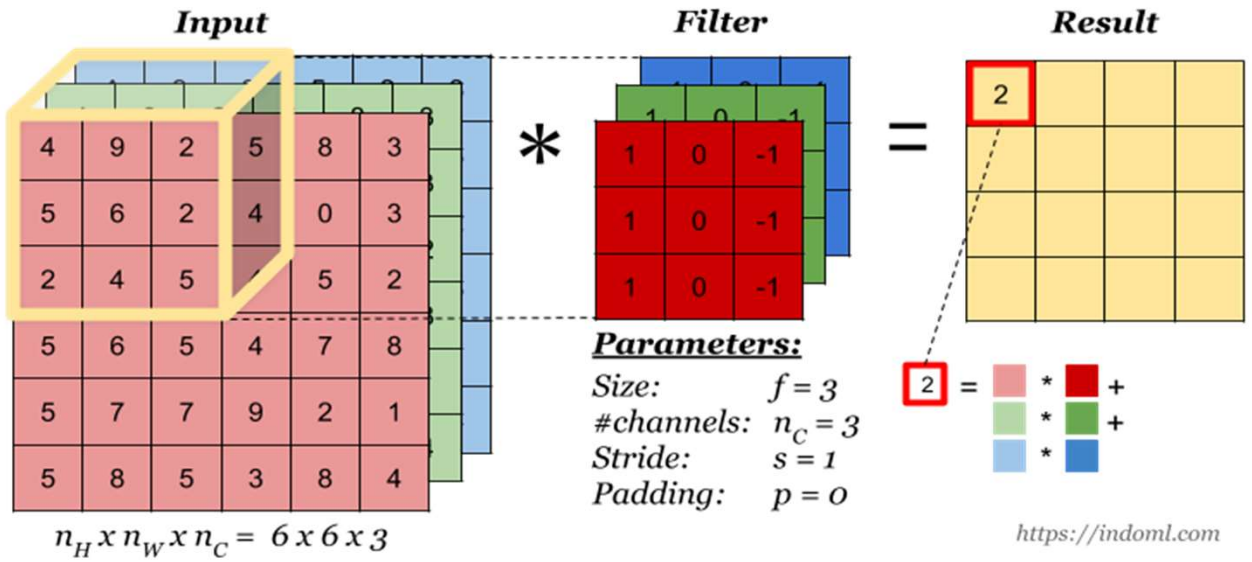
7x1+4x1+3x1+
2x0+5x0+3x0+
3x-1+3x-1+2x-1
= 6

Edge Detection with Convolution



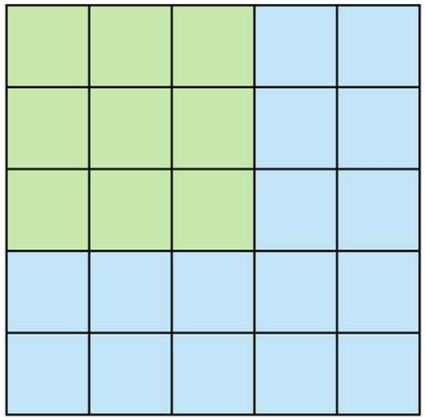
Vertical Edge Detection

Convolution over Volumes

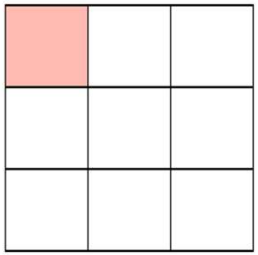


#of parameters: 3 x 3 x 3

Stride

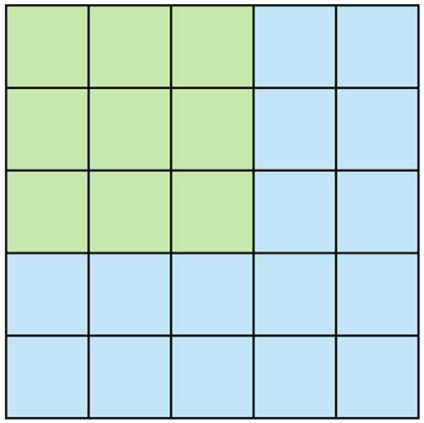


Stride 1

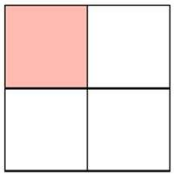


Feature Map

5 x 5 → 3 x3



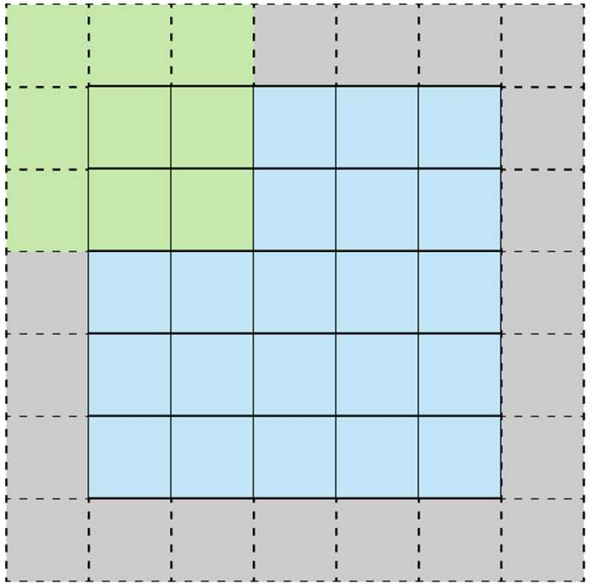
Stride 2



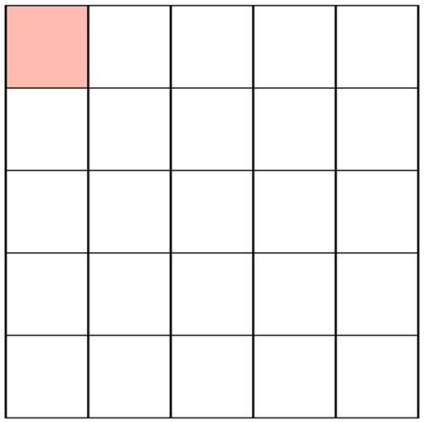
Feature Map

5 x 5 → 2 x2

Padding

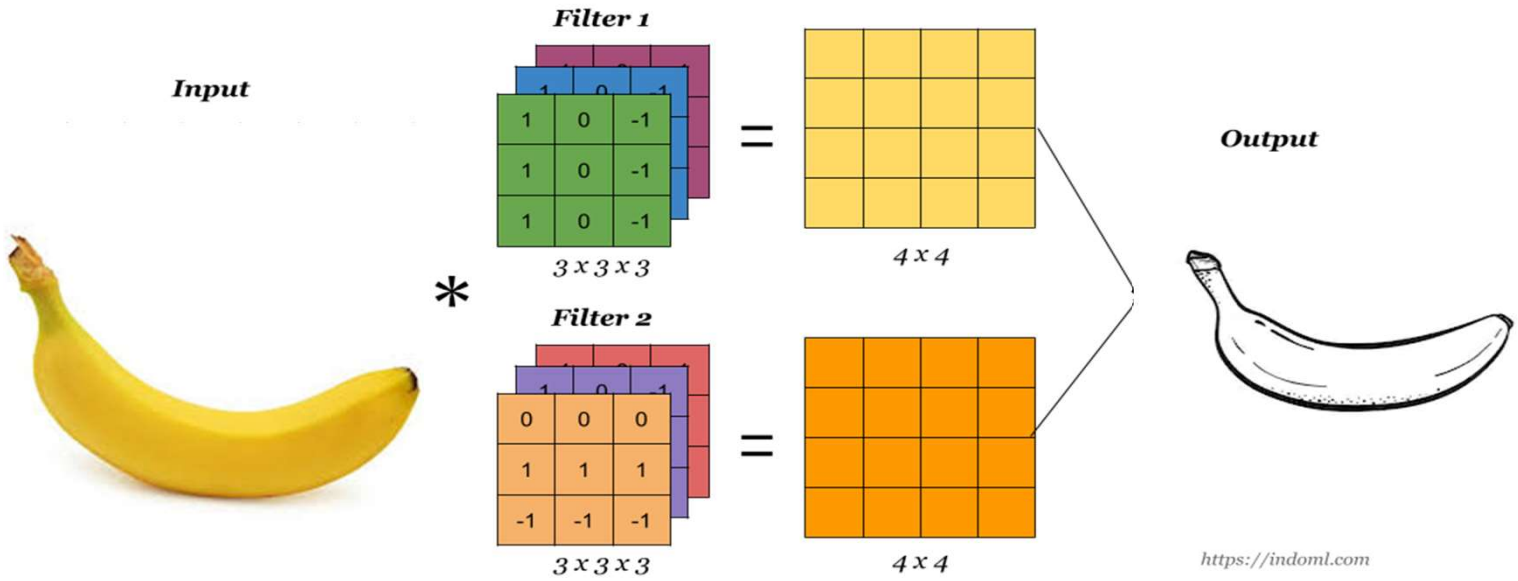


Stride 1 with Padding



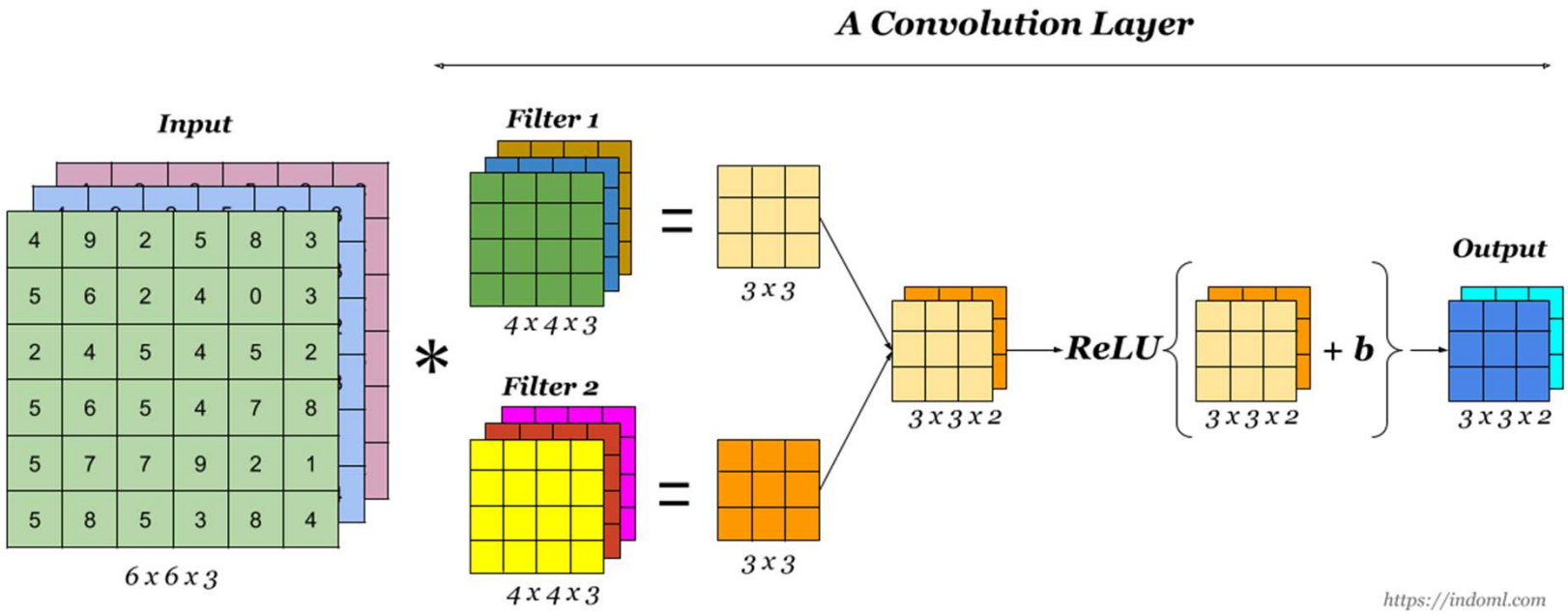
Feature Map

Convolution with multiple filters



# of parameters: 3 x 3 x 3 x 2(# of filters)

Convolution Layer



# of parameters: 4 x 4 x 3 x 2 + 1 (bias)

Pattern Detection with Convolution

-1	-1	-1
1	1	1
0	0	0

-1	1	0
-1	1	0
-1	1	0

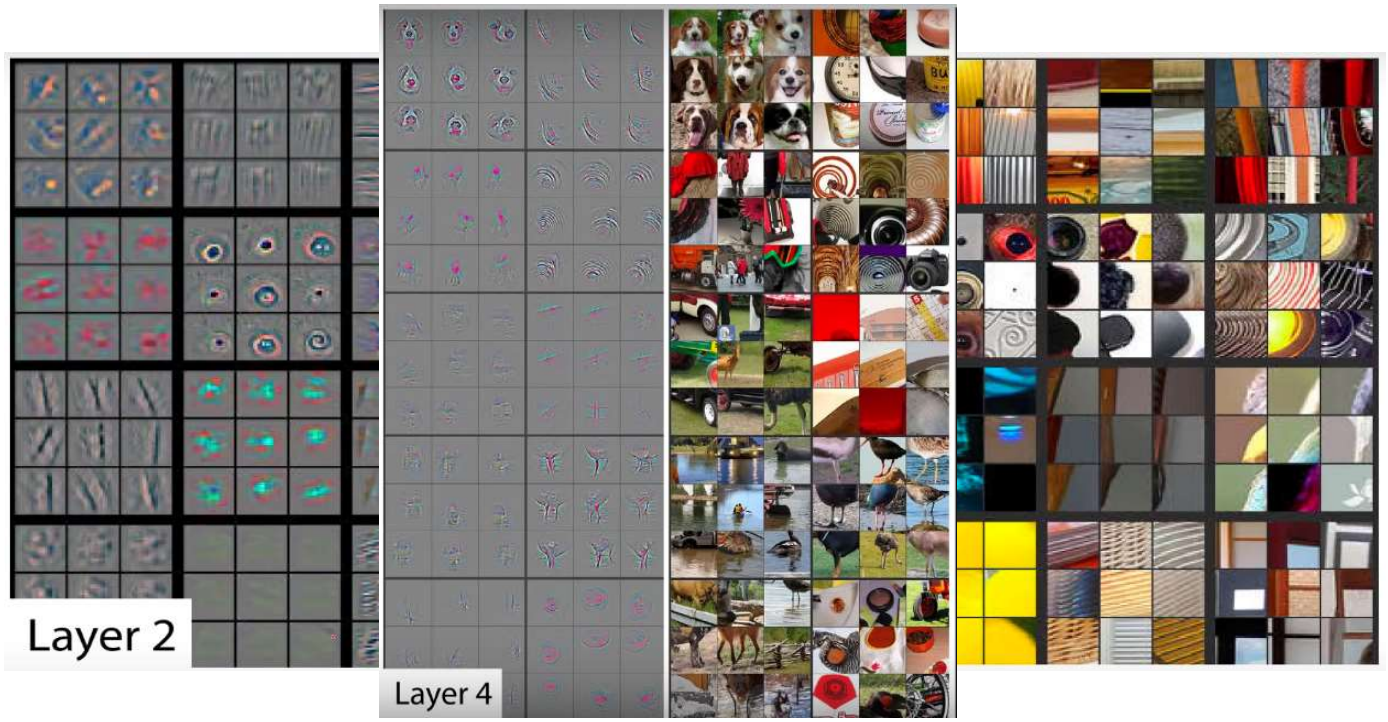
0	0	0
1	1	1
-1	-1	-1

0	1	-1
0	1	-1
0	1	-1

Feature detectors

Output activation maps

Pattern Detection with Convolution

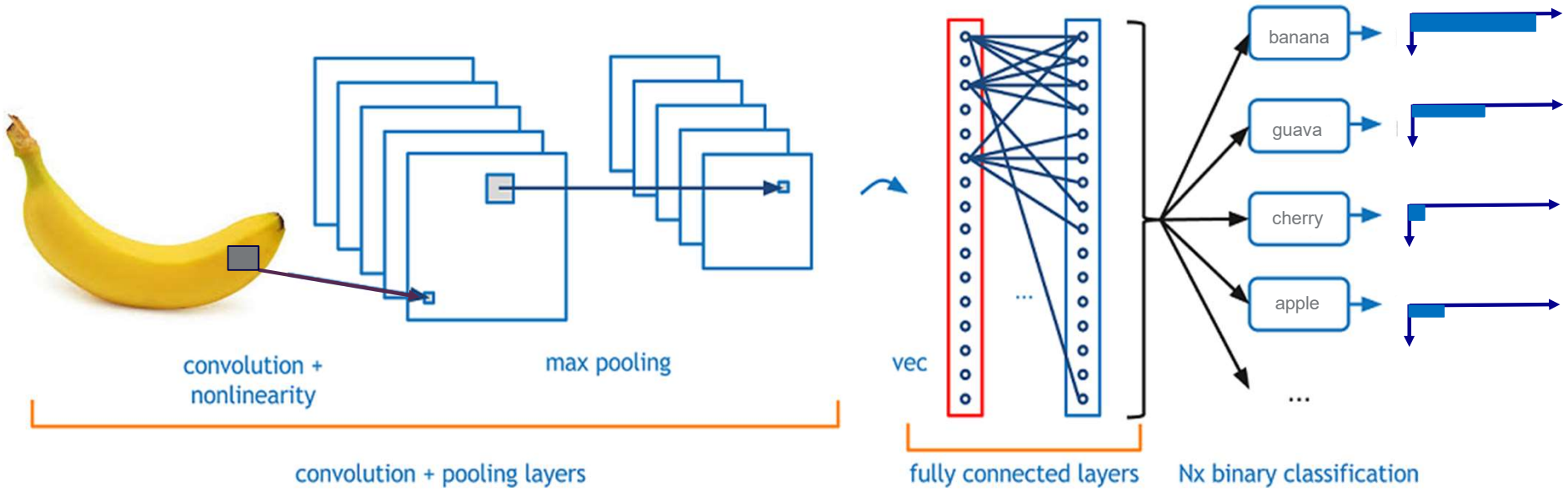


Convolution Hyperparameters

- Filter size and number of filters
- Type of padding
- Stride size

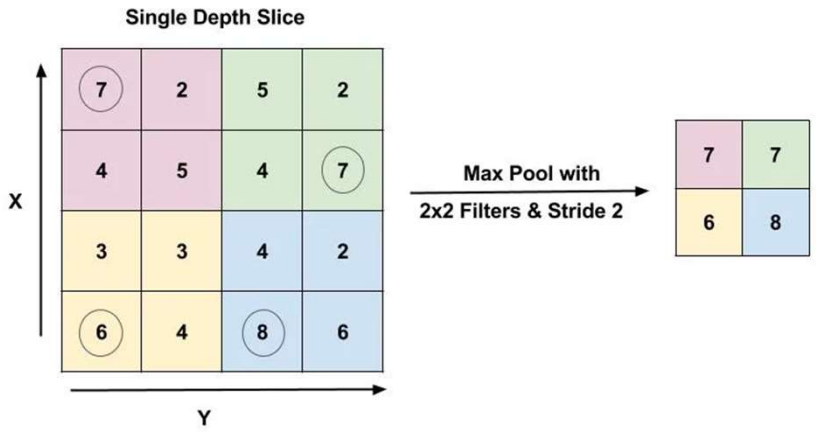
Small filter size (3X3, 5X5) with stride 1 and zeros padding

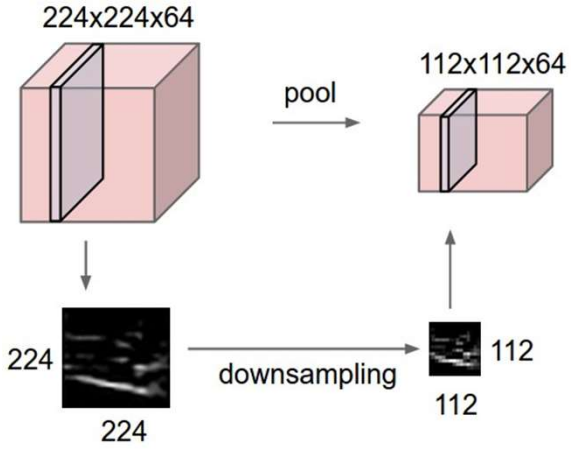
CNN Architecture



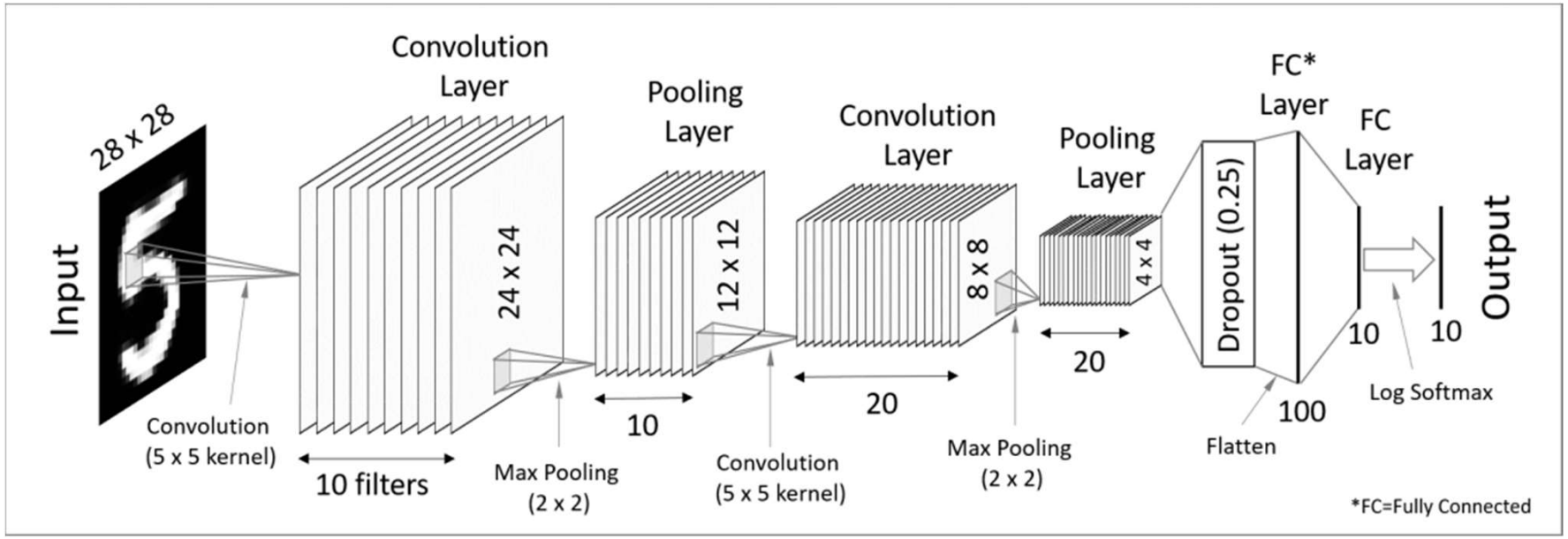
Pooling Layer

- Downsample the input to reduce parameters





End-to-End Network



CNN Hyperparameters

- Filter size and number of filters
- Padding type, stride size

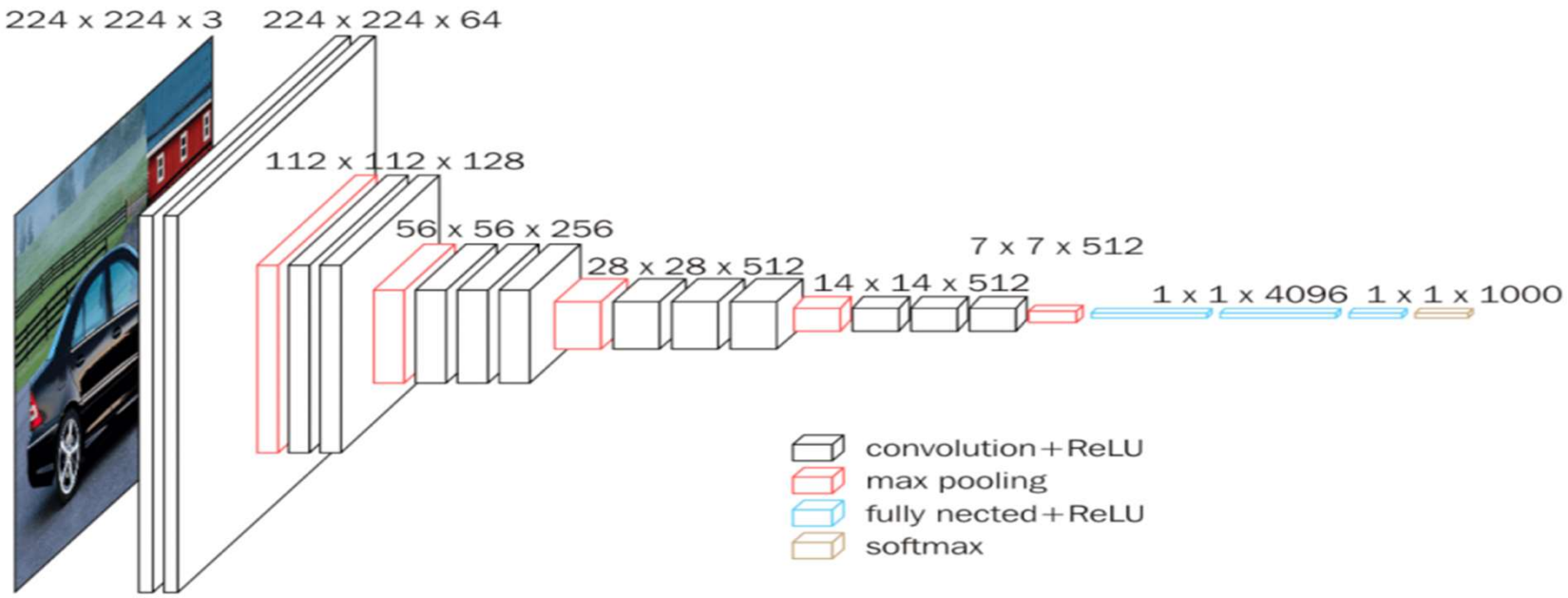
- Pooling size and type

- Number of conv-pool layers, learning rate etc.

Classic CNN models

- VGG-16
- LeNet-5
- AlexNet

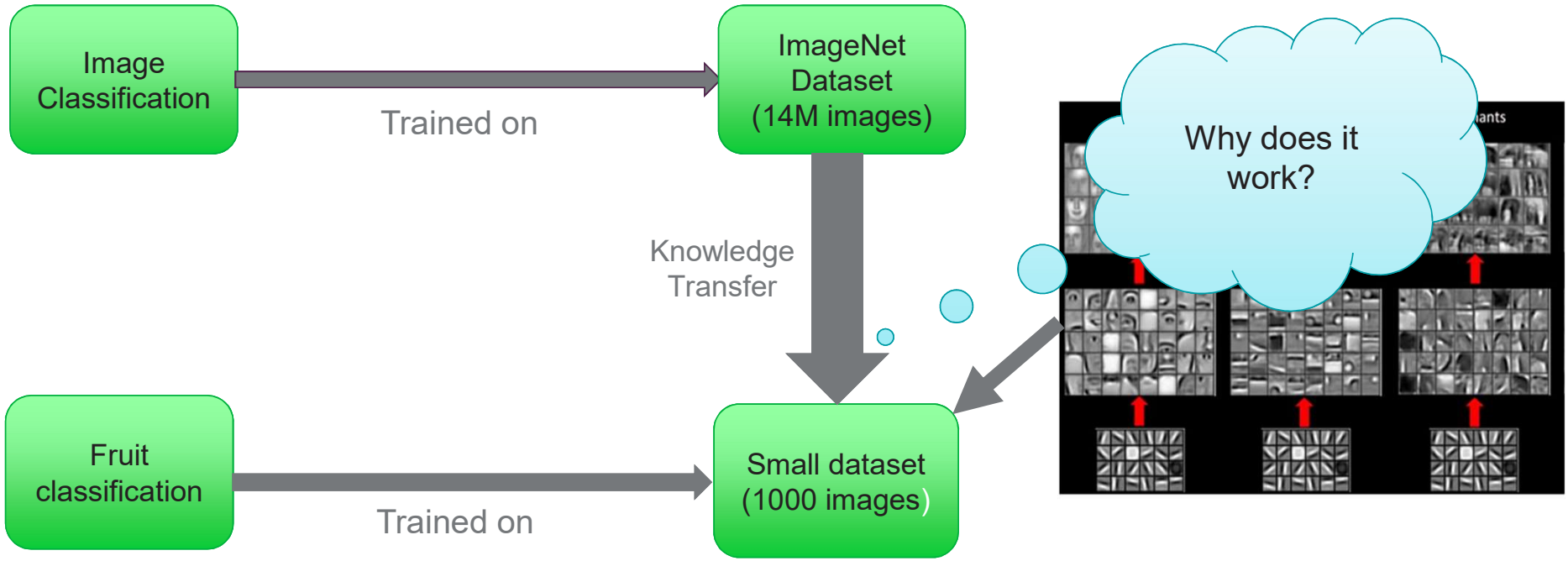
VGG-16 Architecture



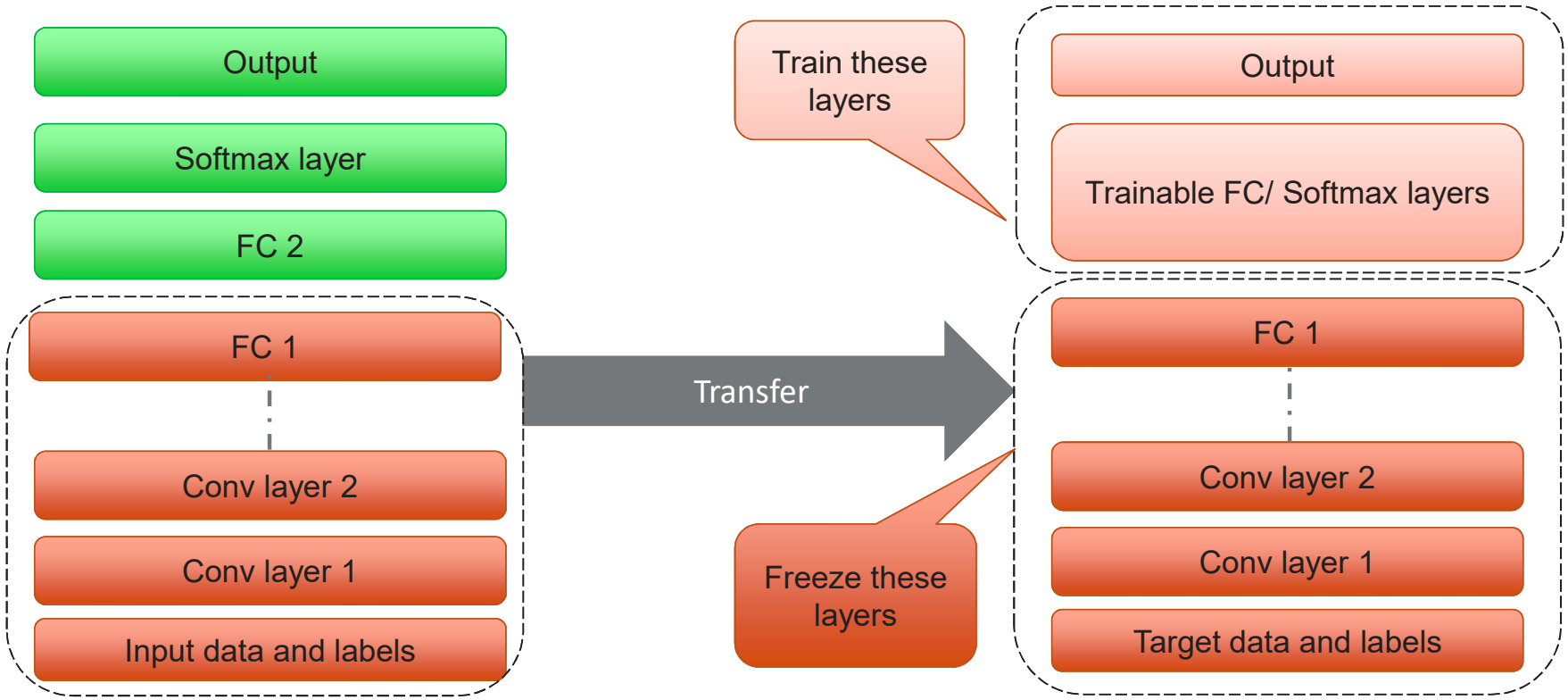
Improving CNN model

- Transfer learning
- Data augmentation

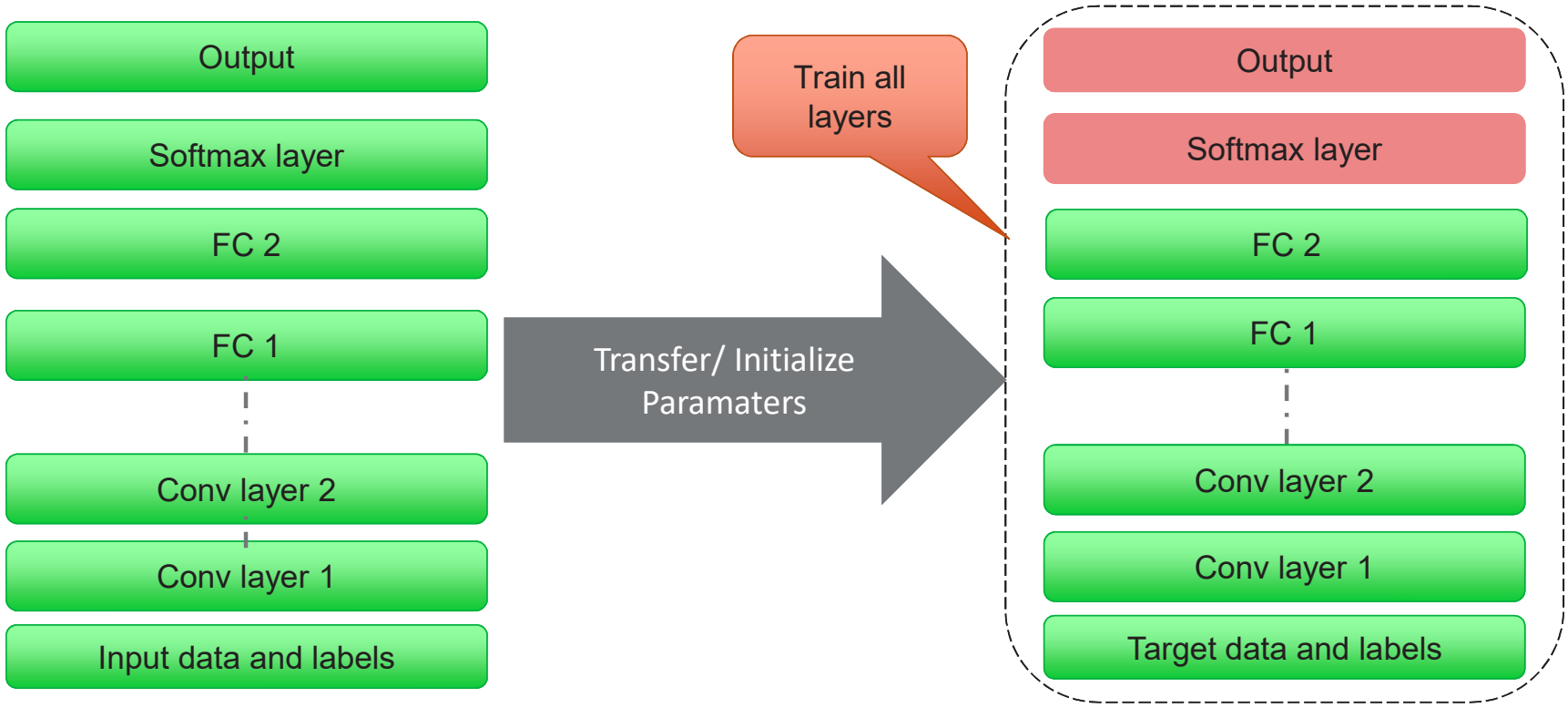
Transfer Learning



Transfer Learning scenarios – Feature extraction



Fine-Tuning Pre-trained model



When to use transfer learning?

- Limited labeled data to train
- Availability of pre-trained model on similar data

Data Augmentation

Conclusion

- What is convolutional neural network.
- How it works.
- How to use pre-trained networks.

Any Questions?


ENOUGH BLABLA!!
JUST SHOW ME THE CODE!!
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