Math 5750/6880: Mathematics of Data Science
Project #3
project final report due November 6, 2025

A GitHub repo for this assignment is located here:

https://github.com/math-data-science-course/Project3

A LaTeX Project3 report template is available on the Canvas Project3 page. You should modify this template to produce your project final report in pdf format.

1. (Fashion-MNIST image classification using sklearn) In this exercise, you will build a classifier for the Fashion-MNIST image dataset using the sklearn `MLPClassifier`. Use the provided code to import and preprocess the Fashion-MNIST image dataset. Build a dense neural network using `MLPClassifier`. Start with a simple model architecture and train your model. Then experiment with your model/training method by changing:

- the number of hidden layers and neurons
- the activation functions
- optimization method and the learning rate
- regularization or early stopping settings.

Observe how each change affects convergence speed and accuracy. In your final report, discuss your findings and compare the accuracy scores, training times, and confusion matrices for models considered.

2. (PyTorch) Familiarize yourself with PyTorch

https://pytorch.org/

Summarize what you learned in your project final report.

3. (Fashion-MNIST image classification using PyTorch) In this exercise, you will repeat Exercise 1 using PyTorch. Use the provided code to import and preprocess the Fashion-MNIST image dataset. Again, start with a simple model architecture and train your model. As above, experiment with the model/training method. With pytorch, there are many more options, so read about them and experiment! Try to further improve your model by using convolutional neural network (CNN) layers and MaxPool2d layers. For a challenge, use transfer learning to import a pretrained model and fine tune it on the Fashion-MNIST image dataset. In your final report, answer the same questions as in Exercise 1.