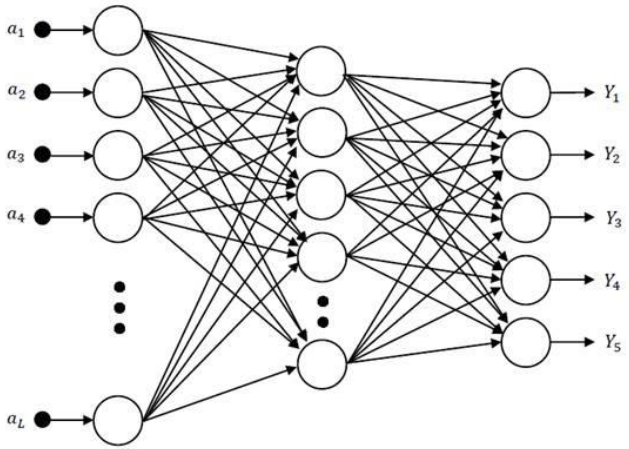
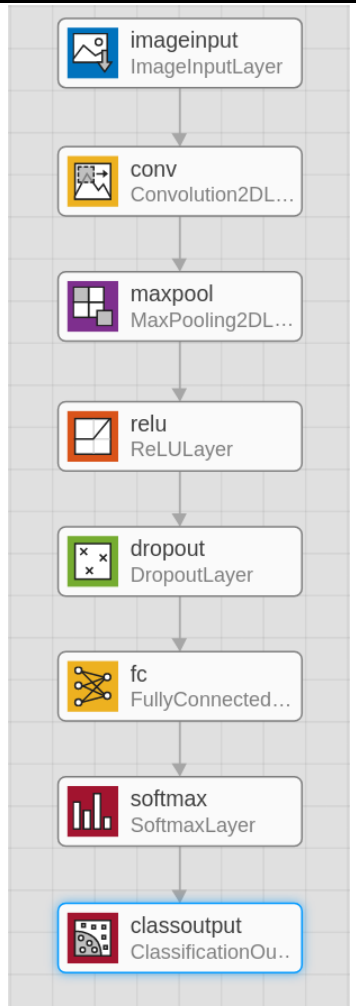
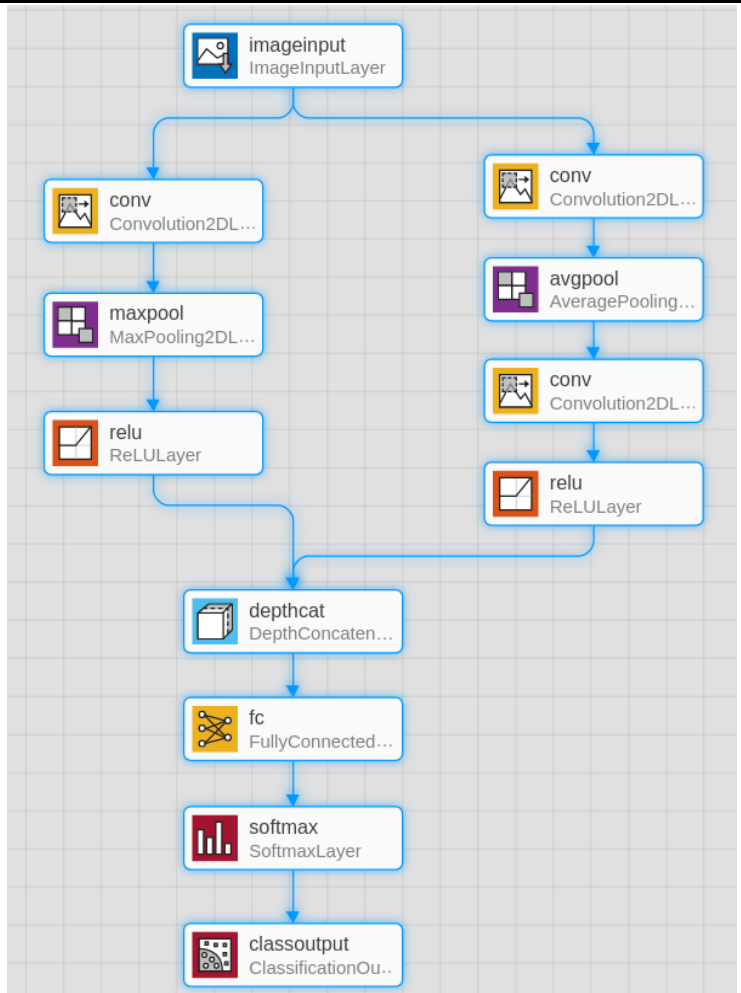
DEEP LEARNING
Layers

ГУУ, 3-й курс 2023, 2-й семестр

Архитектура







Вход

1365

2048

224

224

Свертка

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2

1	0
2	-1

7	-1	-6
9	1	-5
-2	0	-1

Свертка

1	**3**	-1	0
2	**-2**	0	5
4	1	-1	3
-3	0	1	2

1	0
2	-1

$$1 * 1 + 3 * 0 + 2 * 2 + (-2 * -1) = 7$$

7	-1	-6
9	1	-5
-2	0	-1

Свертка

1	**3**	**-1**	0
2	**-2**	**0**	5
4	1	-1	3
-3	0	1	2

1	0
2	-1

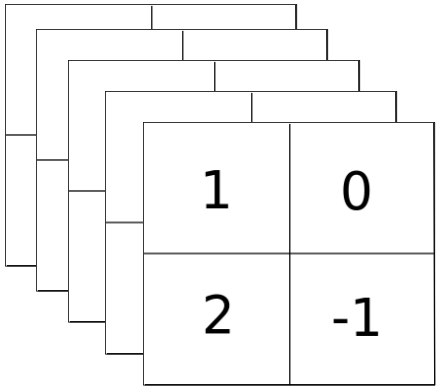
$$1 * 1 + 3 * 0 + 2 * 2 + (-2 * -1) = 7$$

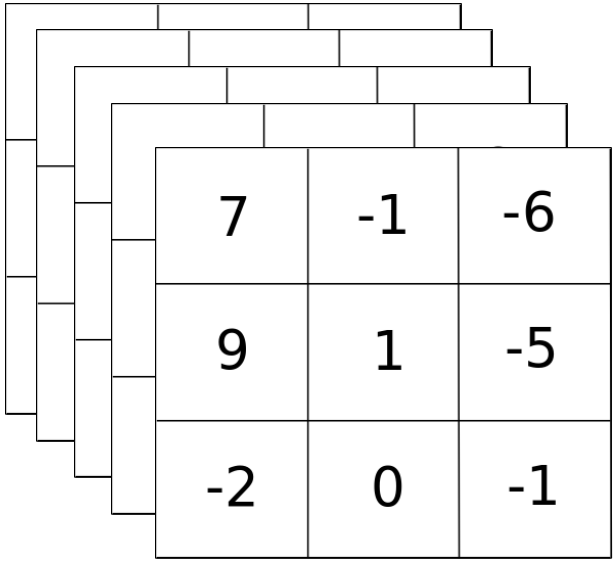
$$3 * 1 + -1 * 0 + -2 * 2 + 0 * -1 = -1$$

7	**-1**	-6
9	1	-5
-2	0	-1

Свертка

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2





Свертка

2	4	9
-5	1	7
-2	0	-1

Свертка

1	0
2	-1

2	4	9
-5	1	7
-2	0	-1

Свертка

2	4	9
-5	1	7
-2	0	-1

Свертка

1	0
2	-1

2	4	9
-5	1	7
-2	0	-1

Ректификация (ReLu)

7	-1	-6
9	1	-5
-2	0	-1

$$f(x) = max(0, x)$$

7	0	0
9	1	0
0	0	0

Субдискретизация (pooling)

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2

Субдискретизация (pooling)

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2

3	

Субдискретизация (pooling)

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2

3	5

Субдискретизация (pooling)

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2

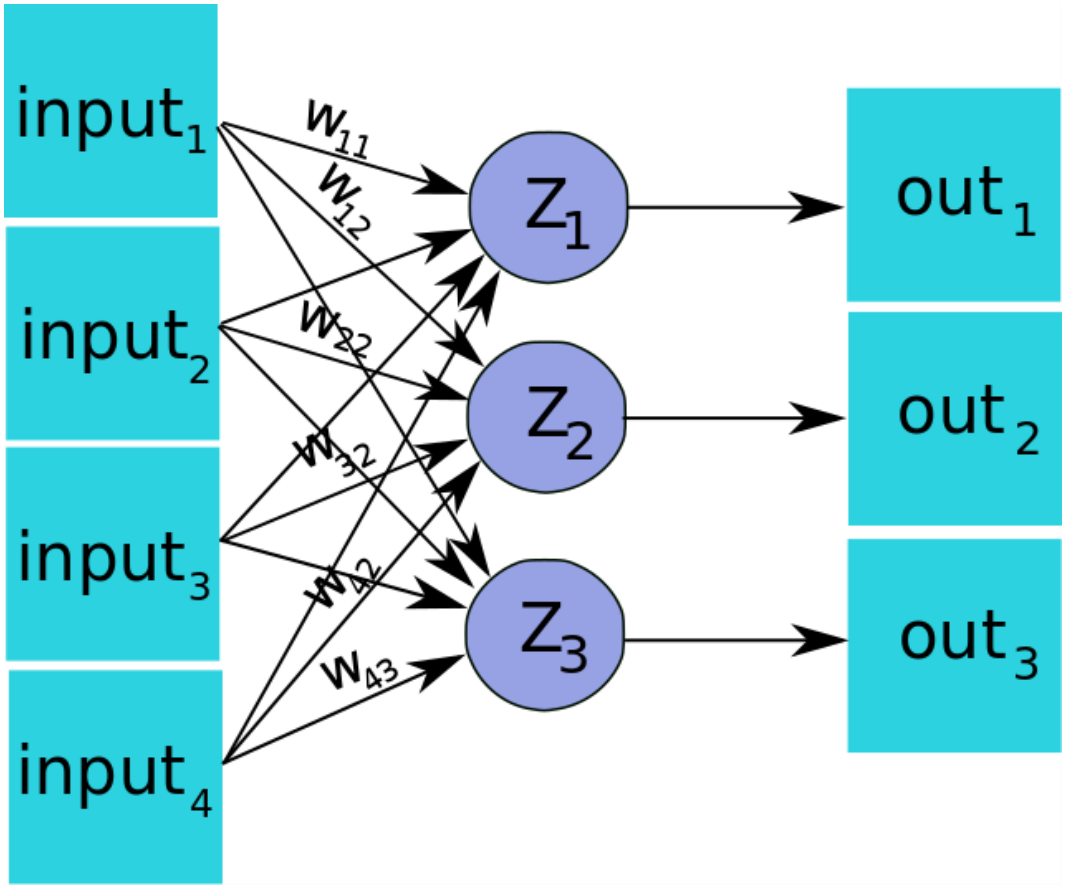
3	5
4	

Субдискретизация (pooling)

1	3	-1	0
2	-2	0	5
4	1	-1	3
-3	0	1	2

3	5
4	3

Полносвязный слой

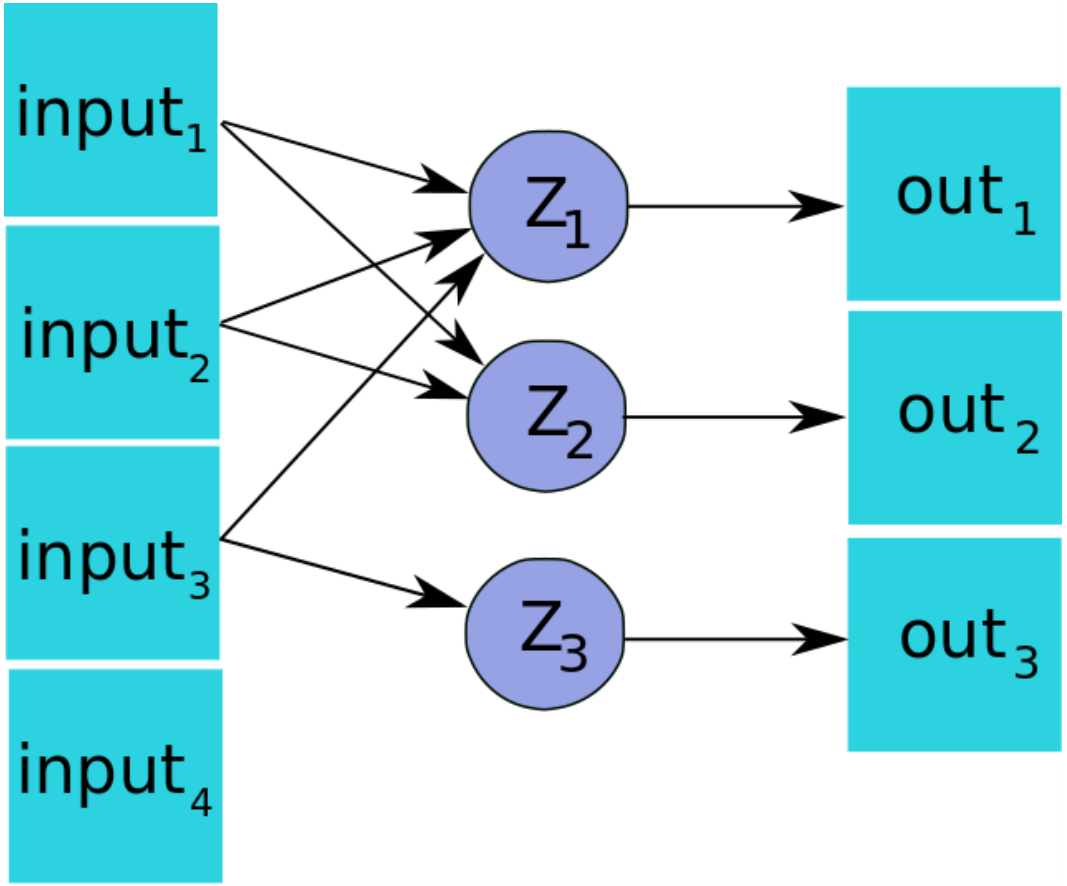


Softmax

$$p(C_k|x) = \frac{p(x|C_k)p(C_k)}{\sum \; p\left(x|C_j\right)p\left(C_j\right)} = \frac{e^{a_k}}{\sum_{j=1}^{K} e^{a_j}}$$

$$a_k = \ln p(x|C_k)\, p(C_k)$$

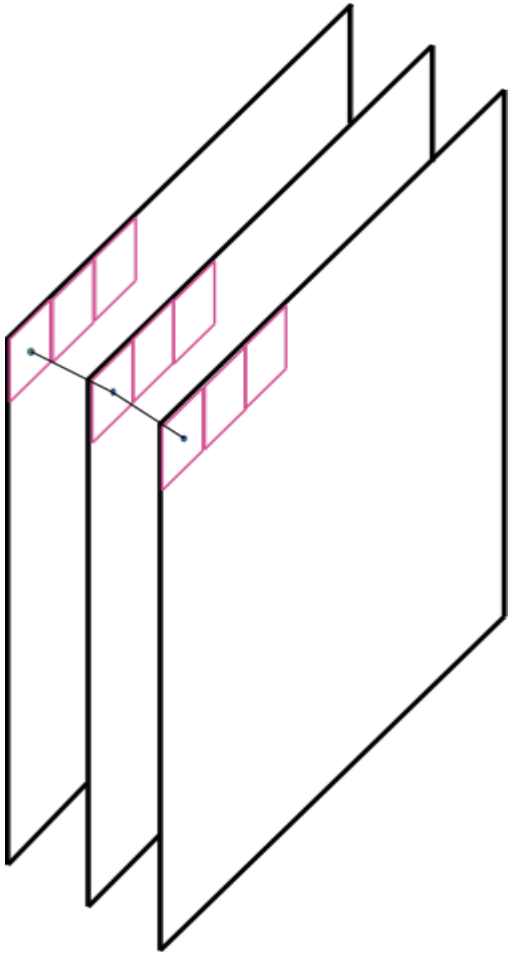
Слои нормализации: dropout

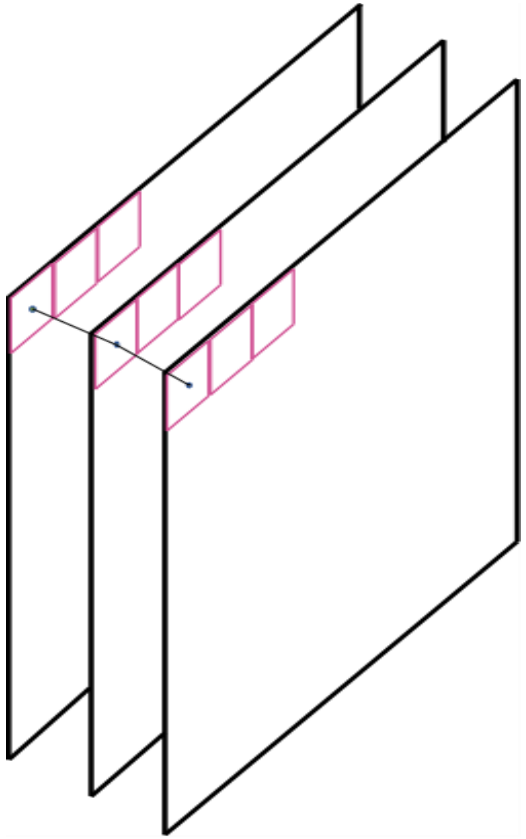


Слои нормализации: BatchNormalization

$$\hat{x}_i = \frac{x_i - \mu_B}{\sigma_B^2 + \epsilon}$$

$$\hat{y}_i = \gamma \hat{x}_i - \beta$$





Слои нормализации: CrossChannelNormalization

$$x' = \frac{x}{\left(K + \frac{\alpha \cdot ss}{windowChannelSize}\right)^{\beta}}$$