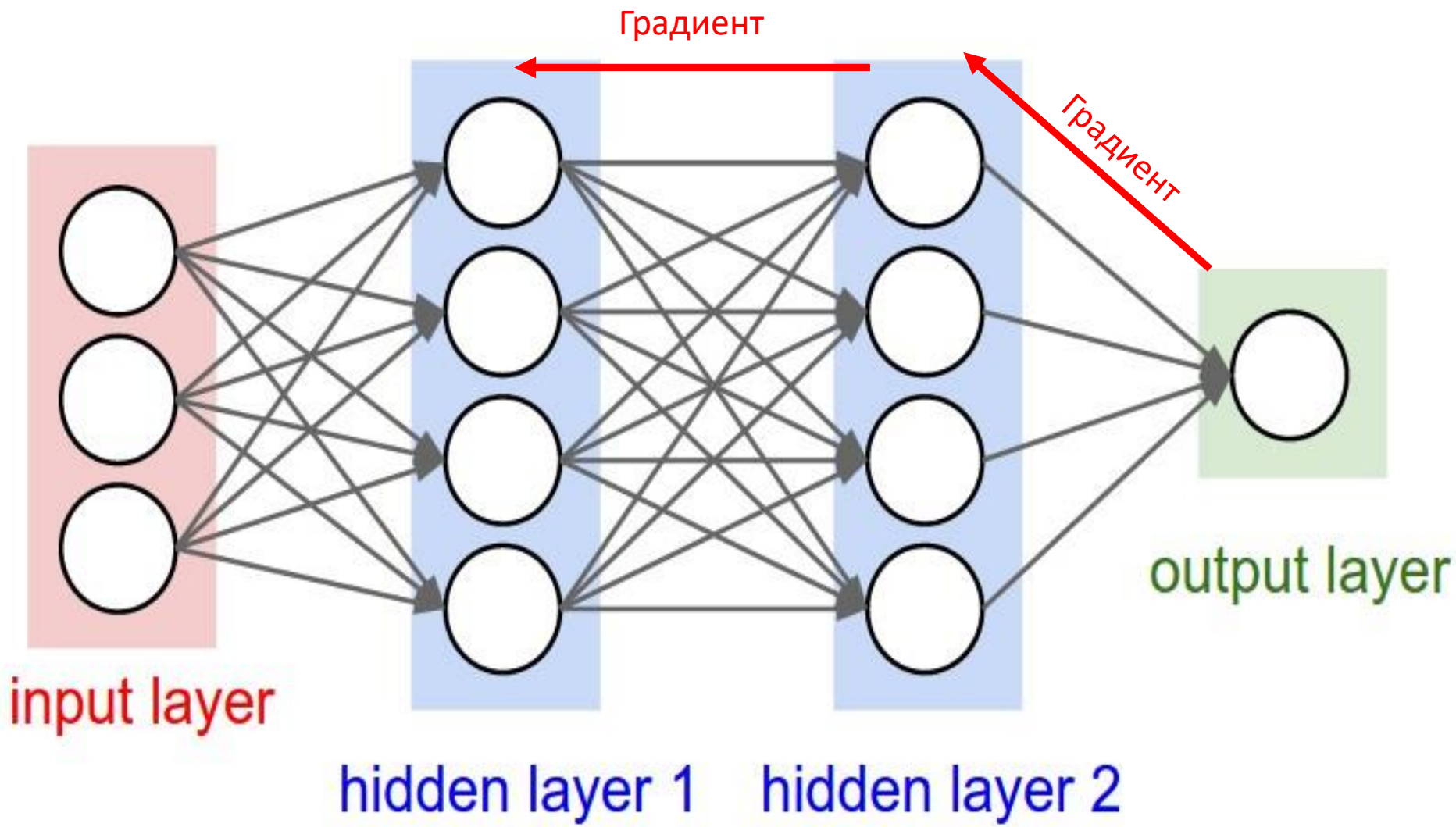
Deep Learning

Back-propagation



David Rumelhart, Geoffrey Hinton and Rondald Williams, 1986

Свертка (Convolution)

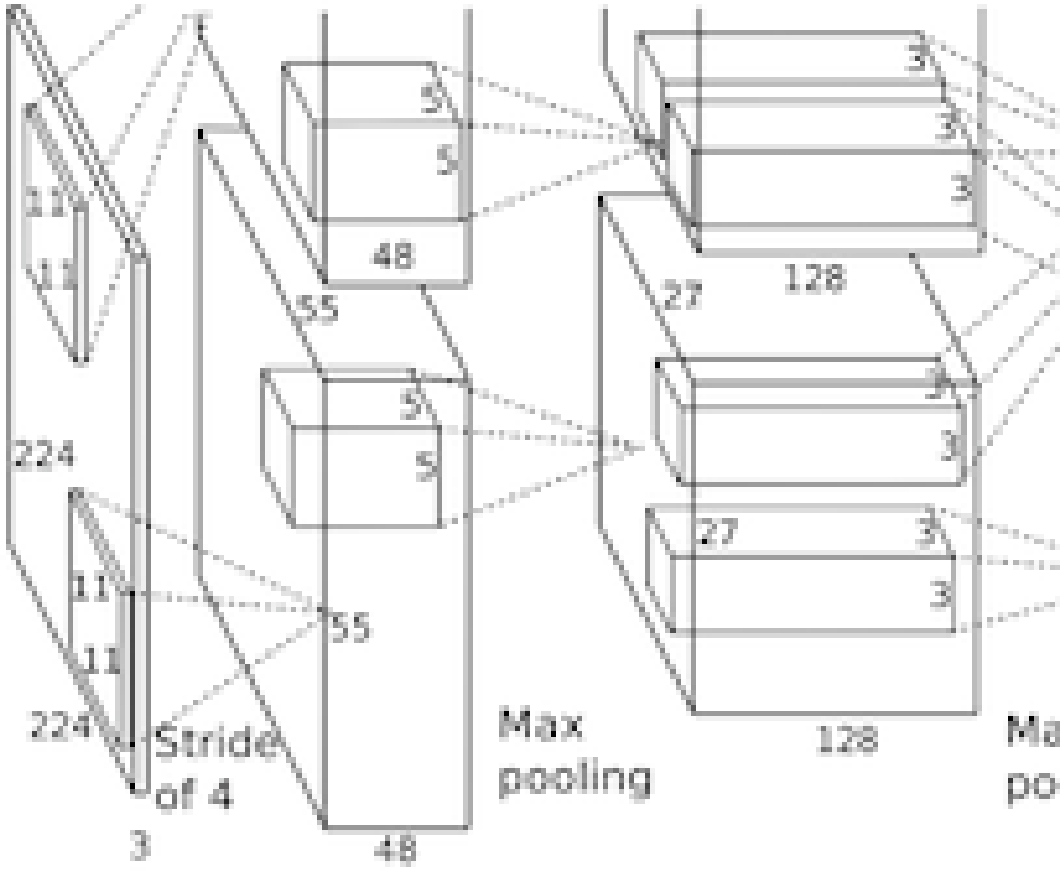
$1_{\times 1}$	$1_{\times 0}$	$1_{\times 1}$	0	0
$0_{\times 0}$	$1_{\times 1}$	$1_{\times 0}$	1	0
$0_{\times 1}$	$0_{\times 0}$	$1_{\times 1}$	1	1
0	0	1	1	0
0	1	1	0	0

Image

4		

Convolved Feature

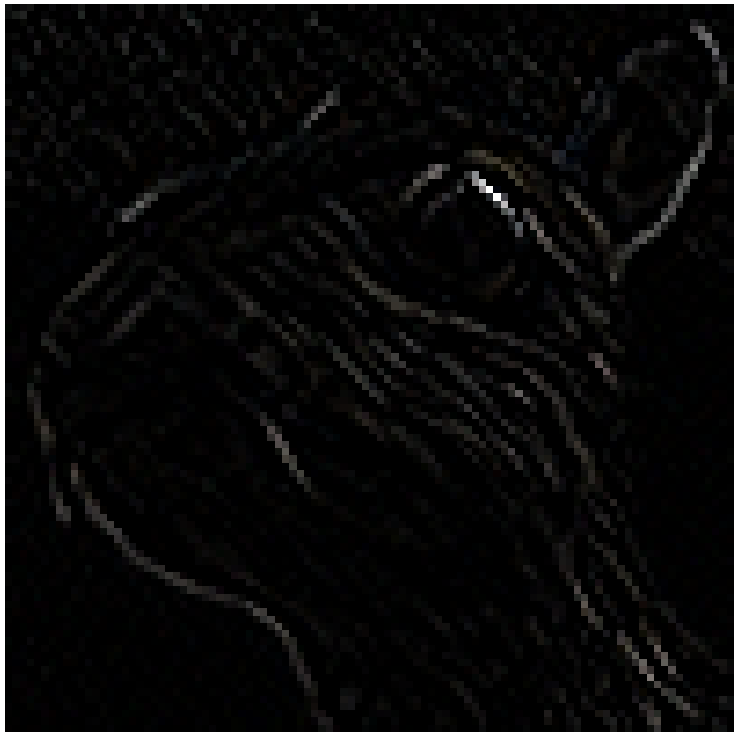
Kernel 3x3, Stride 1



Примеры сверток

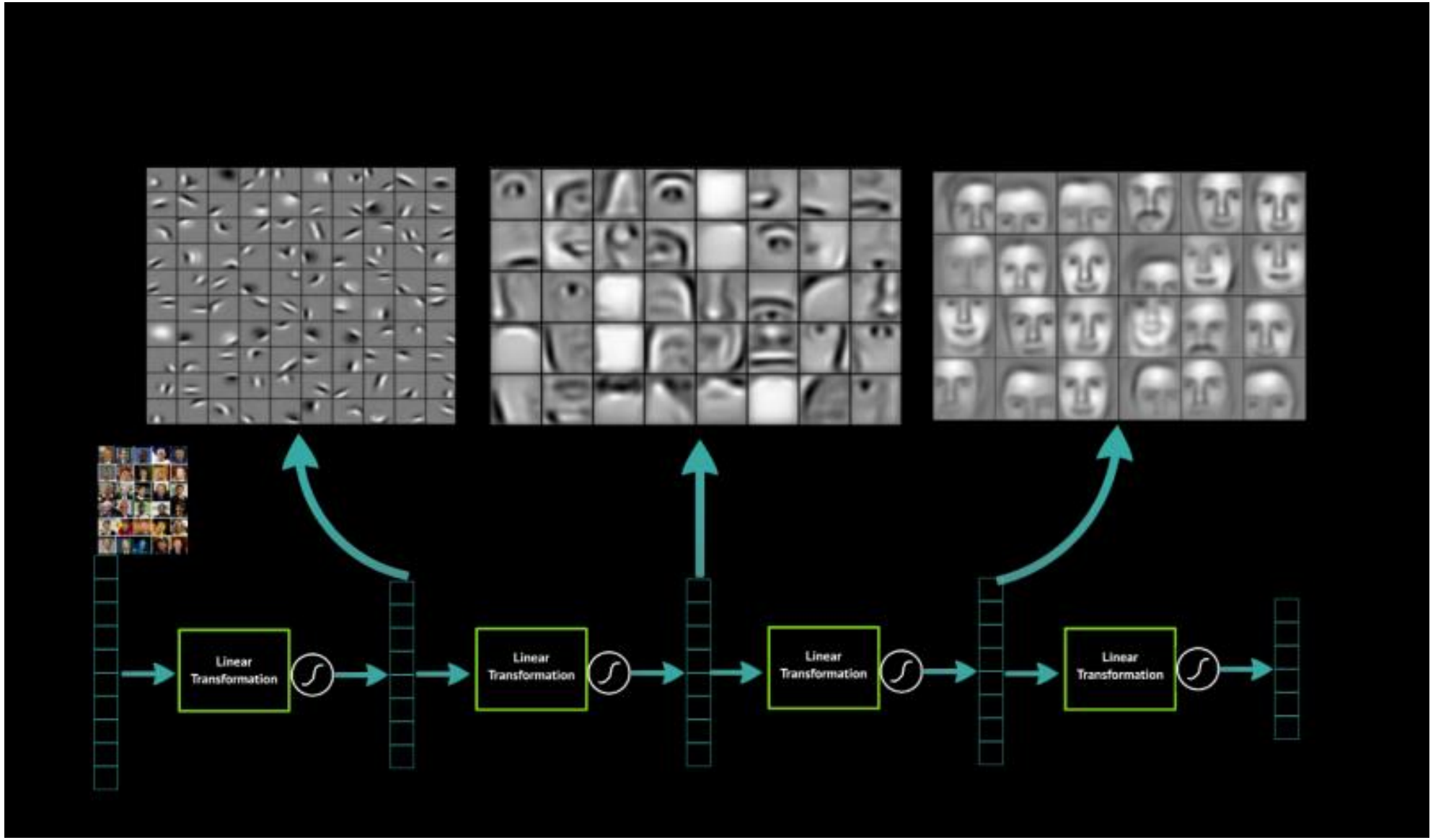
$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$$



$$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

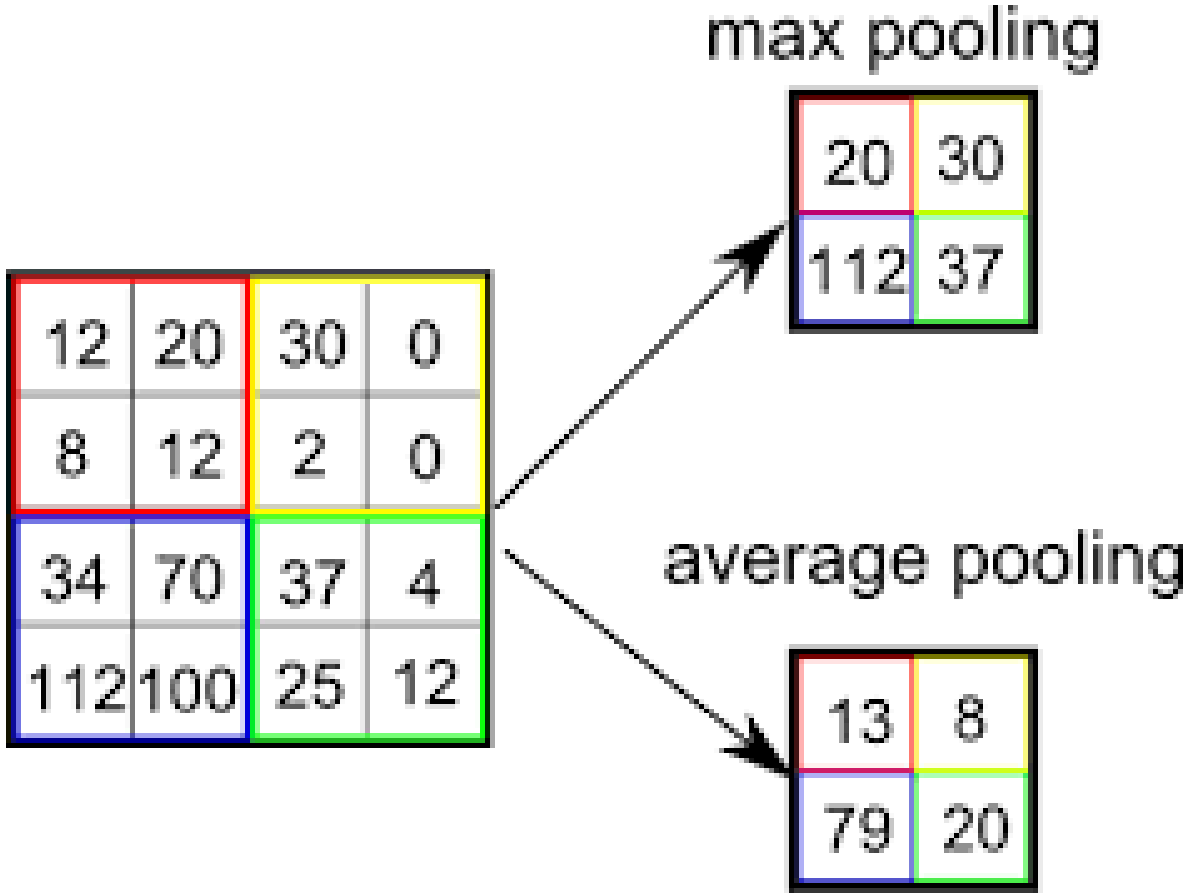
Свертка (Convolution)



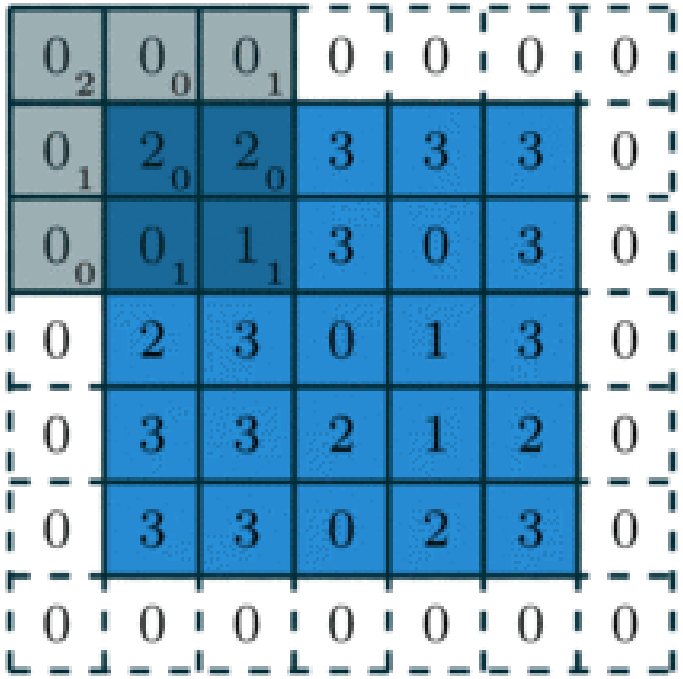
Pooling

Kernel 2x2

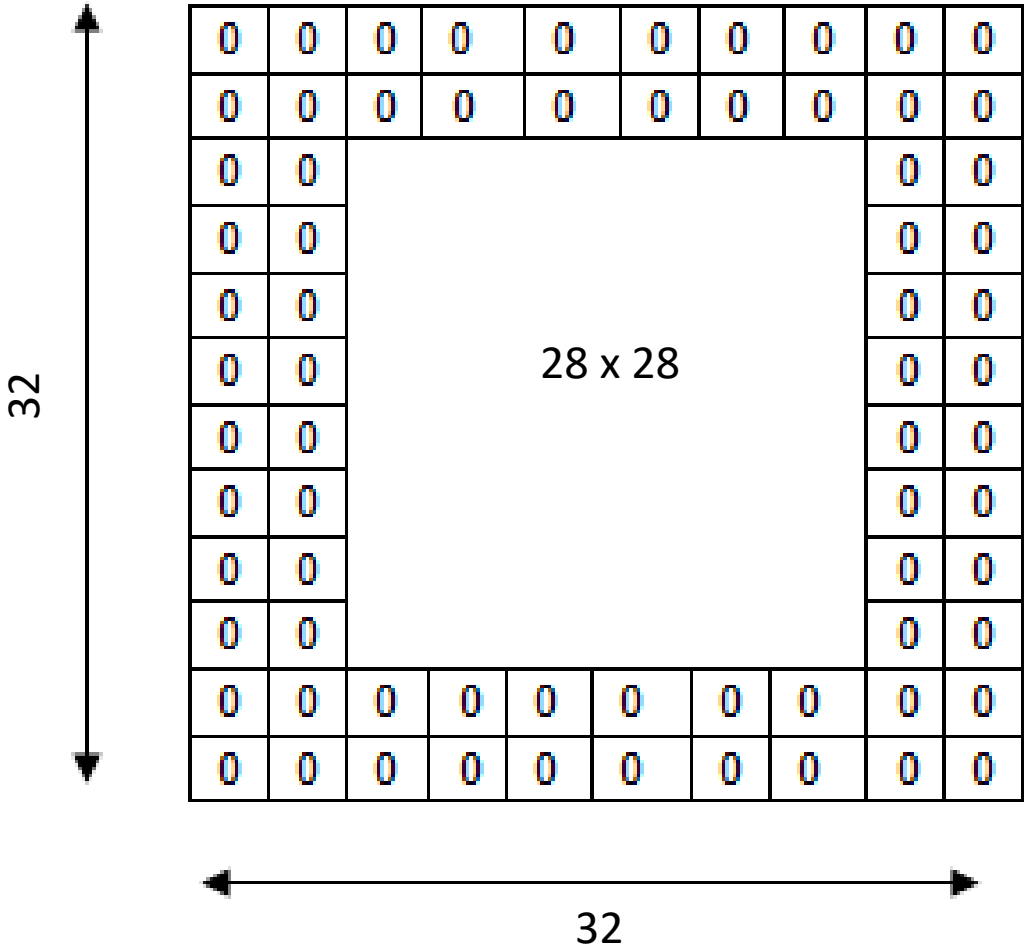
Stride 2



Padding

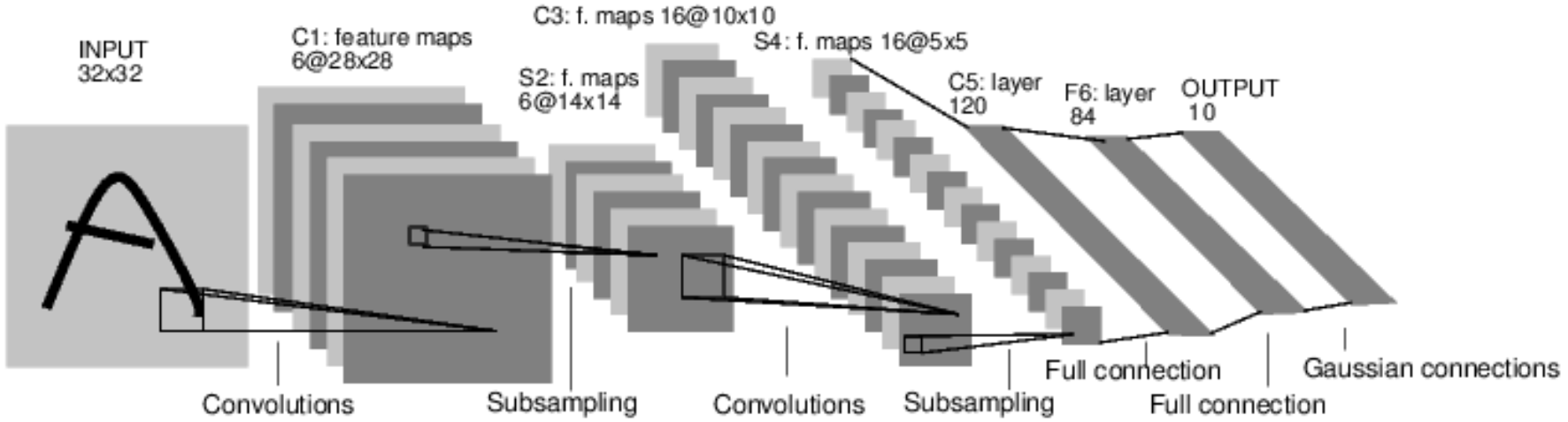


1	6	5
7	10	9
7	10	8



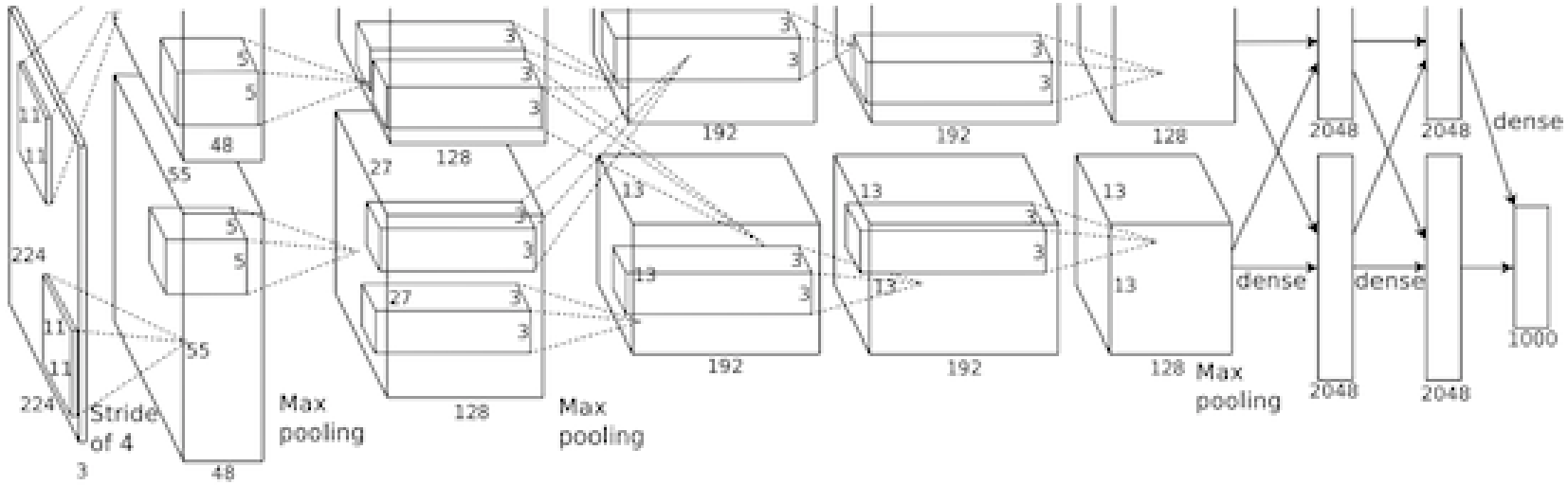
Deep learning

LeNet-5 (1998)



(5x5)x6 + (5x5x6)x16 + (16x5x5)x120 + 120x84 + 84x10 = 61470

AlexNet (2012)



(11x11x3)x48 + (5x5x48)x128 + (3x3x128)x192x2 + (3x3x192)x192 + (3x3x192)x128 + (13x13x128)x2048x2 + 2048x2048x2 + 2048x1000 = 100 207 632

Работа нейронной сети

Deep Visualization Toolbox

yosinski.com/deepvis

#deepvis


Jason Yosinski


Jeff Clune


Anh Nguyen


Thomas Fuchs

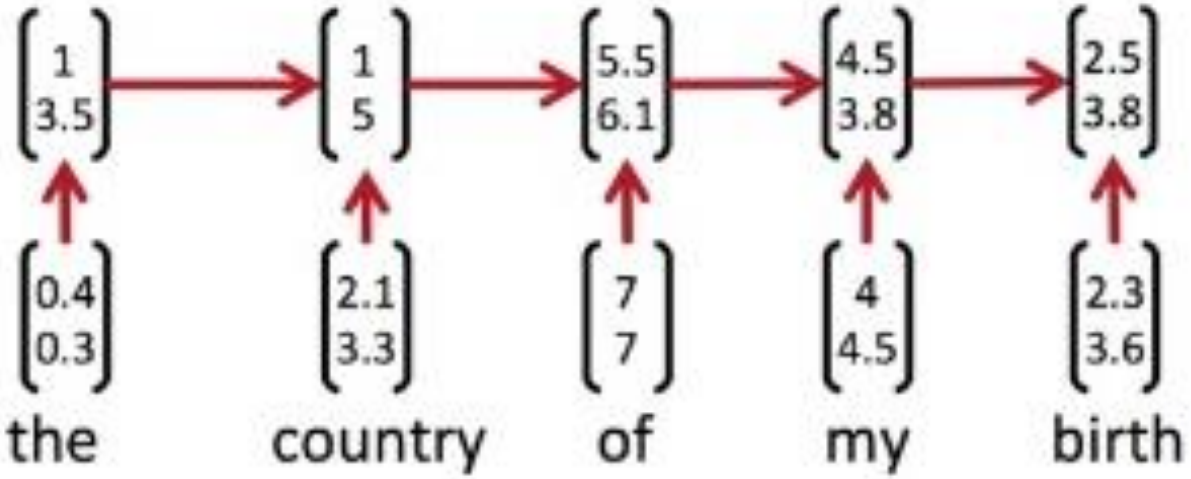

Hod Lipson

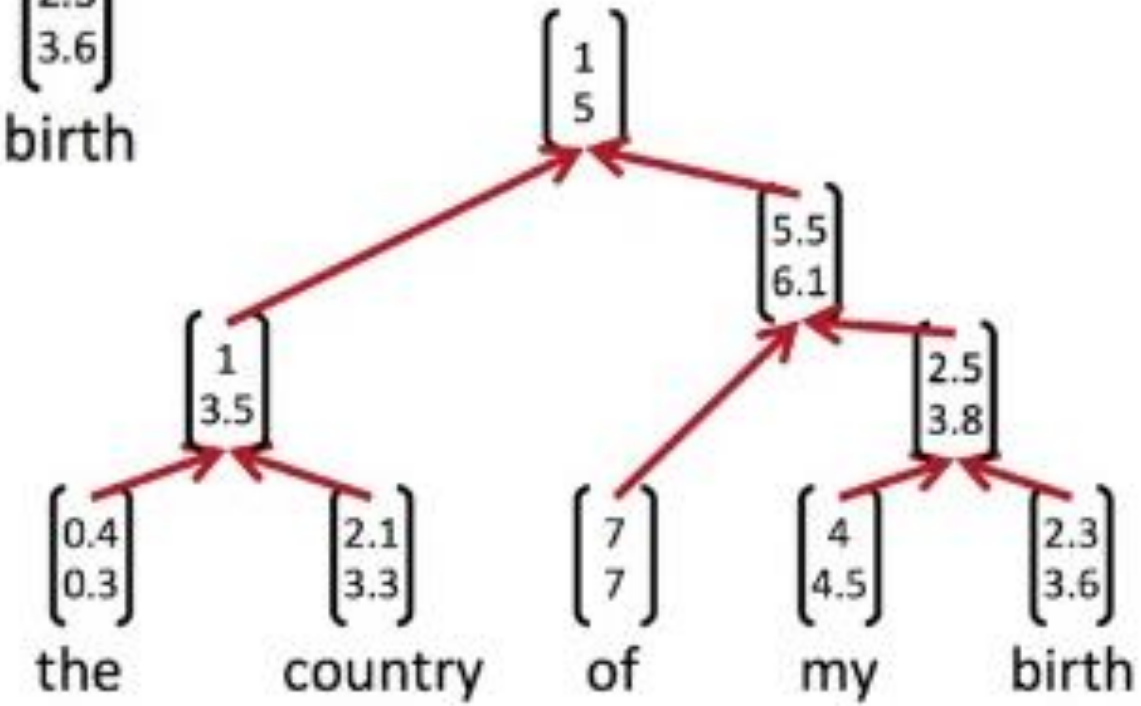
Cornell University

University of Wyoming

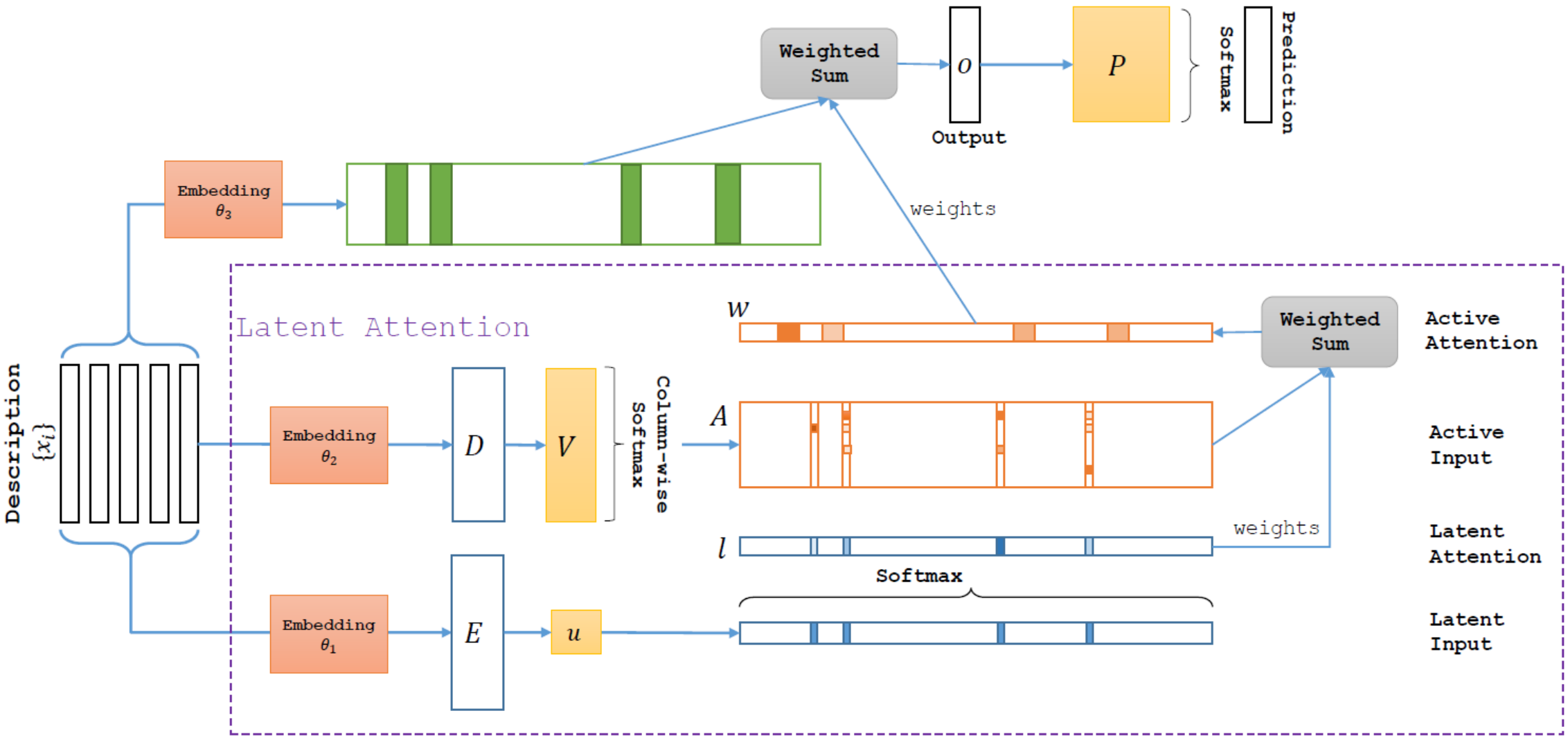
Jet Propulsion Laboratory
California Institute of Technology

Recurrent and Recursive Neural Networks





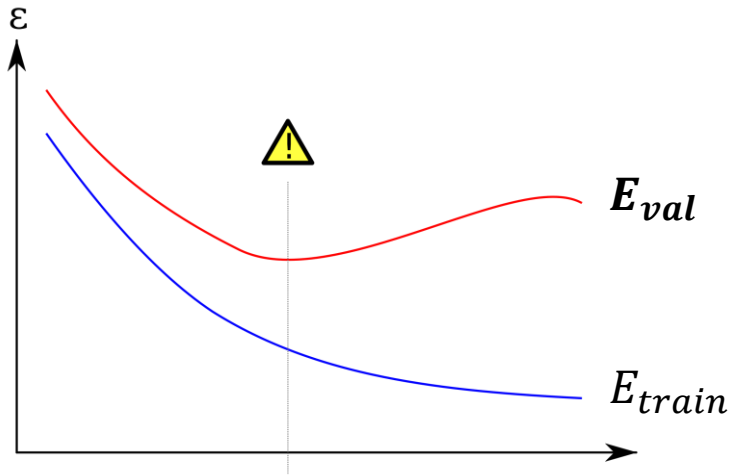
Complex DNN Architecture and Layers



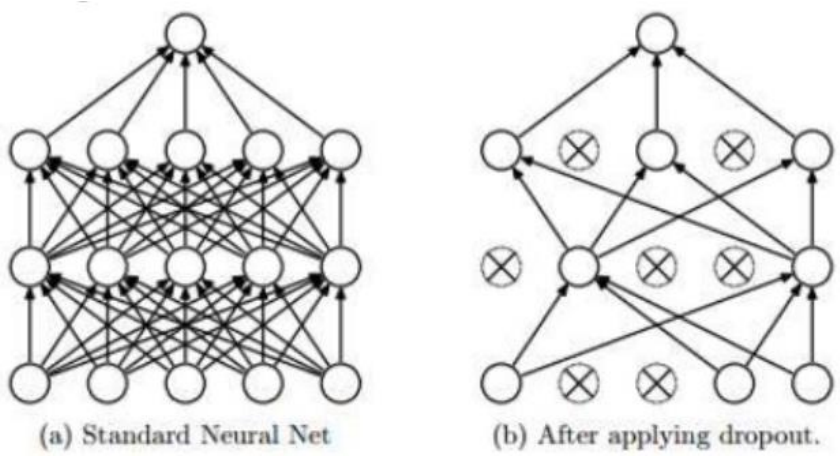
Регуляризация

L2 регуляризация — $C'(w) = C(w) + \frac{\lambda}{2N}||w||_2^2$

Ранняя остановка (Early Stopping):



Dropout:



Искусственное увеличение обучающей выборки (Artificial expansion)

Из-за большого количества гиперпараметров нужно перейти:

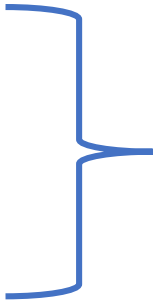
Train,Test -> Train, Validate, Test.

Подготовка к домашнему заданию

Пакеты deep learning:

Theano (deeplearning.net/software/theano)

TensorFlow (www.tensorflow.org)



+ Keras (keras.io)

Torch (torch.ch) - PyTorch

Deeplearning4j (deeplearning4j.org)