Assignment 4

In this assignment, you will implement Fully-Connected Neural Networks and Convolutional Neural Networks for image classification models. The goals of this assignment are as follows:

- Understand Neural Networks and how they are arranged in layered architectures
- Understand and be able to implement modular backpropagation
- Implement various update rules used to optimize Neural Networks
- Implement Batch Normalization for training deep networks
- Implement Dropout to regularize networks
- Understand the architecture of Convolutional Neural Networks and get practice with training these models on data

Please note that Q2 is only required for students in the graduate section of the class. Undergraduates can complete Q2 for extra credit. For graduate students the assignment will be worth 200 points effectively making this assignment 2X the value of the past 3 assignments .

Q1: Fully-Connected Neural Network (100 points)

The notebook **fully_connected_networks.ipynb** will walk you through implementing Fully-Connected Neural Networks.

Q2: Convolutional Neural Network (100 points)

The notebook **convolutional_networks.ipynb** will walk you through implementing Convolutional Neural Networks.

Steps

1. Download the zipped assignment file

- Click here to download the starter code

2. Unzip all and open the Colab file from the Drive

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. We recommend editing your `*.py` file on Google Colab, set the ipython notebook and the code side by side. For more information on using Colab, please see our Colab tutorial.

3. Work on the assignment

Work through the notebook, executing cells and writing code in `*.py,` as indicated. You can save your work, both `*.ipynb` and `*.py,` in Google Drive (click “File” -> “Save”) and resume later if you don’t want to complete it all at once.
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. Q2 only - Download .zip file

Once you have completed a notebook, download the completed `uniqueid_umid_A3.zip` file, which is generated from your last cell of the `convolutional_networks.ipynb` file. Before executing the last cell in `convolutional_networks.ipynb`, please manually save your results so that the zip file includes all updates.

Make sure your downloaded zip file includes your most up-to-date edits; the zip file should include *fully_connected_networks.ipynb*, *convolutional_networks.ipynb*, *fully_connected_networks.py*, *convolutional_networks.py* , *best_overfit_five_layer_net.pth*, *best_two_layer_net.pth*, *one_minute_deepconvnet.pth*, *overfit_deepconvnet.pth* for this assignment.

6. Submit your python and ipython notebook files to Canvas

When you are done, please upload all your code to Assignment 4 on canvas. Your `*.ipynb` files *SHOULD include* all the outputs. Please check your outputs are up to date before submitting yours to Canvas. Zip all Files and submit.

CREDIT: This homework assignment was created by Dr. Justin Johnson at University of Michigan for his EECS course Deep Learning for Computer Vision