Bishop's University

CS 596 – Special Topics in Deep Learning

Assignment 2: Convolutional Neural Networks vs. Fully Connected Neural Networks

1. Overview

This assignment aims to help you to understand the difference between the Fully Connected Neural Networks and the Convolutional Neural Networks (CNN), and to become more familiar with scientific computing tools in Python and PyTorch. You will also get experience in hyper parameter tuning and using proper train/test/validation data splits. For that purpose, you will have to compare the performance of the fully connected neural networks with the one of the convolutional neural network by using the well-known CIFAR-10 image classification dataset. You will need to implement in Python with the help of Pytorch:

- Fully connected neural network,
- Convolutional neural network.

2. Recommendations

To facilitate the required implementations, the source code of neural network based on PyTorch and the one based on Scikit-Learn are provided. But, you are recommended to use the code that is based on PyTorch, especially for the automatic loading of CFIAR-10 image classification dataset. For the convolutional neural network, you can rely on the following tutorials:

- Create a convolution neural network with PyTorch
- CNN Cifar10 #Pytorch #Udacity Challenge Exercise Part1

For the starting project, you have to follow the format of the top-level notebook `CS596 Assignment-1.ipynb`. Setup instructions are below. The format of this assignment is inspired by the Stanford CS231n assignments, and we have borrowed some of their data loading and instructions in our assignment ipython notebook.

If your local machine does not support GPU programming, you are encouraged to use Google Colaboratory to do this assignment; since it provides free access to a Tesla K80 (for running short jobs).

Here are two interesting links about Google Colaboratory with the instructions to install Pytorch:

https://towardsdatascience.com/getting-started-with-google-colab-f2fff97f594c

https://colab.research.google.com/notebooks/welcome.ipynb

By this environment, you will be able to do GPU programming and to run your programs through the cloud computing provided by Google.

3. Environment Setup (Local)

If you will be completing the assignment on a local machine then you will need a Python environment set up with the appropriate packages.

We suggest that you use Anaconda to manage python package dependencies. This guide provides useful information on how to use Conda.

Data Setup (Local)

Once you have downloaded the zip file, navigate to the cifar10 directory in MP1 and execute the get_dataset script provided:

```
cd MP1/cifar/
./get_datasets.sh
```

Data Setup (For Colaboratory)

If you are using Google Colaboratory for this assignment you will need do some additional setup steps.

Download the assignment zip file and follow the steps above to download CIFAR-10 to your local machine. Next, you should make a folder in your Google Drive to hold all of

your assignment files and upload the entire assignment folder (including the cifar10 dataset you downloaded) into this Google drive file.

You will now need to open the assignment 1 ipython notebook file from your Google Drive folder in Colaboratory and run a few setup commands. You can find a detailed tutorial on these steps here (no need to worry about setting up GPU for now).

4. Tasks

a. Extend the code of the assignment 1 by adding the implementation of Fully connected network (FCN) and the CNN. To facilitate your task, I provided implementation of FCN and CNN in PyTorch,
b. Adjust the provided code of FCN and CNN by putting the block of train and predict into functions,
c. Validation of the performances of FCN and CNN for the CIFAR-10 dataset by following the provided instructions in the word file template.

5. Submission

You will have to submit all the programmed solutions. Please, provide a pdf report following the format of the provided word template that highlights the team members, the contribution of each one of them, and the obtained accuracy for each classifier. In addition, the programmed solutions in Python must be submitted. The function that computes this accuracy is already provided in the starting code. ***Please, submit the whole code of the assignment 2 in a separate .zip file***. *Thus, you have to submit a pdf file of the report based on the provided word template, and a .zip file containing the whole code of the assignment 2. Any error in submission implies the attribution of the grade zero.*

Good luck :)