

Week 1: Basics of CNN

1. What is the effect of this matrix on grayscale image?

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

Ans: Detect vertical edges

2. Suppose your input is a 300x300 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)?

Ans: 27,000,100 since dimension of first layer is (100, 270, 000) and a bias term for each. Hence $270,000 \times 100 + 100$

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

Ans: Each filter: $5 \times 5 \times 3 + 1$ bias = 76. 100 filters will have 7600 parameters

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 2 and no padding. What is the output volume?

Ans: $O = \left\lceil \frac{N+2p-f}{s} + 1 \right\rceil$. Hence the output is $29 \times 29 \times 32$

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

Ans: $(N, N) \rightarrow (N + 2p, N + 2p)$, we have $19 \times 19 \times 8$

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?

Ans: Using, $N = N + 2p - f + 1$, padding is 3.

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

Ans: $16 \times 16 \times 16$, using $O = \left\lceil \frac{N+2p-f}{s} + 1 \right\rceil$

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

Ans: False

9. Which of the following statements about parameter sharing in ConvNets are true?

Ans:

- Reduces total number of parameters.
- Allows feature detector to be used in multiple locations.

10. What does sparsity of connection mean?

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