

The basics of ConvNets

TOTAL POINTS 10

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

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

- ☐ 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)?

- ☐ 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)?

- ☐ 2501
- ☐ 2600
- ☐ 7500
- ☒ 7600
4. You have an input volume that is 63x63x16, and convolve it with 32 filters that are each 7x7, using a stride of 2 and no padding. What is the output volume?

- ☐ 16x16x32
- ☒ 29x29x32
- ☐ 16x16x16
- ☐ 29x29x16

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)?
- ☐ $19 \times 19 \times 12$
- ☐ $17 \times 17 \times 8$
- ☐ $17 \times 17 \times 10$
- ☒ $19 \times 19 \times 8$
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
- ☐ 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?
- ☒ $16 \times 16 \times 16$
- ☐ $16 \times 16 \times 8$
- ☐ $32 \times 32 \times 8$
- ☐ $15 \times 15 \times 16$
8. Because pooling layers do not have parameters, they do not affect the backpropagation (derivatives) calculation.
- ☐ 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.)
- ☐ It allows gradient descent to set many of the parameters to zero, thus making the connections sparse.
- ☐ It allows parameters learned for one task to be shared even for a different task (transfer learning).
- ☒ 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.

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

- ☐ Regularization causes gradient descent to set many of the parameters to zero.
 - ☐ Each filter is connected to every channel in the previous layer.
 - ☒ 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
-