CS 639: Deep Learning for Computer Vision, Spring 2023
Problem Set 2

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Due: Thursday, March 23rd, 11:59 PM

Instructions

1. Download the zipped assignment file from Canvas.

2. Once you unzip the downloaded content, please upload the folder to your Google Drive. Then, open each `*.ipynb` notebook file with Google Colab by right-clicking the `*.ipynb` file. No installation or setup is required. For more information, please see this tutorial on using Colab.

3. Next, we recommend editing your `*.py` file on Google Colab, set the ipython notebook and the code side by side. Work through the notebook, executing cells and implementing the codes in the `*.py` file as indicated. You can save your work, both `*.ipynb` and `*.py`, in Google Drive (click "File" -> "Save" or press "Ctrl/Cmd + s") and resume later if you don't want to complete it all at once.

4. While working on the assignment, keep the following in mind:

    - The notebook and the python file have clearly marked blocks where you are expected to write code. **Do not write or modify any code outside of these blocks**.
    - **Do not add or delete cells from the notebook**. You may add new cells to perform scratch computations, but you should delete them before submitting your work.
    - **Run all cells, and do not clear out the outputs, before submitting**. You will only get credit for code that has been run.

5. Once you have completed a notebook, download the completed `uniqueid_PS2.zip` file, which is generated from your last cell of the `convolutional_networks.ipynb` file. Submit this to Canvas. Note that only one person from the group will need to do this.

6. You may complete the assignment individually or with a partner (i.e., maximum group of 2 people). If you worked with a partner, provide the name of your partner in the `*.ipynb` file. **We will be using MOSS to check instances of plagiarism/cheating.**

The goal of this assignment is for you to learn how to build a convolutional neural network so that you can

- Develop a deep understanding of convolution, pooling, batch normalization, and initialization.
- Gain experience using forward function and backward propagation for convolutional neural networks.

The notebook `convolutional_networks.ipynb` will walk you through those pipelines in PyTorch. You are required to write code on `convolutional_networks.py`.[1]

[OPTIONAL] Extra credit short answer problems [up to 0.5% each added to final class score]

Save your answers into a PDF, and submit it together with your code to Canvas.

1. Explain what a "dead ReLU" is, and how Leaky ReLU addresses it.

2. Explain the role of the learnable scale and shift (gamma and beta) parameters in Batch Normalization.

[1] The coding assignment is adapted from Stanford CS 231n.