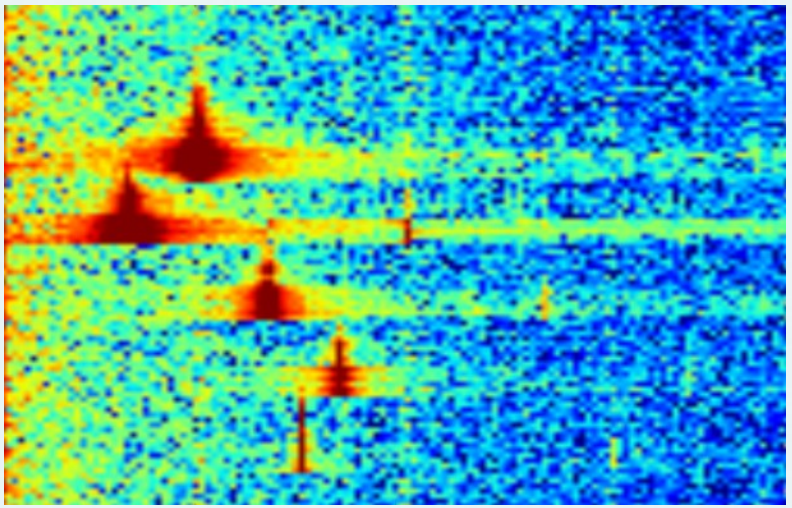
MACHINE LEARNING AND AI

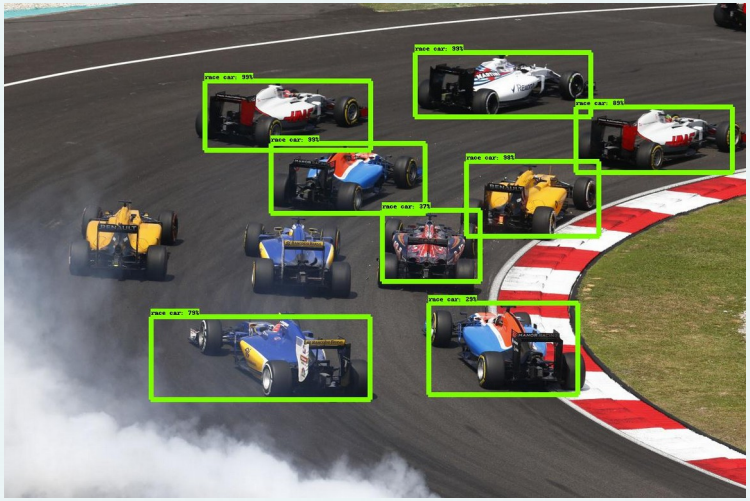
ЛЕКЦИЯ 6

convolutional neural network (cnn)

Собака? (0\1)



Распознавание речи



Поиск объектов

проблема – выделение контура объекта

выделение вертикальных краёв

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

*

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

=

-5	-4	0	8
-10	-2	2	3
0	-2	-4	-7
-3	-2	-3	-16

выделение вертикальных краёв

10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0

*

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

=

0	30	30	0
0	30	30	0
0	30	30	0
0	30	30	0

более сложный пример

10	10	10	0	0	0
10	10	10	0	0	0
10	10	10	0	0	0
0	0	0	10	10	10
0	0	0	10	10	10
0	0	0	10	10	10

*

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

=

0	0	0	0
30	10	-10	-30
30	10	-10	-30
0	0	0	0

общий случай

3	0	1	2	7	4
1	5	8	9	3	1
2	7	2	5	1	3
0	1	3	1	7	8
4	2	1	6	2	8
2	4	5	2	3	9

*

w_1	w_2	w_3
w_4	w_5	w_6
w_7	w_8	w_9

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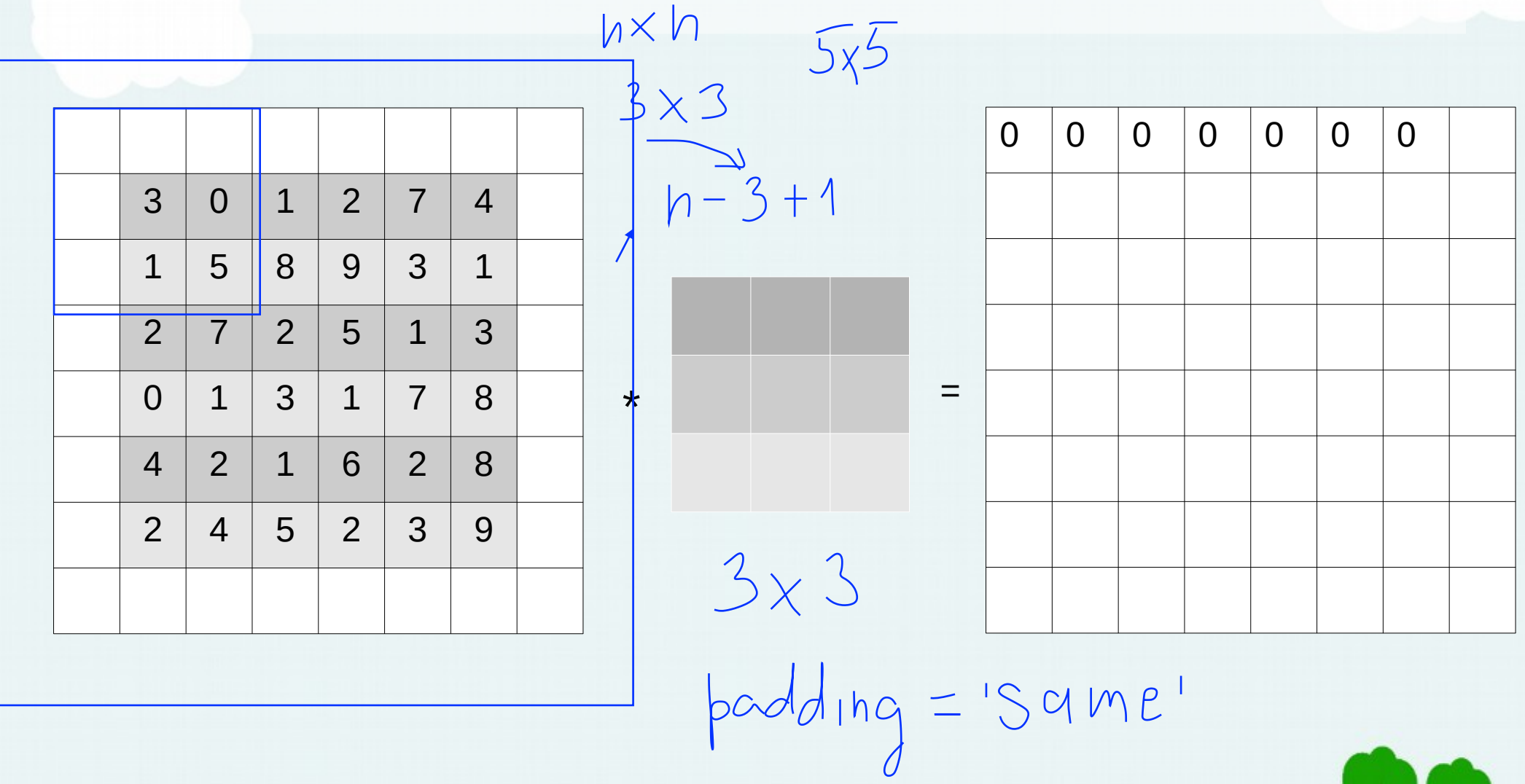
добавление рамки (padding)



	3	0	1	2	7	4	
	1	5	8	9	3	1	
	2	7	2	5	1	3	
	0	1	3	1	7	8	
	4	2	1	6	2	8	
	2	4	5	2	3	9	

*

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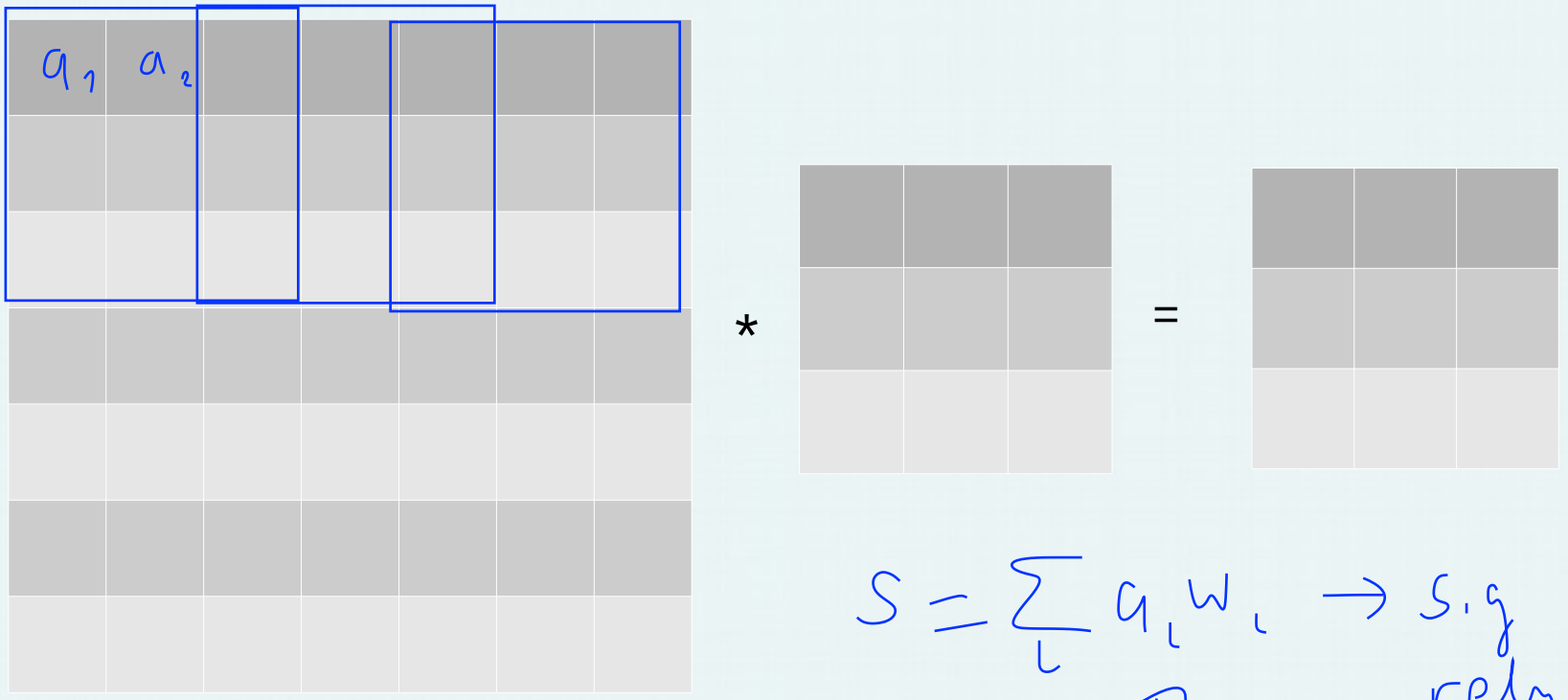
0	0	0	0	0	0	0	

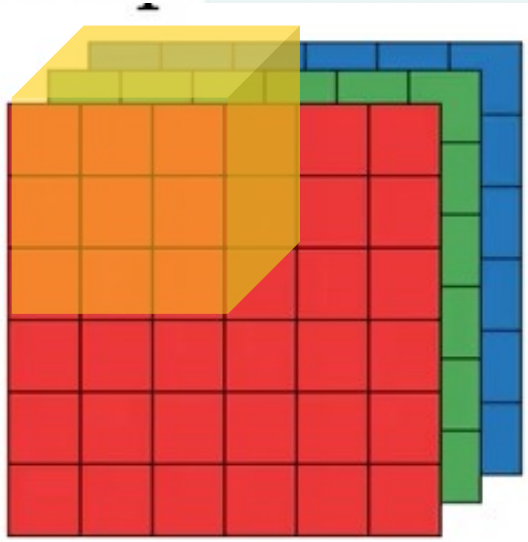
сдвиг (stride) = 1



$$s = \sum_i a_i w_i \rightarrow s.g.$$

relu

свёртка по объёму



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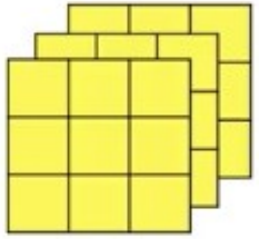

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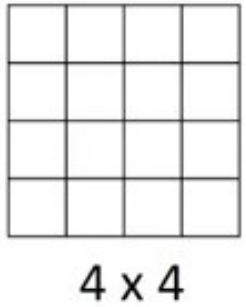

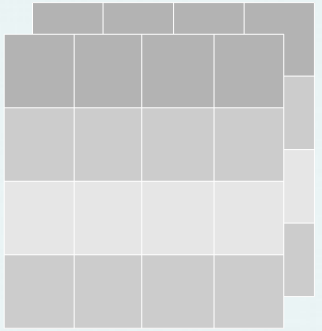

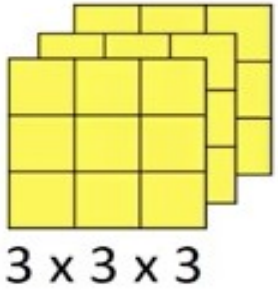

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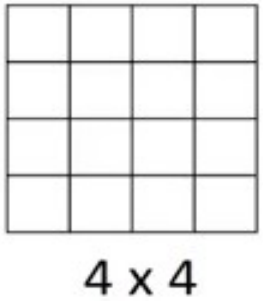
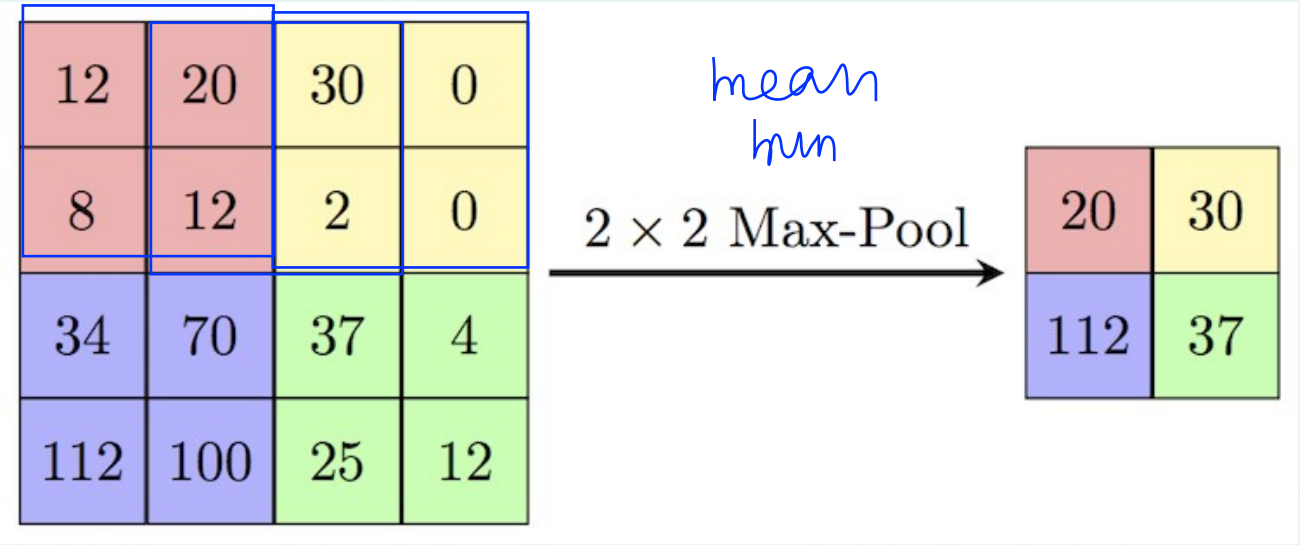
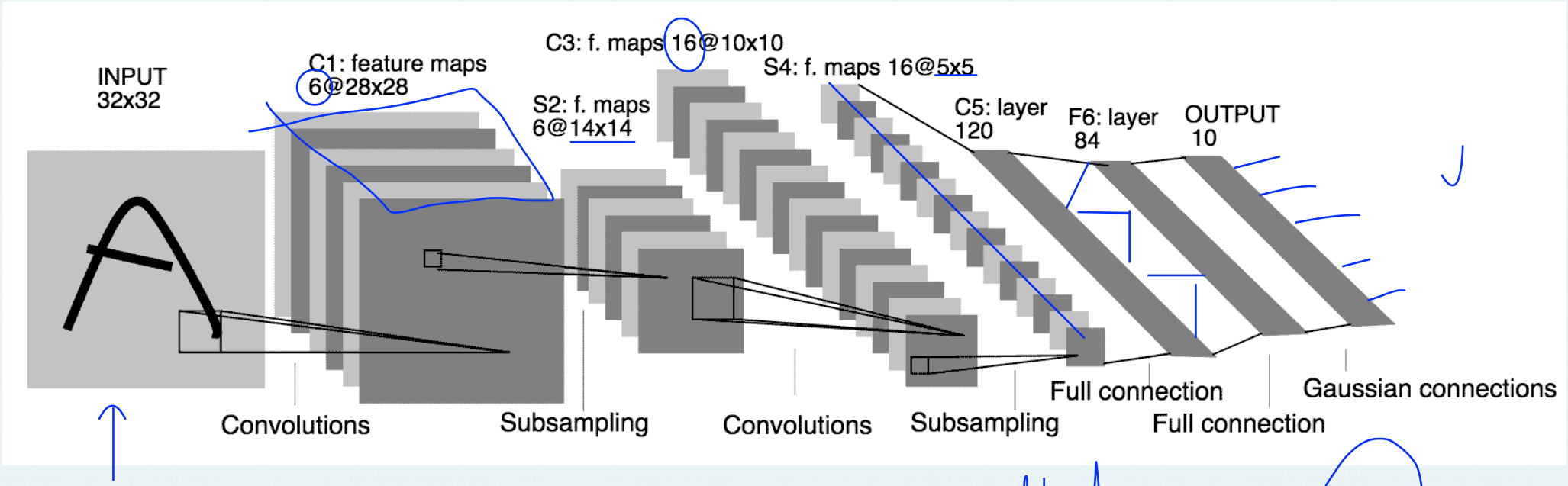


понижение размерности (pooling)

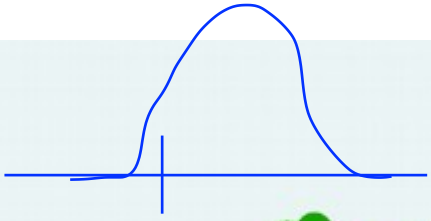


свёрточная нейронная сеть (cnn)

CNN Yan LeCun



input → conv → conv → conv → pool → flat



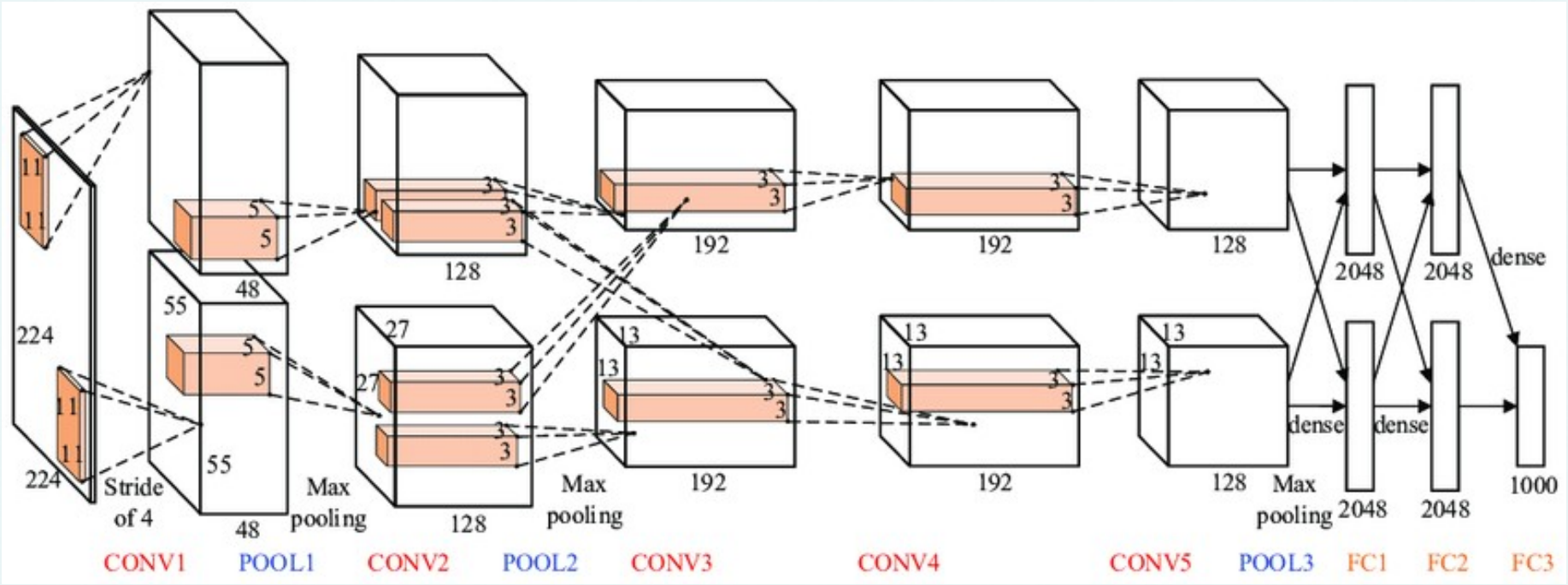
batch_normalization

$$\frac{x - mean}{std}$$

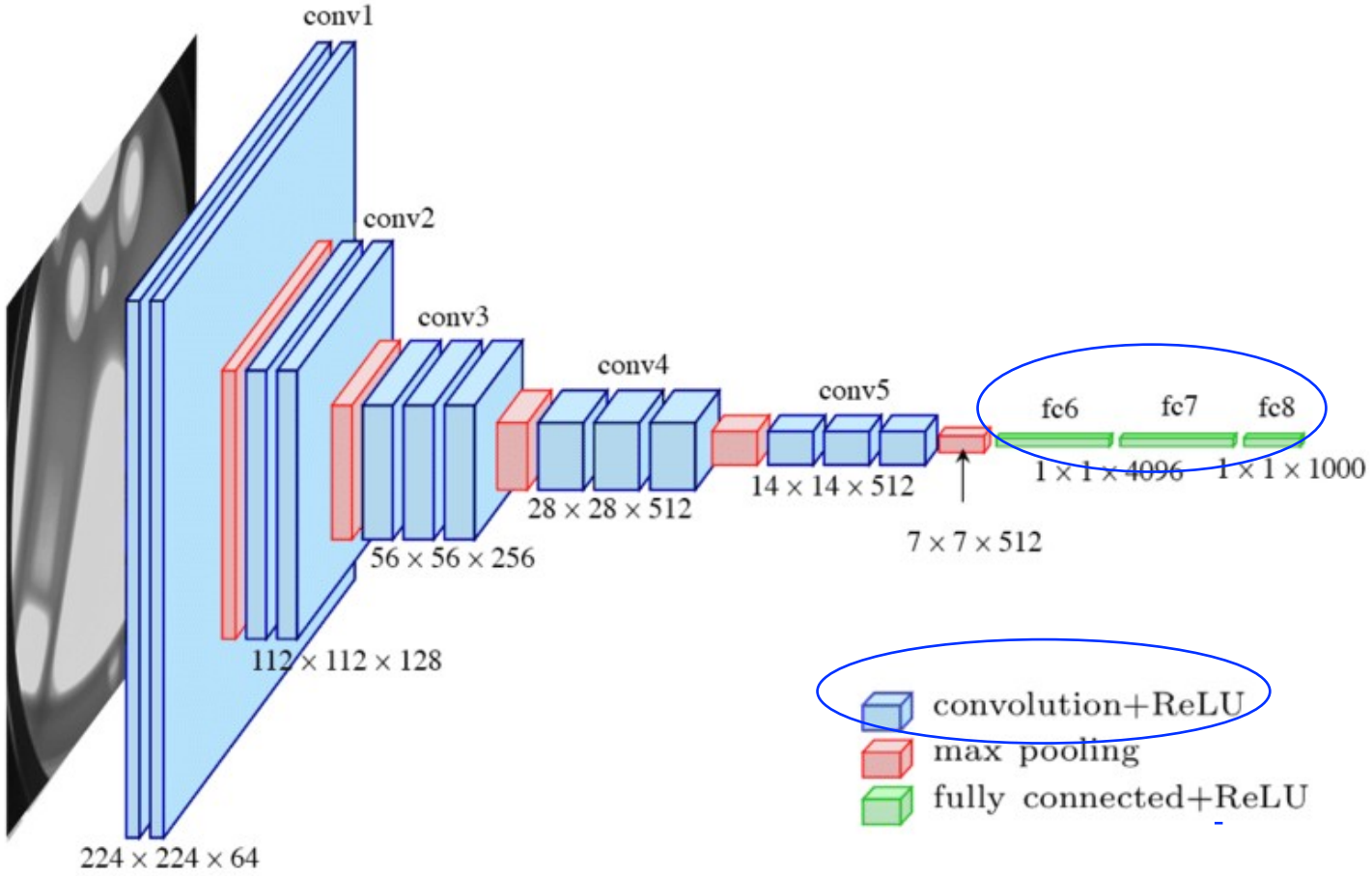
разновидности сетей

- AlexNet →
- VGG →
- Residual Network →
- Siamese networks →
- Encoder-decoder →
- etc.

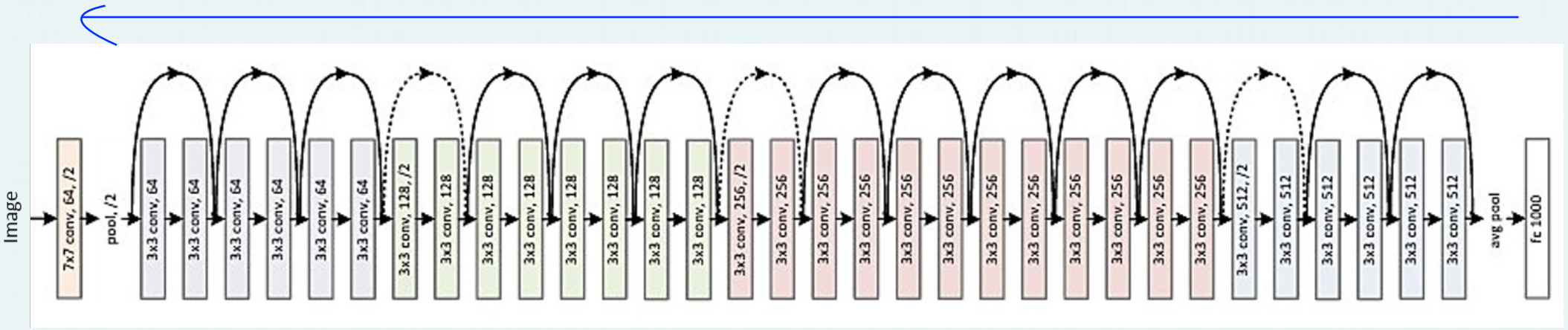
AlexNet architecture



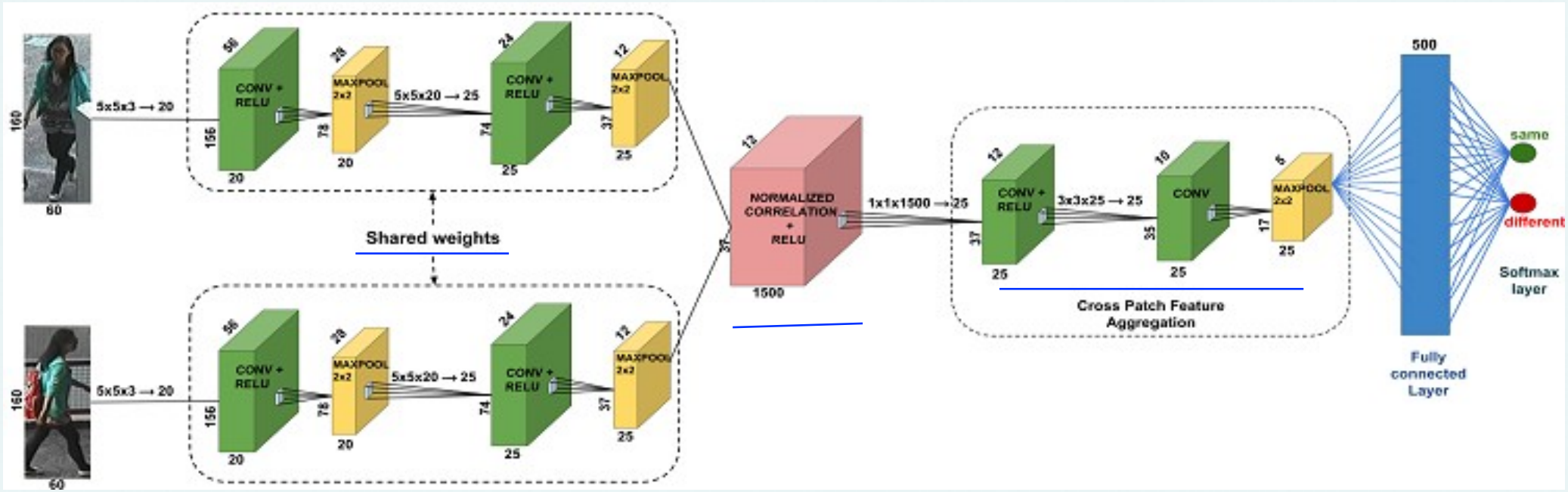
VGG-16 architecture



ResNet architecture



сиамские сети



encoder-decoder