COMP3314_2C Machine Learning

Programming Assignment 2:
Convolutional Neural Networks

Release date: March 25, 2024
Due date: 11:59pm, April 25, 2024

Task:

This assignment is about applying a convolutional neural network (CNN) to the task of digit recognition using the PyTorch framework. Students are required to improve the recognition accuracy of this CNN by tuning several hyper-parameters and submit a report that summarizes their trials. A code template is provided to facilitate the implementation. Note that this assignment is also a group project, like the first programming assignment.

Datasets:

Each image contains a random integer between 0 and 9 (including 0 and 9). Therefore, the dataset defines a 10-category classification problem. The training set contains 3,000 samples for each category, and the testing set contains 500 samples for each category. Each input image has three channels, and each channel contains 32*32 pixels.

Guidelines:

[1] Students should first learn how to use PyTorch to implement a neural network. An official 60-minute blitz (https://pytorch.org/tutorials/beginner/deep_learning_60min_blitz.html) will greatly help you to understand the basic components of PyTorch. Python is the default programming language, and other deep learning frameworks besides PyTorch are prohibited in this assignment.

[2] In the provided template, you are asked to tune hyper-parameters, including the initial learning rate, decay strategy of the learning rate, and the number of training epochs, to improve the performance of the CNN model given in the template. Besides, you are allowed to change the optimizer, data augmentation, and network architectures for better training and testing results.

[3] Report writing: The report should contain the detailed results of your implementation: overall testing accuracy, the accuracy of each class (0-9), and results of different experimental settings. An ideal model should be optimized to achieve an overall accuracy greater than or equal to 90% (the provided template achieves an accuracy of 88%). We will grade each assignment based on the model performance ranking and the report's completeness.

[4] You should record your computer configuration and the running time of your program in the report. The overall running time should be less than 45 minutes (including training and testing stages). GPU is not recommended in this assignment as the model already runs quite fast on CPUs.

Submission Instructions:

[1] One report in **pdf** summarizing your implementations and results.

[2] Source codes packed in **zip** format that can be unzipped and compiled.