Homework 4

EEE 4774 & 6777 Data Analytics

1 Convolutional Neural Networks

MNIST is a popular dataset for handwritten digit classification. Open the mnist-cnn code at `https://github.com/yilmazyasin/Data-Analytics/blob/master/mnist_cnn.ipynb`. This code implements a simple CNN with 2 hidden layers for classifying the MNIST images into 10 digits from 0 to 9.

- Click on the "Open in Colab" icon at the top to run the code on Google Colab, a free cloud service to run python codes without needing to install packages like Tensorflow. You don't need to use Colab. If you want to use your own computer, make sure you have the right version of Tensorflow installed.

- Download the "train.csv" and "test.csv" files from `https://www.kaggle.com/competitions/digit-recognizer/data` and change the file paths in the code to the locations in your Google Drive.

- After you obtain the results for each question below, upload the RESULTS.csv file to `https://www.kaggle.com/competitions/digit-recognizer/submit` to see the performance.

a) [20 pts] The model in the tutorial has two convolutional layers. How does increasing the number of neurons to (64,128) in the two convolutional layers affect the training, validation, and testing accuracy? Plot the training and validation accuracy over epochs.

b) [20 pts] Increase the number of convolutional layers to 3 using (32,64,32) neurons with 3×3 convolution filters in the third layer, and report the effect of more convolutional layers on the training, validation, and testing accuracy.

c) [20 pts] How does the dropout layer affect the test accuracy? Report the accuracy without the dropout layer using the original architecture with 2 convolutional layers.

d) [20 pts] How does the learning rate affect the test performance of the model? Try the learning rate 0.2 and compare its performance with that of 0.1.

e) [20 pts] How does data augmentation affect the performance? Report the test accuracy without data augmentation in the original code.