Project 4 Questions

Instructions

- 5 questions.
- Write code where appropriate.
- Feel free to include images or equations.
- Please make this document anonymous.
- **Please use only the space provided and keep the page breaks.** Please do not make new pages, nor remove pages. The document is a template to help grading.
- If you really need extra space, please use new pages at the end of the document and refer us to it in your answers.

Questions

Q1: In training a neural network classifier, what are the effects of subtracting the mean of each input image from the input image? What are the effects of subtracting the mean of our dataset from our input images?

A1: Your answer here.

Q2a: Consider input to a convolutional neural network layer of 96 x 96 x 3. For a single kernel of size 5 x 5 x 3 and a stride of 1, followed by a 4 x 4 max pooling layer, what will the output feature map size be?

A2a: Multiple choice. Use '\bullet' • to fill in the circles in LaTeX.

5 x 5	○
22 x 22	○
23 x 23	○
24 x 24	○
25 x 25	○

Q2b: For the same input (96 x 96 x 3), let the convolution layer have a kernel of size 3 x 3 x 3 and a stride of 3, followed by an 8 x 8 max pooling layer. What will the output feature map size be?

A2b: Multiple choice.

2 x 2	○
3 x 3	○
4 x 4	○
5 x 5	○
12 x 12	○

Q2c: Given input to a convolutional layer with stride 2x2 and kernel size 3x3, and ignoring the boundary, what is the minimum number of convolutional filters required to preserve all input information in the output feature map?

A2c: Multiple choice.

0.5	○
1	○
2	○
4	○
It's impossible	○

Q3: What effects does adding a max pooling layer have for a single convolutional layer, where the output with max pooling is some size larger than 1 x 1 x d?

A3: Multiple choice. Choose all that apply.

Increases computational cost of training	○
Decreases computational cost of training	○
Increases computational cost of testing	○
Decreases computational cost of testing	○
Increases overfitting	○
Decreases overfitting	○
Increases underfitting	○
Decreases underfitting	○
Increases the nonlinearity of the decision function	○
Decreases the nonlinearity of the decision function	○
Provides local rotational invariance	○
Provides global rotational invariance	○
Provides local scale invariance	○
Provides global scale invariance	○
Provides local translational invariance	○
Provides global translational invariance	○

Q4: With your own research, describe the vanishing and exploding gradient problems in training neural networks. Describe why and how each of these problems affects the sigmoid activation function and the rectified linear unit activation function (ReLU).

A4: Your answer here.

Q5: Many CNNs have a fully connected multi-layer perceptron (MLP) after the convolutional layers as a general purpose decision-making subnetwork. What effects would a locally-connected MLP have on computer vision applications? Please give your answer in terms of the learned convolution feature maps, their connections, and the perceptrons in the MLP.

A5: Your answer here.