Homework assignment 1
Due: Friday, Feb. 4, 2022, 11:59pm

This assignment is about read-and-learn. You are assigned two readings: one about backprop calculation, and the other about MLP classification on the MNIST dataset. The former helps to understand the essential concept in DL; the latter provides a good example of python coding and some common practices in DL training. Each reading is accompanied by questions as follows.

Problem 1. (5 points) Please read the enclosed article, entitled "backpropagation step by step" (or you can access the article at https://hmkcode.com/ai/backpropagation-step-by-step/). The article demonstrates one pass of backward propagation and parameter update. You may notice that after this pass, the prediction error is reduced. Please do another pass of backward propagation based on the updated parameters. What is the prediction error after your backpropagation? Please show your work in detail for a full mark.

Problem 2. (15 points) Please study the enclosed "Multilayer Perceptron.ipynb". One can take advantage of the GPU resource of Google Colab to run the code. If the setting is correct, it takes less than 20 seconds to run one epoch during training. Please modify the code and compare the classification performance and runtime before and after the modification. Discuss/explain your observations.
    (1) What data augmentation is used in training? Please delete the data augmentation and run the code.
    (2) What is batch size in the code? Please change the batch size to 16 and 1024.
    (3) What is the activation function used in the hidden layer? Please replace it with the linear activation function.
    (4) What is the optimization algorithm in the code? Please replace it by any other two algorithms.
    (5) Add dropout in the training.