

The basics of ConvNets

TOTAL POINTS 10

1. What do you think applying this filter to a grayscale image will do?

1 point

$$\begin{bmatrix} 0 & 1 & -1 & 0 \\ 1 & 3 & -3 & -1 \\ 1 & 3 & -3 & -1 \\ 0 & 1 & -1 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 1 & -1 & 0 \\ 1 & 3 & -3 & -1 \\ 1 & 3 & -3 & -1 \\ 0 & 1 & -1 & 0 \end{bmatrix}$$

- ☐ Detect horizontal edges
- ☐ Detect image contrast
- ☐ Detect 45 degree edges
- ☒ Detect vertical edges

2. Suppose your input is a 300 by 300 color (RGB) image, and you are not using a convolutional network. If the first hidden layer has 100 neurons, each one fully connected to the input, how many parameters does this hidden layer have (including the bias parameters)?

1 point

- ☐ 9,000,001
- ☐ 9,000,100
- ☐ 27,000,001
- ☒ 27,000,100

3. Suppose your input is a 300 by 300 color (RGB) image, and you use a convolutional layer with 100 filters that are each 5x5. How many parameters does this hidden layer have (including the bias parameters)?

1 point

- ☐ 2501
- ☐ 2600

☐ 7500☒ 7600

4. You have an input volume that is $63 \times 63 \times 16$, and convolve it with 32 filters that are each 7×7 , using a stride of 2 and no padding. What is the output volume? 1 point

☐ $16 \times 16 \times 32$ ☒ $29 \times 29 \times 32$ ☐ $16 \times 16 \times 16$ ☐ $29 \times 29 \times 16$

5. You have an input volume that is $15 \times 15 \times 8$, and pad it using "pad=2." What is the dimension of the resulting volume (after padding)? 1 point

☐ $17 \times 17 \times 10$ ☒ $19 \times 19 \times 8$ ☐ $19 \times 19 \times 12$ ☐ $17 \times 17 \times 8$

6. You have an input volume that is $63 \times 63 \times 16$, and convolve it with 32 filters that are each 7×7 , and stride of 1. You want to use a "same" convolution. What is the padding? 1 point

☐ 1☐ 2☒ 3☐ 7

7. You have an input volume that is $32 \times 32 \times 16$, and apply max pooling with a stride of 2 and a filter size of 2. What is the output volume? 1 point

☐ $16 \times 16 \times 8$ ☐ $32 \times 32 \times 8$

☐ 15x15x16

☒ 16x16x16

8. Because pooling layers do not have parameters, they do not affect the backpropagation (derivatives) calculation.

1 point

☐ True

☒ False

9. In lecture we talked about “parameter sharing” as a benefit of using convolutional networks. Which of the following statements about parameter sharing in ConvNets are true? (Check all that apply.)

1 point

☐ It allows gradient descent to set many of the parameters to zero, thus making the connections sparse.

☒ It reduces the total number of parameters, thus reducing overfitting.

☒ It allows a feature detector to be used in multiple locations throughout the whole input image/input volume.

☐ It allows parameters learned for one task to be shared even for a different task (transfer learning).

10. In lecture we talked about “sparsity of connections” as a benefit of using convolutional layers. What does this mean?

1 point

☐ Each filter is connected to every channel in the previous layer.

☐ Regularization causes gradient descent to set many of the parameters to zero.

☒ Each activation in the next layer depends on only a small number of activations from the previous layer.

☐ Each layer in a convolutional network is connected only to two other layers