Homework 03
Detecting Handwritten Digits with CNNs

Description

The MNIST dataset is an acronym that stands for the Modified National Institute of Standards and Technology dataset. It is a dataset of 60,000 small square 28×28 pixel grayscale images of handwritten single digits between 0 and 9. The task is to classify a given image of a handwritten digit into one of 10 classes representing integer values from 0 to 9, inclusively. In this assignment, you need to create a simple CNN from scratch using the deep learning framework of your choice (Keras, TensorFlow, PyTorch) to perform classification on the MNIST dataset.

Part A:

The specific steps for this task are:
1. Create a base CNN model (Conv -> MaxPooling -> Flatten -> Dropout -> FC).

Part B:

You can submit only if you have submitted HW03-PartA-ICA. No extensions will be offered.

1. Train the model for 10 epochs using 10% for validation (batch_size=32, optimizer=Adam, dropout=0.5, activation=relu).
2. Evaluate the performance of the model and report the confusion matrix and the test accuracy.
3. Update your base model by adding more layers (e.g., x2, x3 Conv) and report the performance (confusion matrix and accuracy). Also, try using different batch sizes (i.e., 64, 128, 256) and activation functions and comment on your observations.
4. What is the difference between epoch and batch? How does batch size affect the training time and performance?
5. What is the purpose of the max pooling layer?

Submission Guidelines

You need to submit your code and report to GitHub.

1. Submit your working code in Teams (**both as an .ipynb and a .pdf file**)
2. Upload any .zip file or folder if your code refers to the paths of those files.
3. A pdf of your report (name: HW05-Report-Firstname-Lastname.pdf) with your output and comments

References
1. "Simple MNIST CNN",
   https://keras.io/examples/vision/mnist_convnet/