Fundamentals of Convolutional Neural Networks Quiz Solutions

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1 Filter Size

Given that an input is 256x256 and that the size of layer 1 is 224x224, what is the size of the first convolution filter? (Assume 0 padding and a stride of 1)

2 Output size

With input size 32 x 32, a kernel size of 3x3, a stride of 3, and 2 on both sides, what is the result of the output feature map?

3 Same padding

With input size 32 x 32, a kernel size of 7x7, and a stride of 1, what padding is necessary in order to achieve a "same" convolution? (A "same" convolution refers to a convolution which results in an output with the same shape of the original input).

4 3x3 Filters

A 3x3 filter covers only 9 neurons while a 15x15 filter covers 225 neurons. How many 3x3 filter layers are required to achieve the same coverage as 1 15x15

filter?

5 CNN Advantages

Why would we use convolutional neural networks as opposed to fully connected layers between two feature maps?

6 Image Classification Intuition

For classification, why do many architectures use fully connected layers after the convolutional layers in order to make classification predictions?

7 HyperParameters

Which of the following are hyperparameters of a Convolutional Neural Network?

- Size of Filters
- Stride lengths
- Depth of the Network
- The values of the filters

8 Vanishing Gradient Problem

As more layers using ReLu activation functions are added to a CNN, the gradients of a loss function approaches zero. What technique is used in a famous CNN architecture to combat this vanishing gradient problem?

9 Pooling

Why is pooling important in CNN architectures?

10 Convolutions as Matrix-Vector Multiplications

Convolutional layers represent linear transformations, and they can be expressed as a matrix vector multiplication $A\vec{x}$ for some matrix A and some vector $\vec{x}$. Explain how to obtain these, and explain why convolutions aren't implemented as matrix-vector multiplications in practice.