

Q1 1

46 Points

For a Convolutional Neural Network:

Input volume: $128 \times 128 \times 3$

Convolution with $32 \ 5 \times 5$ filters with stride 1, pad 3

Q1.1

1 Point

Q1.2 1

10 Points

What is the output volume size?

$$(128 + 2 \cdot 3 - 5) / 1 + 1 = 130 \rightarrow 130 \times 130 \times 10$$

Q1.3 2

10 Points

The number of parameters in this layer?

$$\text{each filter has } 5 \cdot 5 \cdot 3 + 1 = 76 \rightarrow 76 \cdot 32 = 2432$$

Q1.4 3

5 Points

0	0	0	0	0
0	1	3	1	0
0	0	1	1	0
0	2	2	-1	0
0	0	0	0	0

 $*$

-2	-2	1
-2	0	1
1	1	1

 $=$

Calculate the following convolution operation.

▼ IMG_20210423_173753.jpg

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Handwritten solution for the convolution operation:

Input matrix x (5x5):

0	0	0	0	0
0	1	3	1	0
0	0	1	1	0
0	2	2	-1	0
0	0	0	0	0

Kernel matrix h (3x3):

-2	-2	1
-2	0	1
1	1	1

Output matrix (3x3):

-8	5	2
-10	1	9
-3	6	4

Convolution formula:

$$\sum_j \sum_i x[i, j] \cdot h[1-i, 1-j]$$

Calculations for output values:

Output $[0, 0] = 3 \cdot h(0, -1) + 1 \cdot h(-1, -1) = -8$

Output $[0, 1] = 1 \cdot h(0, 1) + 1 \cdot h(0, -1) + 1 \cdot h(-1, 0) + 1 \cdot h(-1, 1) = 5$

Output $[0, 2] = 3 \cdot h(0, 1) + 1 \cdot h(-1, 1) + 1 \cdot h(-1, 0) = 2$

Output $[1, 0] = 1 \cdot h(1, 0) + 3 \cdot h(1, -1) + 1 \cdot h(0, -1) + 2 \cdot h(-1, 0) + 2 \cdot h(-1, -1) = 1 - 3 - 2 - 4 - 2 = -10$

Output $[1, 1] = 1 \cdot h(1, 1) + 3 \cdot h(1, 0) + 1 \cdot h(1, -1) + 1 \cdot h(0, -1) + 2 \cdot h(-1, 1) + 2 \cdot h(-1, 0) + -1 \cdot h(-1, -1) = 1 + 1 + 1 - 2 + 2 - 4 + 2 = 1$

Output $[1, 2] = 3 \cdot h(1, 1) + 1 \cdot h(1, 0) + 1 \cdot h(0, 1) + 2 \cdot h(-1, 1) - 1 \cdot h(-1, 0) = 3 + 1 + 1 + 2 + 2 = 9$

Output $[2, 0] = 1 \cdot h(1, -1) + 2 \cdot h(0, -1) = -3$

Output $[2, 1] = 1 \cdot h(1, 0) + 1 \cdot h(1, -1) + 2 \cdot h(0, 1) - 1 \cdot h(0, -1) = 6$

Output $[2, 2] = 1 \cdot h(1, 1) + 1 \cdot h(1, 0) + 2 \cdot h(0, 1) = 4$

Q1.5 4

10 Points

What is the role of pooling layers in a CNN?

reduces the amount of parameters. This reduces the amount of calculation.
Exp:Max pooling

Q1.6 5

10 Points

A convolutional neural network has 3 consecutive 4X4 convolutional layers with stride 2 and no pooling. How large is the support of a neuron in the 3rd on-image layer of this network?

144x144

Q2 2

5 Points

Write at least 5 **hyperparameters** for a convolutional networks.

filter size,padding,stride,pooling layer,
number of channels

Q3 3

10 Points

What if we use a learning rate that's too small or too large?

If the learning rate is too small, neural network will slowly converge towards the error minimum increasing the amount of time needed to train model. If learning rate is too high the gradient descent algorithm will make huge jumps missing the minimum. This will make the learning process unstable.

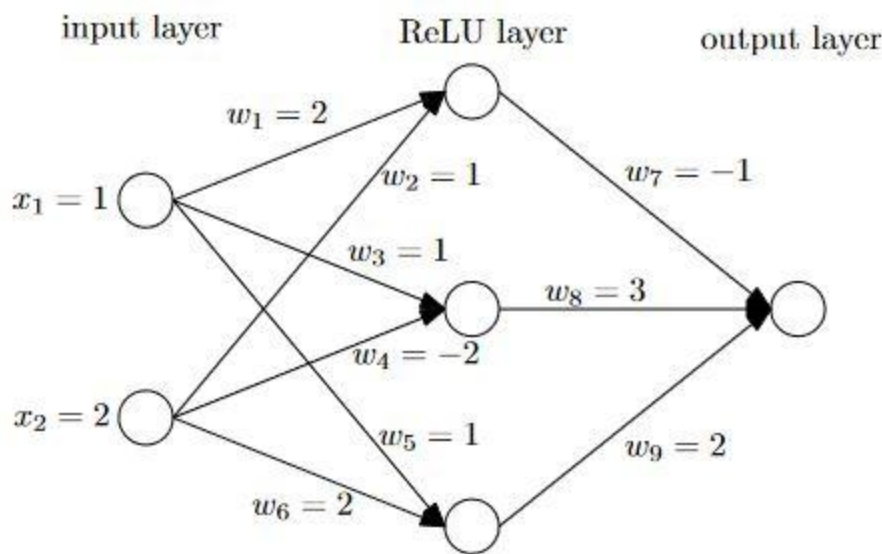
Q4 4

40 Points

Q4.1 1

20 Points

Assume the artificial neural network on the right, with mean square error loss and gold output of 3. Compute the values of all weights w_i after performing an SGD update with learning rate 0.1.

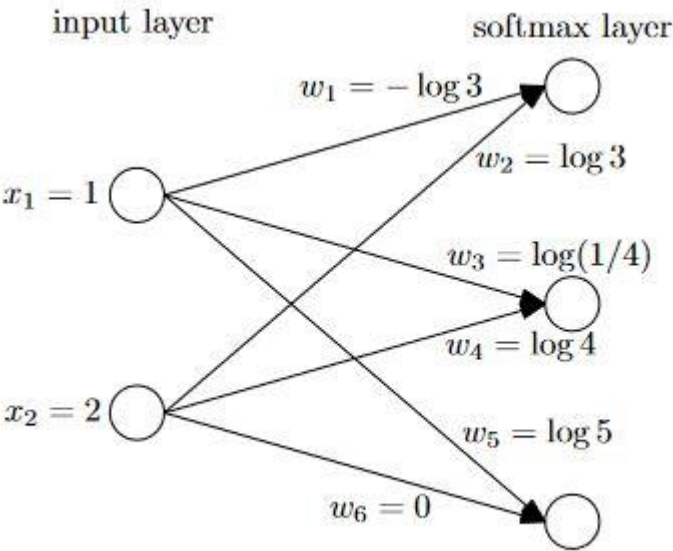


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Q4.2 2

20 Points

Assume the artificial neural network on the right, with negative log-likelihood (cross-entropy) loss and gold distribution (0,0,1), i.e., the last class is the gold one. Compute the values of all weights w_i after performing an SGD update with learning rate of 0.1



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Quiz-4

GRADED

STUDENT
MEHMET TAHA USTA

TOTAL POINTS
43 / 101 pts

QUESTION 1

1		28 / 46 pts
1.1	(no title)	0 / 1 pt
1.2	1	8 / 10 pts
1.3	2	10 / 10 pts
1.4	3	0 / 5 pts
1.5	4	10 / 10 pts
1.6	5	0 / 10 pts

QUESTION 2

2	5 / 5 pts
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QUESTION 3

3

10 / 10 pts

QUESTION 4

4

0 / 40 pts

4.1 1

0 / 20 pts

4.2 2

0 / 20 pts