

Assignment 2

Note: This assignment is originally from the EECS 498-007/598-005 course at the University of Michigan.

In this assignment, you will implement various image classification models, based on the SVM / Softmax / Two-layer Neural Network. The goals of this assignment are as follows:

- Implement and apply a Multiclass Support Vector Machine (SVM) classifier
- Implement and apply a Softmax classifier
- Implement and apply a Two-layer Neural Network classifier
- Understand the differences and tradeoffs between these classifiers
- Understand how a Two-layer Neural Network can approximate an arbitrary function
- Practice implementing vectorized gradient code by checking against naive implementations, and using numeric gradient checking

Due Date: Friday, Nov 17, at 11:59 PM **(No extensions will be granted)**

Q1: Linear Classifiers (57 points)

The notebook `linear_classifier.ipynb` will walk you through implementing SVM and Softmax classifiers. You need to write code on `linear_classifier.py`.

Q2: Two-layer Neural Network (38 points)

The notebook `two_layer_net.ipynb` will walk you through implementing a two-layer neural network-based classifier. Your implementation will go to `two_layer_net.py`.

Q3: MNIST Challenge (5 points)

The notebook `challenge_problem.ipynb` will walk you through the challenge problem where you will manually set the weights of a Two-layer Neural Network classifier and evaluate on MNIST hand drawn digits. Your output is `hand_drawn_weights.jpg`.

Steps

1. Download the zipped assignment file

Click [here](#) to download the starter code. You can also access the starter code through Cybercampus.

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

Unzip the downloaded folder, and upload the contents to your Google Drive. To open the `.ipynb` notebook files in Google Colab, right-click on the files in Drive and select "Open with Google Colab". No installation is required. For more information on using Colab, please see our [Colab tutorial](#).

3. Open your corresponding *.py from Google Colab and 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.

4. Download and Compress Your Work

Once you complete the notebooks, download the relevant files and compress them into a single `.zip` file. Name the file using the format: `{student_id}_A2.zip`. Make sure your `.zip` file contains your most up-to-date edits. The `.zip` file should include `linear_classifier.py`, `two_layer_net.py`, and `hand_drawn_weights.jpg` for this assignment.

5. Submit your zip file to Cybercampus

Submit your compressed `.zip` file on Cybercampus. Ensure your `.ipynb` files include all outputs.