Assignment #2

CSE 6367-002 **Student Name:**

Fall 2024 **Student ID:**

Due date: 11/03/24 11:59 pm Central Time

Submission Guidelines:

Submit your source code through Canvas in a single .ipynb file. The name of the .ipynb file should be YourStudentID.ipynb. (For example: 1001234567.ipynb) The images are available in the ./Images directory. Your TA will use the same directory name to grade your submission. You don't need to attach the images folder with your submission.

1. **(15 pts)** The MNIST dataset, depicted in the figure below, contains low-resolution images of handwritten digits (from 0 to 9). The assignment consists of writing Python code to train a Convolutional Neural Network model (CNN) to classify MNIST images into one of the ten classes (e.g., the digits). The CNN model for the assignment should adhere to the following rules:

   (a) You **CAN** use the example from the "`intro to python`" lecture at the beginning of the course. However, you will have to implement the CNN model from scratch. **No pre-defined nor pre-trained model can be used**.

   (b) The CNN should contain at least ten (10) convolutional layers and three (3) multiplayer perceptron (MLP) layers for classification.

   (c) Your code should run and train within five minutes of being executed in `google colab`. This restriction is reasonable, given the size and simplicity of the MNIST dataset.

   (d) The project should be implemented only in the Python programming language and using `pytorch` library to code and train the model. Other helper libraries with useful functions are allowed.

   (e) The code should report the final overall classification accuracy on the test dataset. Additionally, the confusion matrix for all the classes must be reported. See some documentation on how confusion matrices work here.

   (f) To train the model use the cross-entropy loss.

   (g) The main purpose of the assignment is not to get the highest accuracy; however, if low accuracy is due to a flaw in the model, that will be considered in the final grade.

   (h) **Three (3) extra points** will be awarded if the model includes batch normalization and residual connections.

   (i) Honor code: You should implement your own model. Plagiarism or copying code from other sources will be investigated and reported if detected.

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Figure 1: MNIST Dataset.