电子科技大学
格拉斯哥学院
Glasgow College, UESTC

UESTC 3036: Machine Learning & AI

Fall Semester 2022-2023

Lab 2 - Week 8

Report Due Date: Friday, 03 November 2023 at 23:59 CST

Student's Chinese Name	
Student's English Name	
Student's UESTC ID	
Student's UoG ID	

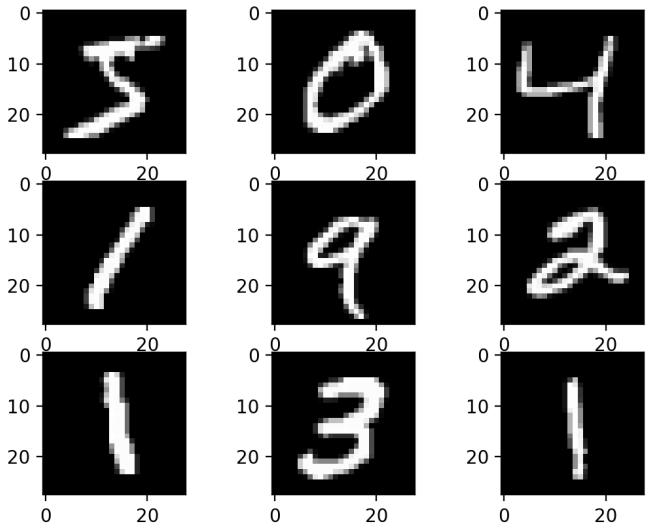
Neural Network

1. Overview

In this lab, you will complete a handwritten digit recognition task using a basic feedforward neural network (FNN). Feedforward neural networks were among the first and most successful learning algorithms. They are also called deep networks, multi-layer perceptron (MLP), or simply neural networks.

2. Dataset

The Mixed National Institute of Standards and Technology (MNIST) produced the handwritten digits dataset. This dataset is one of the most researched datasets in deep learning and is used to classify handwritten digits. This dataset is helpful for predictive analytics because its sheer size allows deep learning to work its magic efficiently. This dataset contains 60,000 training images and 10,000 testing images, formatted as 28 x 28 pixels monochrome images presented in the figure below.



3. Pytorch

PyTorch is an open-source machine learning (ML) framework based on the Python programming language and the Torch library. It's one of the preferred platforms for deep learning research. The framework is built to speed up the process between research prototyping and deployment.

4. Lab procedure

1. Learn the basic knowledge and manipulation method of tensors.
2. Download and construct dataset by using "dataloader".
3. Illustrate example data.

4. Preprocessing data by adjusted standardization.
5. Use PyTorch to build a feedforward neural network.
6. Training the model and plotting the accuracy and losses in this process.
7. Evaluation model by drawing confusion matrix of the test set.
8. Validating the model by using different learning rate.

5. Lab Tasks and Report

1. Please find 2 way to transform the given tensor ([2, 3, 5]) into the shape of [10, 3], and state the difference between these two methods. [10 marks]
2. Explain why we need "softmax" as the last activation function. [10 marks]
3. Draw a plot reflecting the change of accuracy and losses relative to the number of the epoch. Compare and comment on the classification performance. [40 marks]
4. Draw a confusion matrix using the test data loader. [20 marks]
5. Use different learning rates to train the model, then compare the training process by drawing a similar plot mentioned above. [20 marks]