PROGRAMMING ASSIGNMENT 4
HOMEWORK 7, FOR CREDIT
MA5755
DUE MAY 1ST, 2024

Building a Neural Network from Scratch. In this exercise we build the digit recognizer neural network from scratch, using numpy, pandas and pyplot.

First, watch the YouTube video by Samson Zhang. You may use his code from the kaggle website that is linked in the description of the video. However, don't just simply copy the file, instead, make sure that you understand each line, as Samson Zhang explains it in the video.

In google colab you can get the MNIST files from the `keras` datasets and you have to make some appropriate changes to the code to load the data from there. In any case, make sure that the gray scale values for the images are scaled in the interval $[0, 1]$.

First you should verify that the code runs in a very similar manner as seen in the video. That is, with 500 forward/backward propagation steps and learning rate $\alpha = 0.1$, the accuracy of the trained network should be about 82 to 85 percent.

In the hope to get a higher accuracy, enlarge the neural network, by adding an additional hidden layer and adding more interior nodes. Try 20 nodes in the first and 10 nodes in the second hidden layer. Run propagation with 1000 steps and learning rate $\alpha = 0.1$. How much improvement does the larger network provide? Turn in your code for the larger dataset and some printout that documents the accuracy rate.