Neural Network

Due: 2024.11.29

Goal of the assignment

The goal of this assignment is implementing **a simple neural network (up to 5 layers)** with your preferred architecture. All the computation, including forward and backward propagation with weight optimization should be done ***only with Python 3 and numpy library (https://numpy.org/) without using PyTorch (https://pytorch.org/)*** as PyTorch already provides ready-to-use functions. All code should be implemented by yourself without using any built-in libraries. The code can be based on either CPU or GPU.

Students should train and test their network on MNIST dataset (https://www.kaggle.com/datasets/hojjatk/mnist-dataset), which include 60K and 10K training and testing images, respectively. The network should be trained only with the training set, and the testing set should not be exposed during the training. Using the MNIST dataset, the network should classify an input image to 10 numbers of classes.

Submission format

Below are required submissions.

- Source code
  - train.py
  - test.py
  - model.py
  - data.py
  - With detailed comments in English. If the code is not recognizable due to the badly-organized structure, this will be penalized
- Trained network
  - ckpt.pkl
- Document (up to 2 pages), which include a brief description of the code and experimental results. If you add some interesting ideas in your system, please elaborate them in the document.

Below is a detailed directory structure. Do not submit red, and green is what you need to submit. Zip green as $STUDENT_NUMBER_$NAME.zip and submit it. For example, 20240000_Gyeongsik.zip.

```
dataset (do not submit this)
|-- t10k-images.idx3-ubyte
|-- t10k-labels.idx1-ubyte
|-- train-images.idx3-ubyte
|-- train-labels.idx1-ubyte
src
|-- train.py # training script
|-- test.py # testing script
|-- model.py # includes definitions of a model
|-- data.py # includes a data loader
```

ckpt
|-- ckpt.pkl
report.pdf

- For the training, the code should be executable with python train.py. When running this command, the terminal should show progress of the training (e.g., current iteration, total iterations, and loss values)
- For the testing, the code should be executable with python test.py. When running this command, the terminal should show test results (e.g., accuracy on the training and testing sets)
- **If the program does not work either with python train.py or python test.py, the submission will have zero score.**

How to submit

Send $STUDENT_NUMBER_$NAME.zip to dgistintrotoai@gmail.com before the deadline. For example, 20240000_Gyeongsik.zip. The submission is valid until 23:59 PM 11/29.

Evaluation

The score will be pass/fail (binary), and it will not be based on the accuracy of the network on the test set as long as the accuracy is not too bad. Instead, students who submit reasonable quality of model, code, and document will be passed. **Cheating is strictly forbidden, and those who are related with the cheating will have zero score and could get F grade.**

Note

Final exam will include hand-written implementation of the backpropagation and neural network architecture, so please try this assignment by yourself.