

ELEC-4010N Assignment-01

In this assignment, the students are required to finish two problems and write a summary report (no more than three pages). The summary report should include the output results (e.g., final loss/accuracy, figures) and discussion. **Code (`.ipynb`) and the summary report (`.pdf`)** should be submitted via Canvas by **28 Feb (Tuesday) at 23:59:59**. If the code is not submitted, 20% of the points will be deducted.

Colab sharing link (`ELEC4010N-Assignment_01.ipynb`): [link](#); or you can upload `*.ipynb` to Colab via File => Upload notebook.

Problem 1. Train an MLP network on the MNIST dataset(40%)

MNIST ("Modified National Institute of Standards and Technology") is the de facto "hello world" dataset of computer vision. Since its release in 1999, this classic dataset of handwritten images has served as the basis for benchmarking classification algorithms. As new machine learning techniques emerge, MNIST remains a reliable resource for researchers and learners alike.

Use a four-layer MLP to train the MNIST dataset.

Layer	Type	Input	Output	Activation
1	Linear	28 * 28	128	ReLU
2	Linear	128	64	ReLU
3	Linear	64	32	ReLU
4	Linear	32	10	-

- a.) Implement the function `__init__` and `forward` in `Model` (15%);
- b.) Implement the training code (15%);
- c.) Plot the curve of accuracy and loss(10%).

Problem 2. Train a LeNet network on the EMNIST dataset(60%)

EMNIST (Extended MNIST) is a dataset of handwritten characters and digits that is used for training machine learning algorithms in computer vision. The dataset was created by merging several datasets of handwritten digits and characters, including the original MNIST dataset. EMNIST is widely used in research and industry for evaluating and comparing different models. The extended size of the dataset, and the greater diversity of characters and digits it contains, makes it a valuable resource for training more robust and accurate machine learning models.

LeNet is a Convolutional Neural Network (CNN) architecture for image classification tasks, particularly for handwritten digit recognition. It was introduced by Yann LeCun et al. in 1998 and is considered one of the earliest deep-learning models for image classification.

- a.) Implement the model and training code (30%);
- b.) Plot the loss and accuracy curves (10%);

c.) Try different batch sizes, learning rates, or optimizers, Any findings? Discuss the reason and possible solutions (20%).