Problem Set 3

The required weekly readings and lecture slides should be helpful in completing the assignment. You can find these on our course website. For your submission, you must submit a PDF that has been typed. Provide all responses using your own words.

1. **Regularization [2 points]:** Define what is regularization in deep learning and describe the motivation for using regularization.
2. **CNN Features [3 points]:** Describe what are low-level, mid-level, and high-level features in CNNs.
3. **Fine-Tuning [2 points]:** Identify two advantages of fine-tuning a neural network over training a network from scratch.
4. **Computer Vision Problems [6 points]:** Define the problems of image classification, object detection, and semantic segmentation and describe how the output layers of computer vision models for these three problems differ.
5. **Recurrent Neural Networks; i.e., RNNs [12 points]:**
   (a) Describe two advantages of using recurrent layers instead of fully connected layers in a neural network.
   (b) Describe how recurrent layers differ from convolutional layers and when one should choose the former versus latter in a neural network.
   (c) Describe how to design recurrent neural networks to solve each of the following problems: one-to-many, many-to-one, and many-to-many sequence problems. Your response should indicate what should be the input and output of each network.
   (d) Describe the motivation for gated RNNs and identify two types of gated RNNs.
   (e) Assume you design a 2-layer RNN to predict a character sequence when given an input character sequence. What will happen to the number of model parameters when the number of input characters doubles?