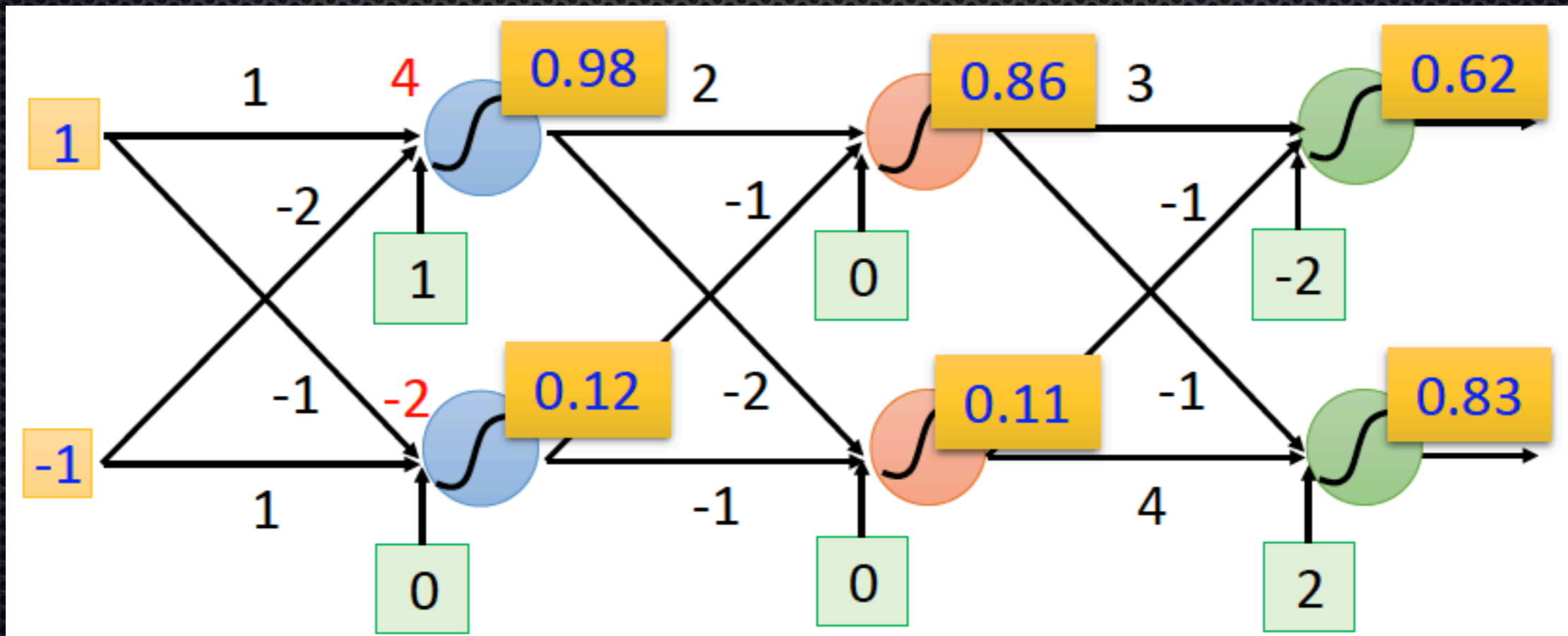


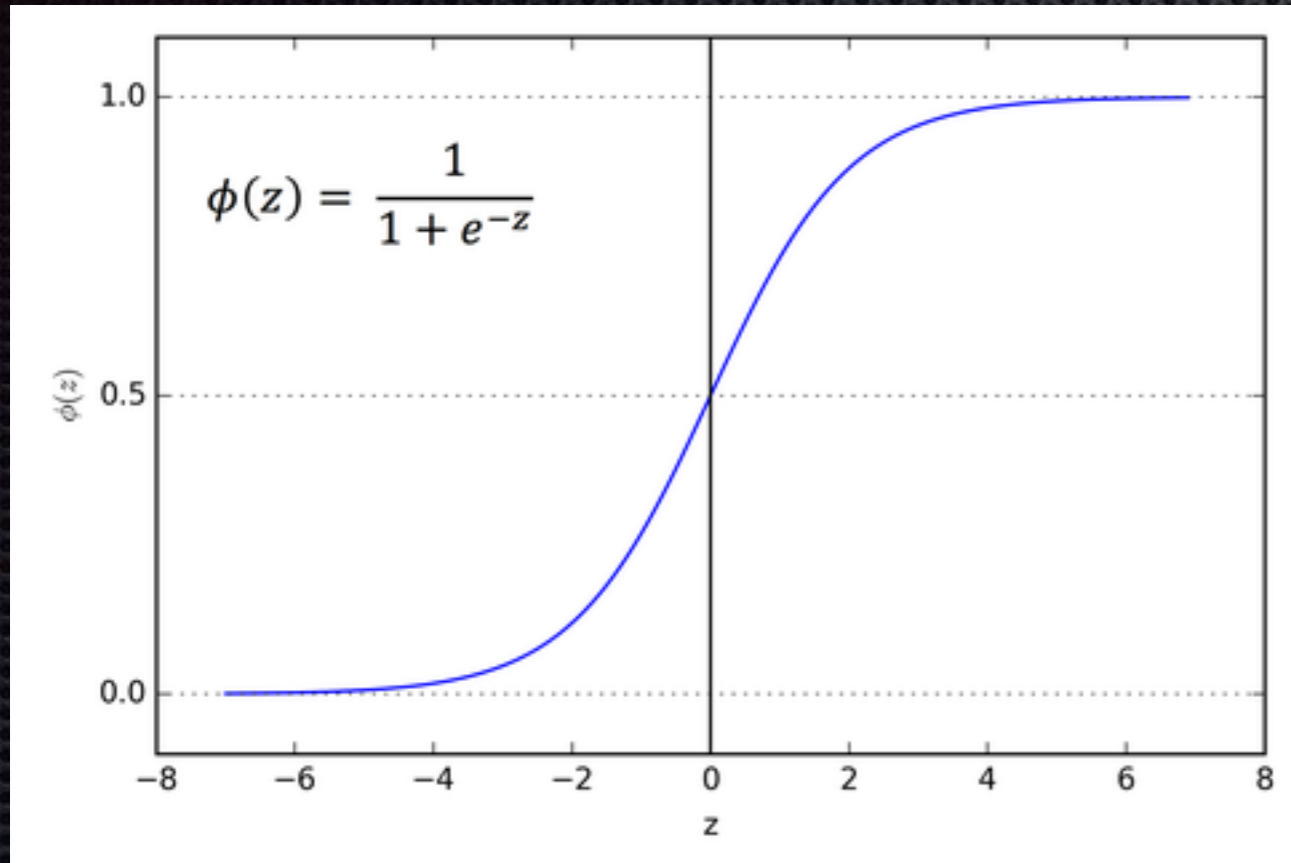
An introduction to Neural Network

How does neural network work?

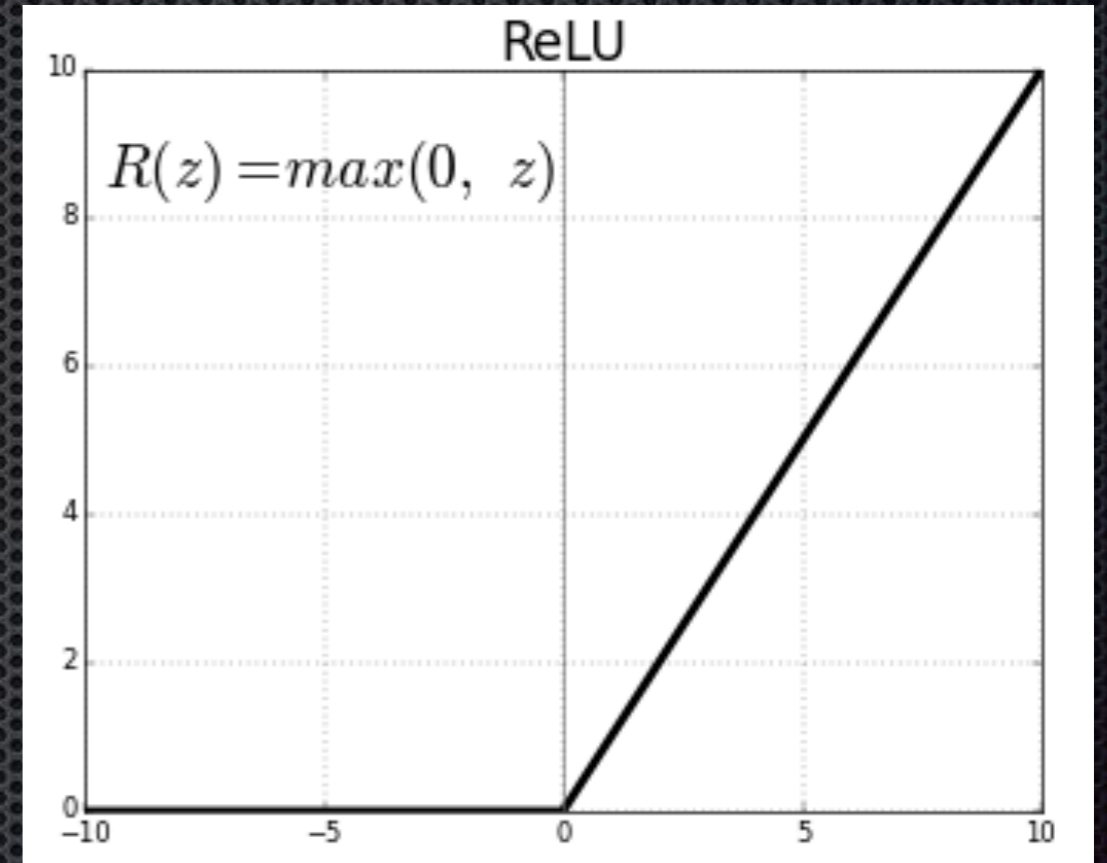
- ✦ EX: $0.98 = \text{Sigmoid}((1 \times 1) + (-1 \times -2) + 1)$
- ✦ And 0.12, 0.86, 0.11 etc. so on...



What is activation function?



Sigmoid Function



ReLU Function

1. <https://sebastianraschka.com/images/faq/logisticregr-neuralnet/sigmoid.png>
2. <https://ml4a.github.io/images/figures/relu.png>

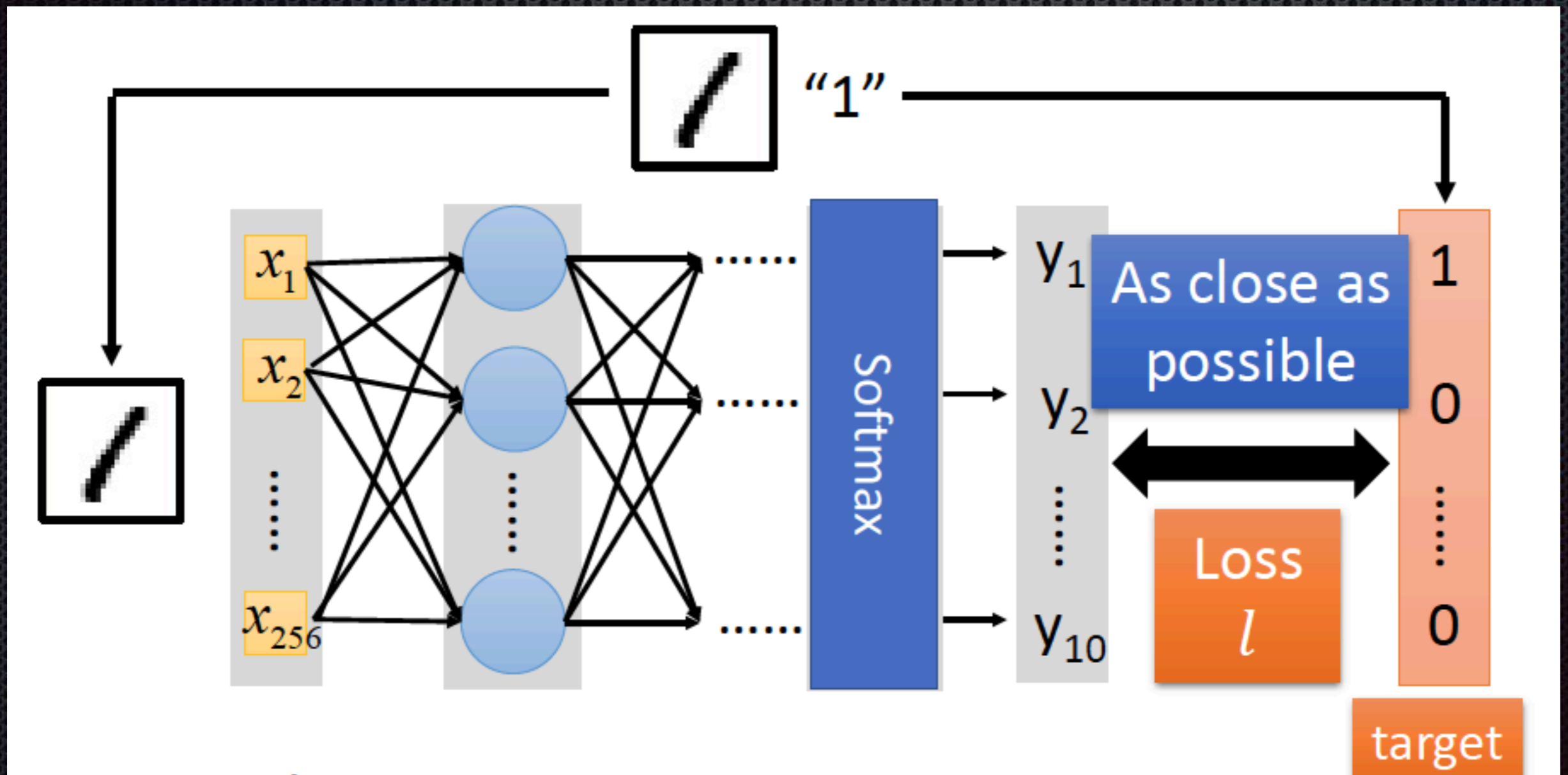
What is Softmax Function?

- a generalization of the logistic function that "squashes" a K -dimensional vector \mathbf{z} of arbitrary real values to a K -dimensional vector $f(\mathbf{z})$ of real values in the range $(0, 1)$ that add up to 1.

$$\sigma(\mathbf{z})_j = \frac{e^{z_j}}{\sum_{k=1}^K e^{z_k}} \quad \text{for } j = 1, \dots, K.$$

LOSS

Loss can be **square error** or **cross entropy** between the network output and target.

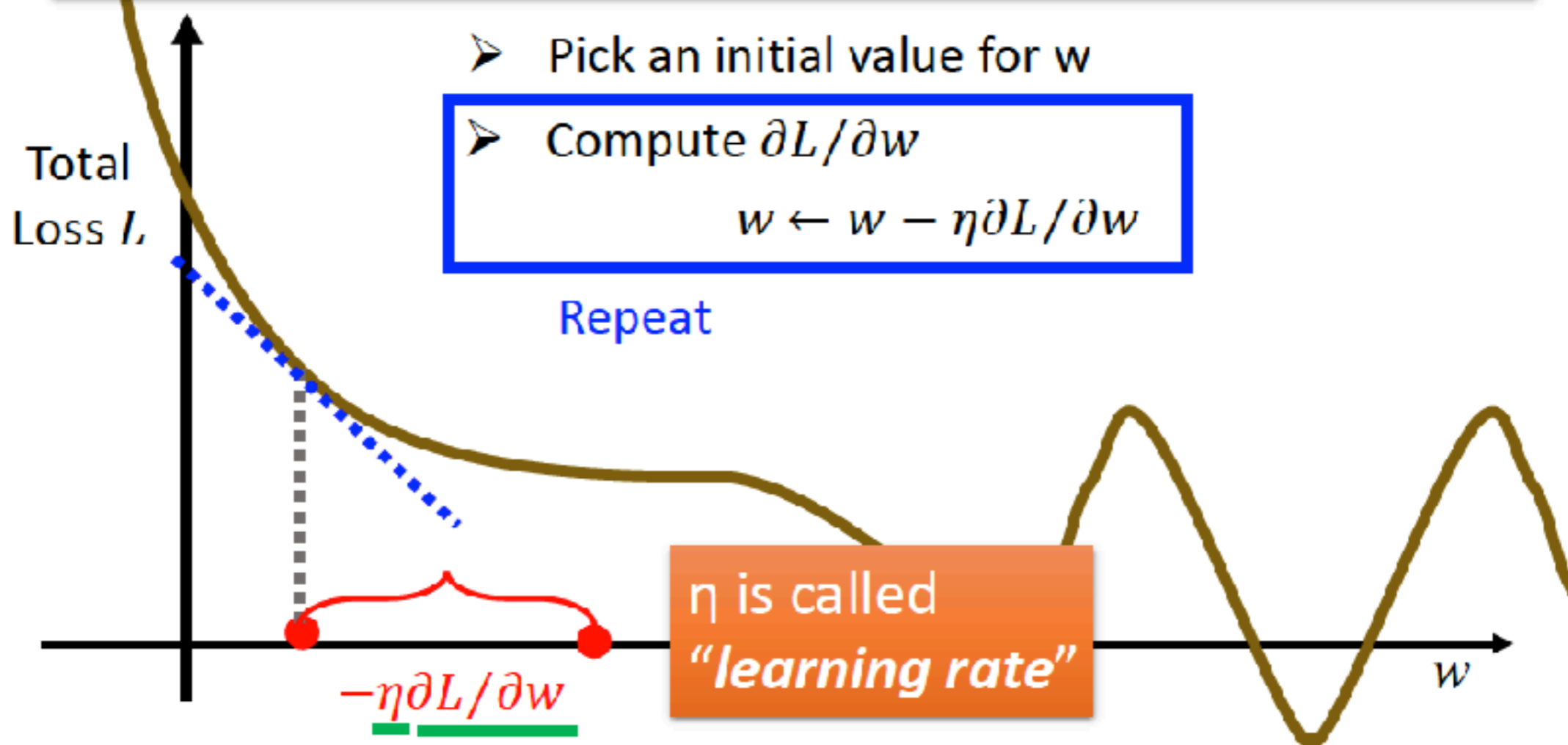


How to learn?

Network parameters $\theta = \{w_1, w_2, \dots, b_1, b_2, \dots\}$

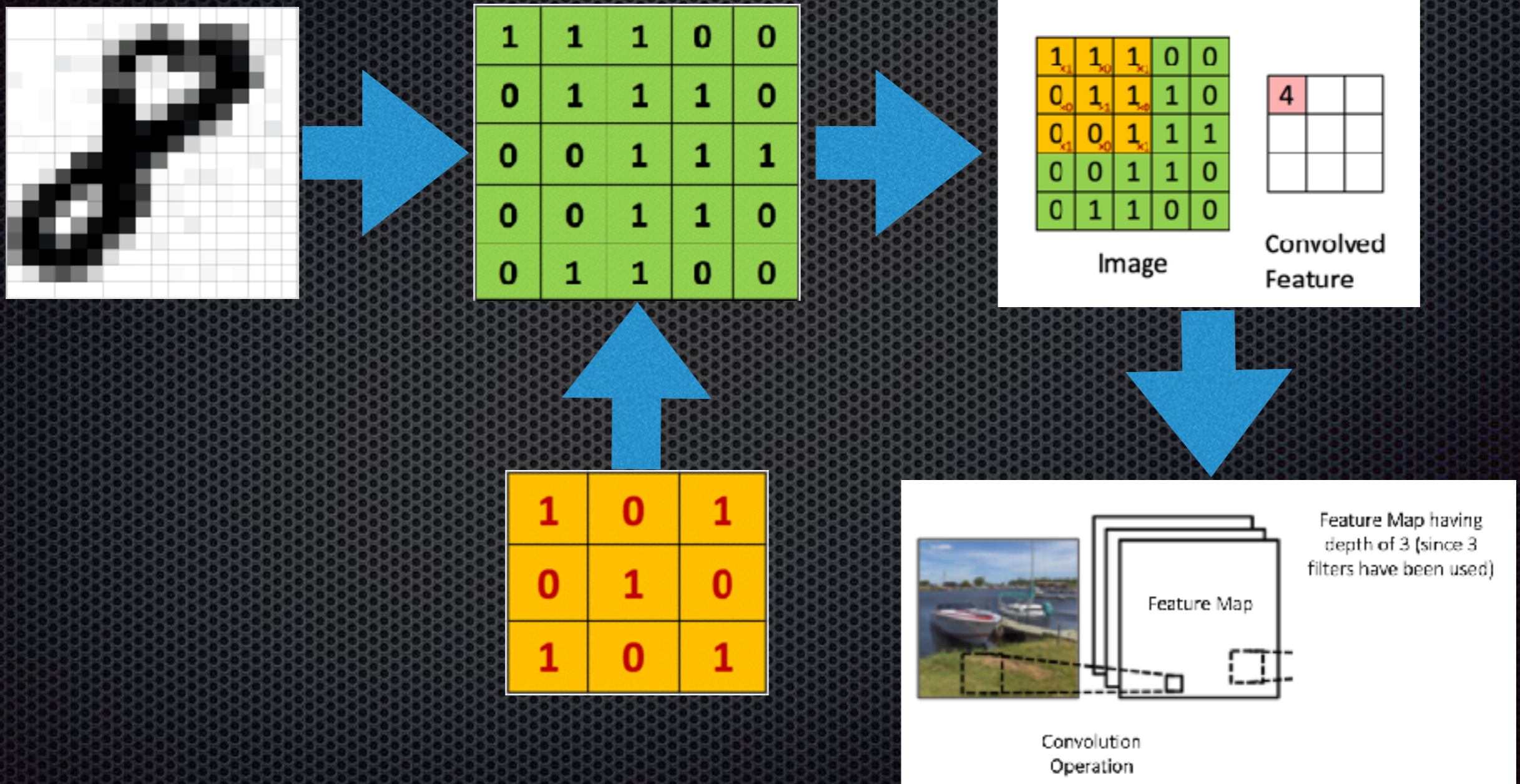
Learning Target

Find the network parameters θ^* that minimize total loss



An introduction to Convolution

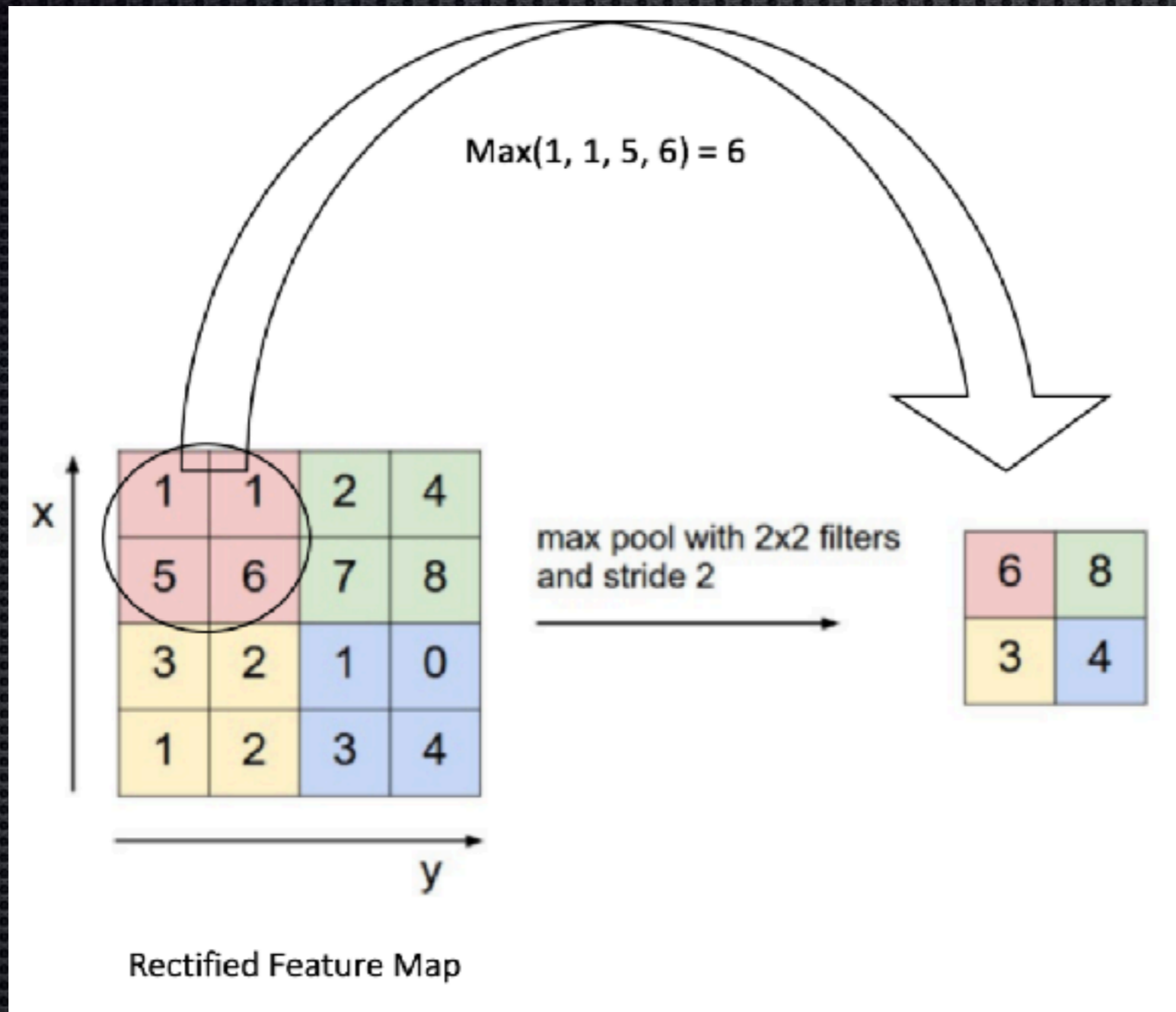
Convolution Process



Reference: An Intuitive Explanation of Convolutional Neural Networks-

<http://www.kdnuggets.com/2016/11/intuitive-explanation-convolutional-neural-networks.html>

Pooling Process

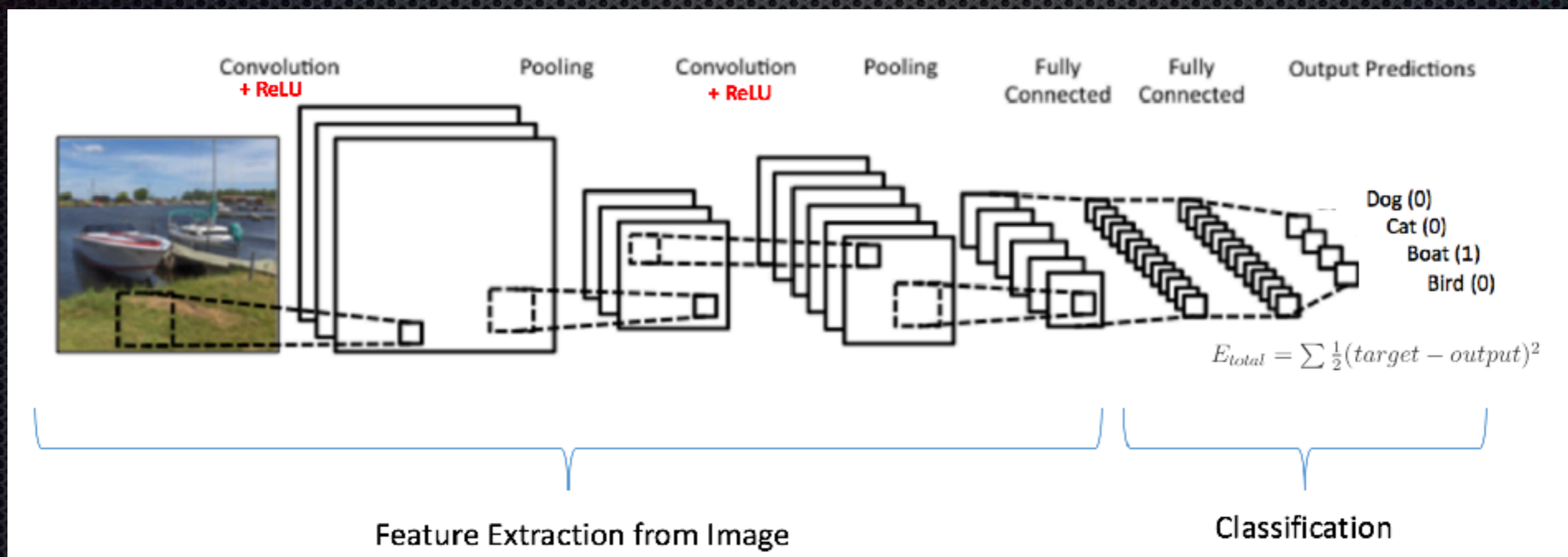


Reference: An Intuitive Explanation of Convolutional Neural Networks-

<http://www.kdnuggets.com/2016/11/intuitive-explanation-convolutional-neural-networks.html>

Convolutional neural network

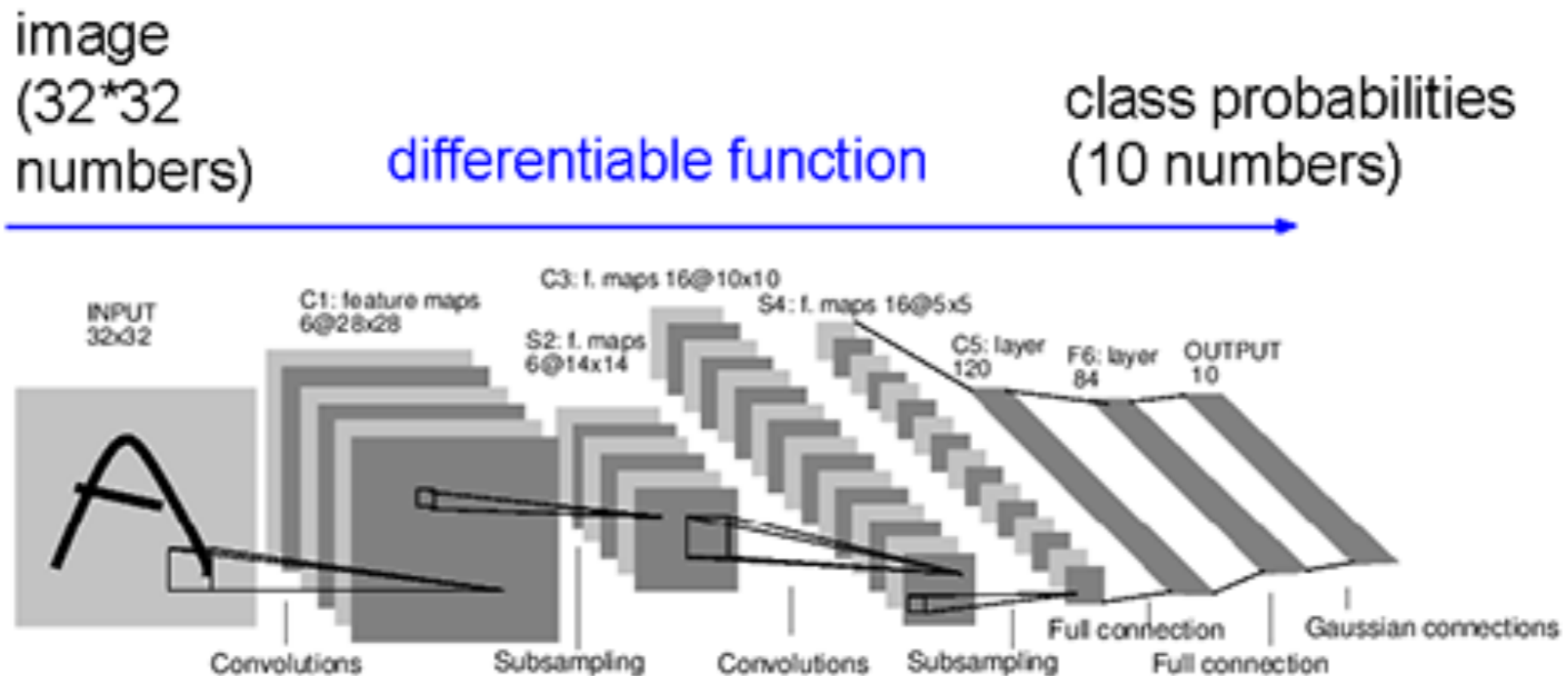
Convolutional Neural Network-Overview



Reference: An Intuitive Explanation of Convolutional Neural Networks-

<http://www.kdnuggets.com/2016/11/intuitive-explanation-convolutional-neural-networks.html>

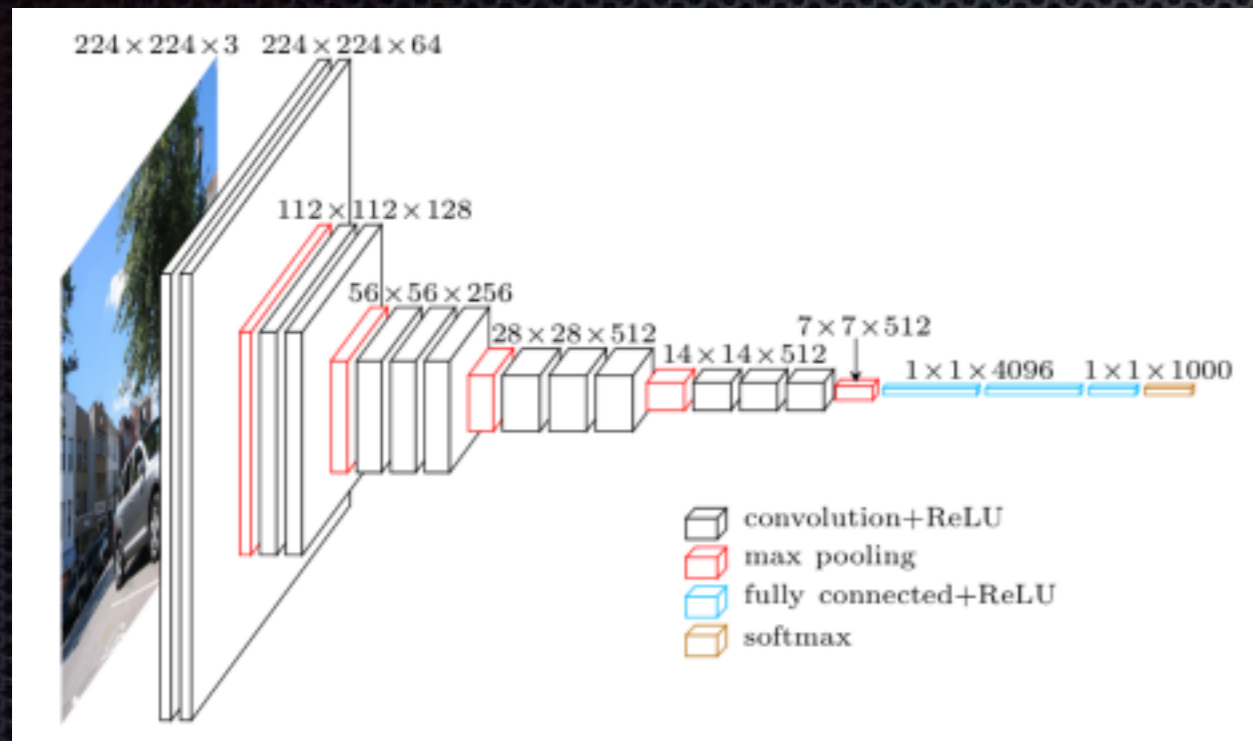
More Convolutional Neural Network(1/2)



[LeCun et al., 1998]

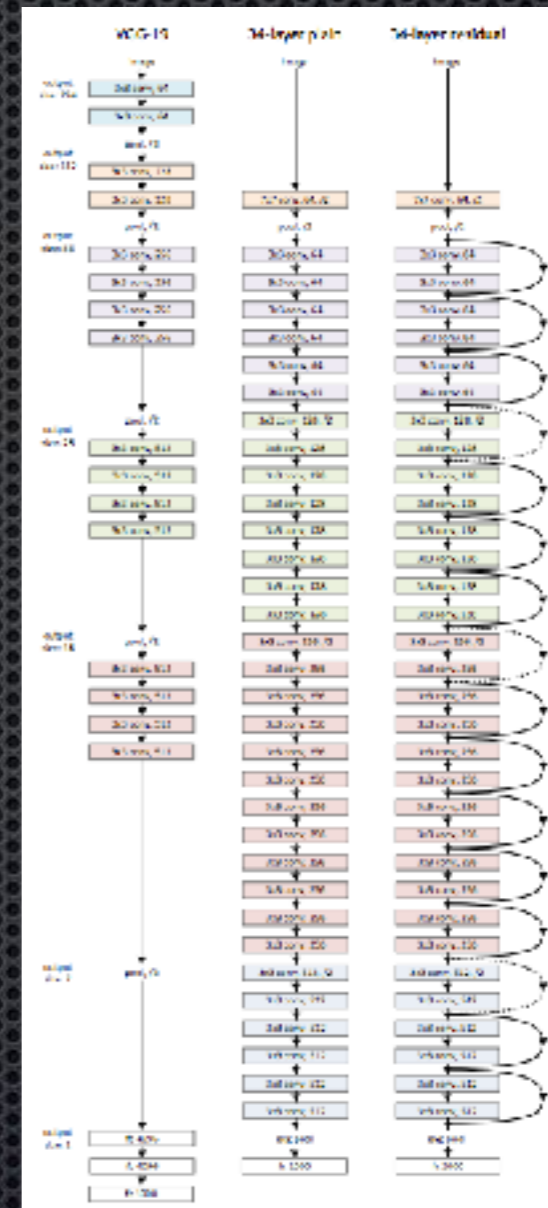
Reference: <http://www.self-catering-scotland.co.uk/bags-imagenet-classification-with-deep-convolutional-neural-networks-krizhevsky.html>

More Convolutional Neural Network(2/2)



VGG-16

VGG19&Residual Net



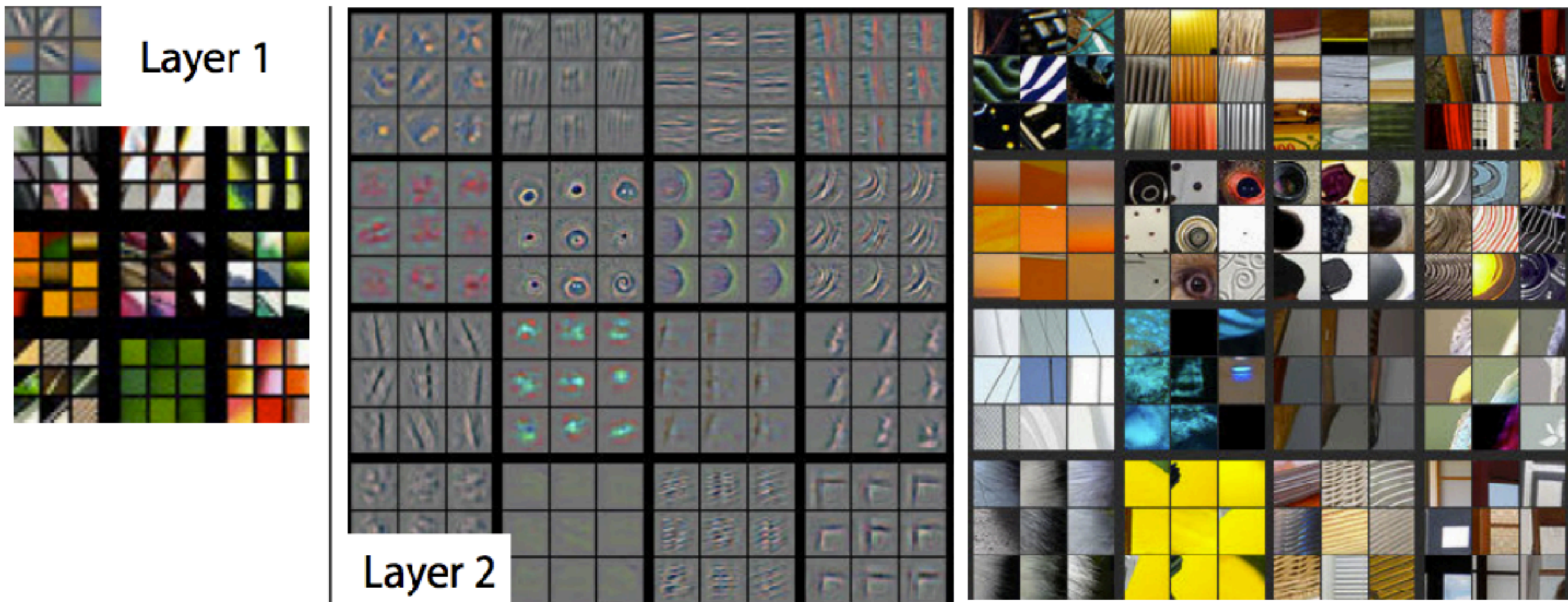
Reference:

1. <http://www.cs.toronto.edu/~frossard/post/vgg16/>

2. <https://www.quora.com/How-does-deep-residual-learning-work>

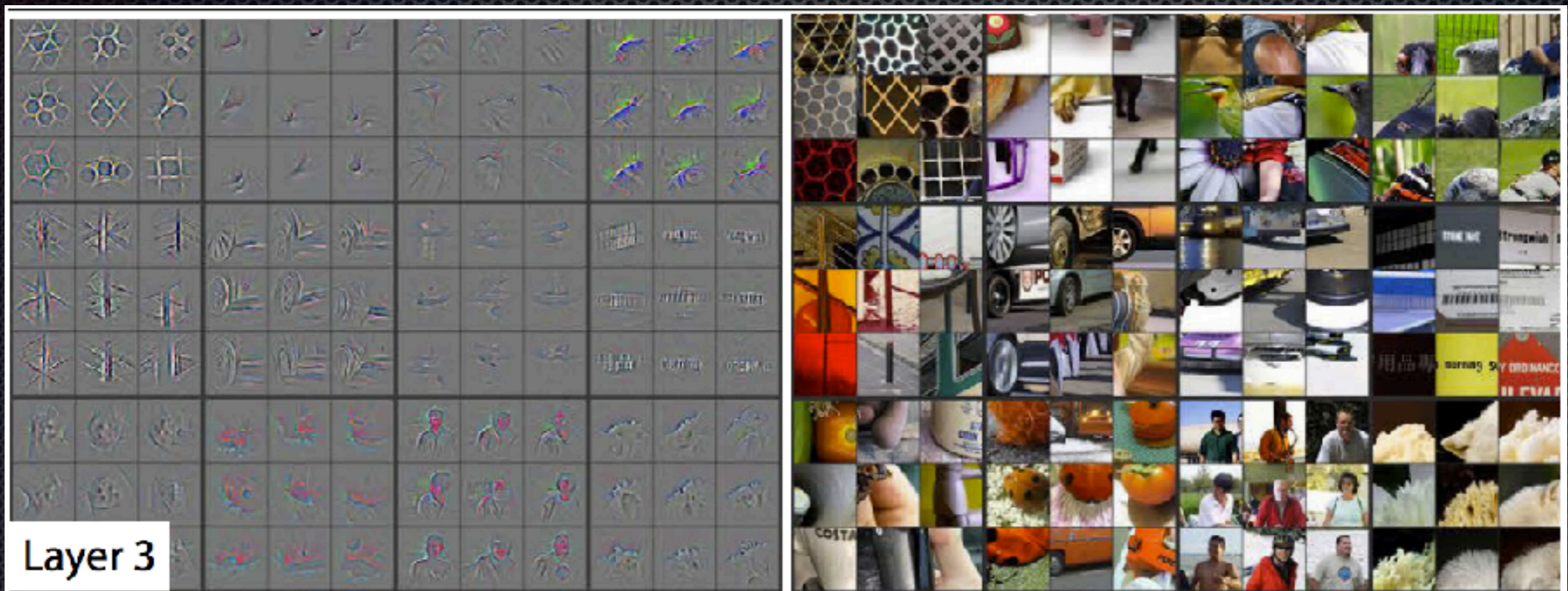
What have each layer learned?

What have each layer learned?(1/3)



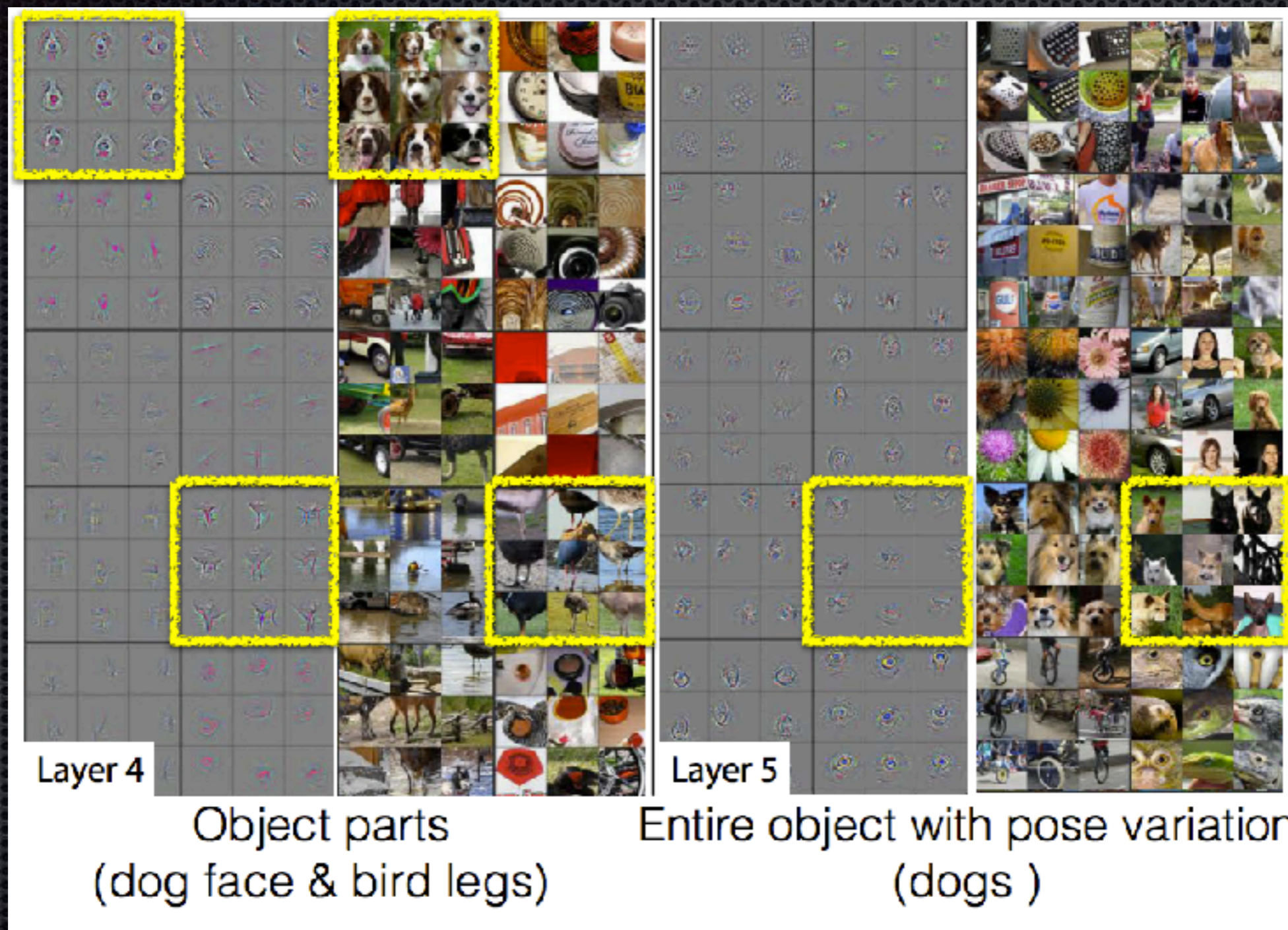
corners & edge/color conjunctions

What have each layer learned?(2/3)



similar textures

What have each layer learned?(3/3)



「Thank You °」

-Miles Lee