Deep Learning and Applications

Homework 1

Due date: Feb. 16, 2020

1   Task Description

In class, we have learned PyTorch programming, including basic tensor operations, standard layers and modules in PyTorch, and how to build our own models. Also, in the next few weeks, we will learn convolutional neural networks and recurrent neural networks.

In this homework, we will review these tensor operations, and build some advanced deep learning models for two real problems, including image classification and sentence classification.

There are three sections in our homework:

- **Part 1: Tensor Operations.** As we have learned in class, tensors are the fundamental data structure used in PyTorch, and PyTorch has implemented a variety of tensor operations, which serve as building blocks of our deep learning models. To let you get more familiar with the basic tensor operations, in this part we will review some of the operations. If you are not familiar with some of the operations, you could refer to the official document of PyTorch, where the detailed explanation is provided.

- **Part 2: Convolutional Neural Networks.** In computer vision, the convolutional neural network is one of the most important model, since many advanced models are build on top of that, as you will learn in class. Also, convolutional neural networks have been proven effective in a variety of applications, such as image classification and object detection. In this part, we will implement a convolutional neural network, and apply it for image classification on the CIFAR10 dataset. To better understand the use case of convolutional neural networks, you may check this demo.

- **Part 3: Recurrent Neural Networks.** In natural language processing, the recurrent neural network is a representative model, and many recent state-of-the-art models are certain variants of recurrent neural networks, such as LSTM, bi-directional LSTM. To get more familiar of recurrent neural networks, in this part, we will build a recurrent neural network for the sentiment analysis task, i.e., classifying a sentence into positive, negative and neutral based on the sentiment. To better understand why sentiment analysis is important, you could check the demo.

2 Instruction

The more detailed instructions of the homework are available at the Colab notebook. You could directly work on the Colab environment, where GPUs are provided to accelerate training. **Please do not save on the original file. Instead, you should make a copy of the file on your own Google drive, and do the homework on your own copy.**

3 Handing in Your Answer

After finishing that, you could hand in the Colab file through the link.

4 Evaluation

For all the three parts of the homework, we will check your codes and results to see whether you implement the models in a correct way, and we will give grades based on the correctness. Also, for the part 2 & 3, there are some tables to be filled in, and we will check the tables as well.