CIS*4780 Assignment 3

Classification using neural networks

Handed out: March 14, 2022

Due: April 4, 2022

In this assignment, you will develop networks for classifying images according to the category they belong to. The images you will use come from the CIFAR-10 dataset.

https://www.cs.toronto.edu/~kriz/cifar.html

Note that there are utilities within PyTorch to automatically open this dataset which you can figure out easily from examples online.

You will develop your code in a .ipynb notebook (Jupyter notebook). For this assignment, it's strongly recommended that you look into Google Colab as a resource for running your code and training networks.

Unlike prior assignments, you are not provided with a template but will develop this from scratch. This is so that you will become familiar with all the libraries to import, ways of fetching the data and the overall steps for framing the problem.

Note that there are *many* examples available online that can help guide you in the development of your code. You are allowed to make used of these but you must **reference any site, code or other source that either inspired or contributed to your codebase.**

You should develop your code using PyTorch.

[5 Marks] Part I: Fully connected NN

Develop a fully connected neural network for classifying images from the CIFAR-10 dataset. How you choose to do this is up to you. This means that you have a choice of the number of layers, non-linearities used, learning rate, optimization algorithm and any other hyperparameters or regularization you choose to include. You should divide your data into training, testing and validation sets. When training your algorithm you should aim for the best result. Consider looking at when your validation error begins to rise as a stopping point for training.

[5 Marks] Part II: Convolutional NN

For this portion of the assignment, you will repeat the steps from part I, but will employ a convolutional neural network instead of a fully connected network.

[5 Marks] Part III: Performance

You will be graded on the performance of your networks developed in part I and part II. You should perform sufficient experimentation and adaptation of your networks to achieve the best classification

performance. Note that chance is 10% so anything above this is positive. However, you should push things as much as possible to achieve the best results you can.

[5 Marks] Part IV: Discussion

Since you might make use of information you derive from online sources, perform your own experimentation, play around with hyperparameters etc. you should discuss how all of this contributed to the success of your approach.

Specific questions to address:

i. What external sources did you make use of, and how did you adapt these, go further or experiment in order to achieve the best possible result?
ii. Between fully connected and convolutional neural networks, which performed better? Why do you think this is the case?
iii. How did you decide on your learning rate, optimization, any regularization or other hyperparameters?
iv. State your best performance for fully connected and convolutional neural networks.
v. If you had more time or could repeat the assignment, what might you do differently?

To hand in:

You lastname_firstname.ipynb file that implements the above.

A pdf file lastname_firstname.pdf that addresses the questions for part IV. Since there is a lot of thinking, research, and experimentation involved you might want to aim for at least 1 page of discussion or more to demonstrate all the work you did that may not be reflected in the code alone. Note that since parts I and II may make use of external resources, this is the opportunity to explain the work you did independently, experiments you tried and other factors. Therefore your grade for parts I and II may also depend on what you write in your description.