✓ **Congratulations! You passed!**

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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 vertical edges.

○ Detect 45-degree edges.

⦿ Detect horizontal edges.

○ Detecting image contrast.

1 / 1 point

⤢ **Expand**

✓ **Correct**
Correct. There is a high difference between the values in the top part from those in the bottom part of the matrix. When convolving this filter on a grayscale image, the horizontal edges will be detected.

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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)?

⦿ 27,000,100

○ 27,000,001

○ 9,000,001

○ 9,000,100

1 / 1 point

⤢ **Expand**

✓ **Correct**
Correct, the number of weights is $300 \times 300 \times 3 \times 100 = 27,000,000$, when you add the bias terms (one per neuron) you get $27,000,100$.

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3. Suppose your input is a 256 by 256 color (RGB) image, and you use a convolutional layer with 128 filters that are each 7×7. How many parameters does this hidden layer have (including the bias parameters)?

○ 6400

⦿ 18944

○ 18816

○ 1233125504

1 / 1 point

⤢ **Expand**

✓ **Correct**
Yes, you have $7 \times 7 \times 3 + 1$ weights per filter with the bias. Given that you have 128 filters, you get

$(7 \times 7 \times 3 + 1) \times 128 = 18944.$

4. You have an input volume that is $127 \times 127 \times 16$, and convolve it with 32 filters of 5×5, using a stride of 2 and no padding. What is the output volume?

1 / 1 point

- ⦿ $62 \times 62 \times 32$
- ◯ $123 \times 123 \times 16$
- ◯ $123 \times 123 \times 32$
- ◯ $62 \times 62 \times 16$

↗ **Expand**

✓ **Correct**

Correct, using the formula $n_H^{[l]} = \frac{n_H^{[l-1]} + 2 \times p - f}{s} + 1$ with $n_H^{[l-1]} = 127, p = 0, f = 5$, and $s = 2$ we get 62.

5. You have an input volume that is 31x31x32, and pad it using "pad=1". What is the dimension of the resulting volume (after padding)?

1 / 1 point

- ◯ 33x33x33
- ◯ 31x31x34
- ⦿ 33x33x32
- ◯ 32x32x32

↗ **Expand**

✓ **Correct**

Yes, if the padding is 1 you add 2 to the height dimension and 2 to the width dimension.

6. You have a volume that is $64 \times 64 \times 32$, and convolve it with 40 filters of 9×9, and stride 1. You want to use a "same" convolution. What is the padding?

1 / 1 point

- ◯ 6
- ◯ 0
- ⦿ 4
- ◯ 8

↗ **Expand**

✓ **Correct**

Yes, when using a padding of 4 the output volume has $n_H = \frac{64 - 9 + 2 \times 4}{1} + 1.$

7. You have an input volume that is 32x32x16, and apply max pooling with a stride of 2 and a filter size of 2. What is the output volume?

1 / 1 point

- ◯ 16x16x8
- ◯ 15x15x16
- ⦿ 16x16x16
- ◯ 32x32x8

Expand

✓ Correct

Correct, using the following formula: $n_H^{[l]} = \frac{n_H^{[l-1]} + 2 \times p - f}{s} + 1$

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

1 / 1 point

○ True

◉ False

Expand

✓ Correct

Everything that influences the loss should appear in the backpropagation because we are computing derivatives. In fact, pooling layers modify the input by choosing one value out of several values in their input volume. Also, to compute derivatives for the layers that have parameters (Convolutions, Fully-Connected), we still need to backpropagate the gradient through the Pooling layers.

9. Which of the following are the benefits of using convolutional layers? (Check all that apply)

1 / 1 point

☑ It reduces the total number of parameters, thus reducing overfitting through parameter sharing.

✓ Correct

Yes, a convolutional layer uses parameters sharing and has usually a lot fewer parameters than a fully-connected layer.

☐ It reduces the computations in backpropagation since we omit the convolutional layers in the process.

☑ Convolutional layers are good at capturing translation invariance.

✓ Correct

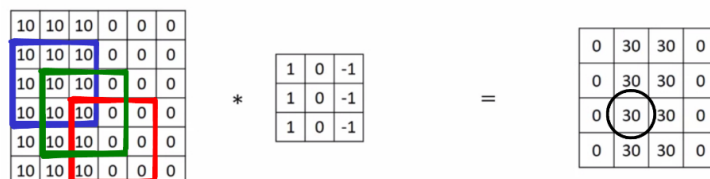Yes, this is due in part to applying the same filter all over the image.

Expand

✓ Correct

Great, you got all the right answers.

10. The following image depicts the result of a convolution at the right when using a stride of 1 and the filter is shown right next.

1 / 1 point

On which pixels does the circled pixel of the activation at the right depend?

○ It depends on all the pixels of the image on the left.

◉ It depends on the pixels enclosed by the green square.

○ It depends on the pixels enclosed by the blue square.

○ It depends on the pixels enclosed by the red square.

Expand

✓ **Correct**
Yes, this is the position of the filter when we move it two pixels down and one to the right.

Expand

✓ **Correct**
Yes, this is the position of the filter when we move it two pixels down and one to the right.