ECE4880J: Computer Vision May 15, 2022

Homework 2: Python Programming

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Instruction

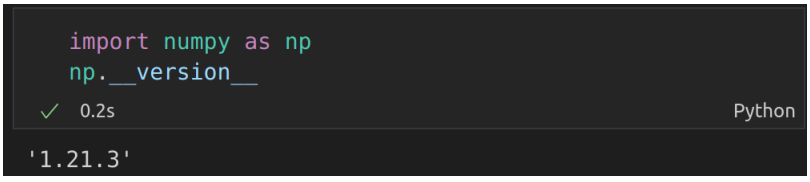
- This homework is due at 11:59:59 p.m. on ** May 30th, 2022.
- The write-up must be an electronic version edited by LATEX using **this template** and submitted in **pdf** format.
- Please DO NOT rename python files and their functions. Just fill it.
- The overall submission should be a .zip file named by xxx(student id)-xxx(name)-Assignment2.zip

Python Environment. We are using Python 3.7 for this course. We will use the following packages in this course: Numpy, SciPy, Matplotlib, Pytorch.

Q1. Welcome to Python [20 points]

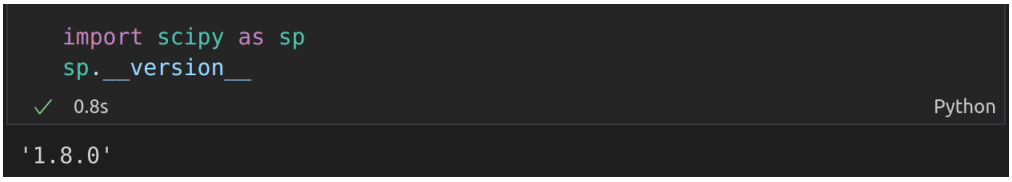
Q2. Numpy Crash [40 points]

Write-up: As shown in the following figure, the numpy version installed is **1.21.3**



Q3. SciPy Crash [10 points]

Write-up: As shown in the following figure, the scipy version installed is **1.8.0**



Q4. Matplotlib Crash [10 points]

Write-up: As shown in the following figure, the scipy version installed is **3.4.3**

```
import matplotlib as plotlib
plotlib.__version__
```

✓ 0.1s Python

```
'3.4.3'
```

And the following pictures show the result of the output for w1 to w5

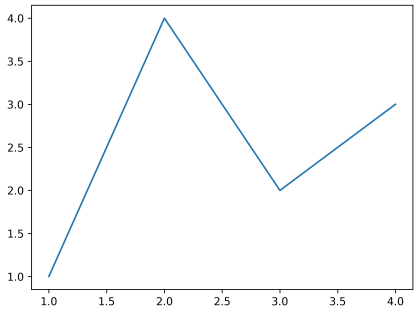


Figure 1: question 4 w1

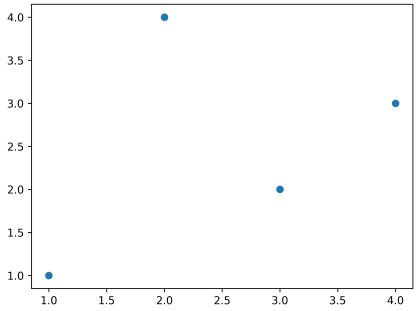


Figure 2: question 4 w2

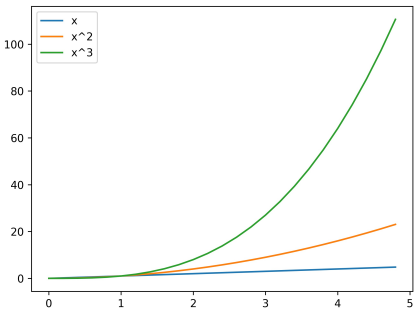


Figure 3: question 4 w3

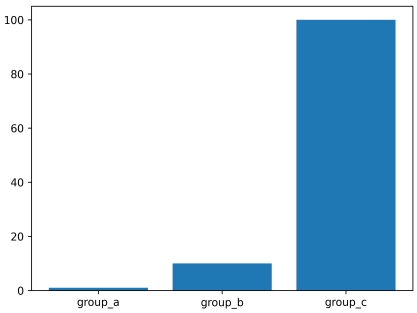


Figure 4: question 4 w4

Figure 5: question 4 w5

Q5. Introduction to Pytorch [20 points]

The aim is to guide you to know the functionality of Pytorch.

Installation. Please install Pytorch and show your Pytorch version in a screenshot.

Task. Please follow the instruction and fill in blanks in pytorch_main.py and complete your first convolutional neural network to handle image classification.

- Read the demo code and fill in the blank noted by """ xxx here """ in pytorch_main.py
- Vary the training epoch as $1, 2, 4, 8, 16$ and plot the accuracy of the "plane" category as a function of the training epoch.
- Vary the learning rate as $[10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}, 10^{-1}, 1]$ and plot the accuracy of the "ship" category as a function of the learning rate.
- Let's try another loss function: Mean Squared Error(MSE loss). Compare the performances.

Submission Format. Please submit your filled pytorch_main.py. Show your screenshot of Pytorch version in the write-up. Write and analyze your experiment results of above tasks in the write-up.

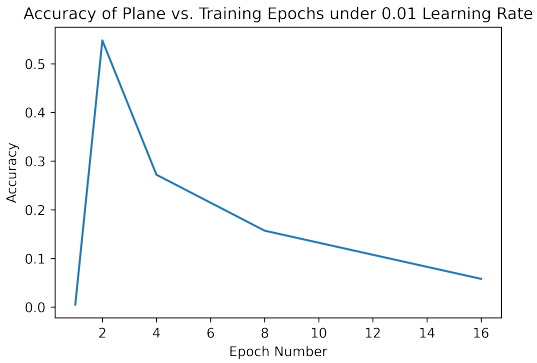
Write-up: As shown in the following figure, the numpy version installed is **1.11.0+cpu**. I have no NVIDIA GPU with my computer.

```
import torch
torch.__version__
```

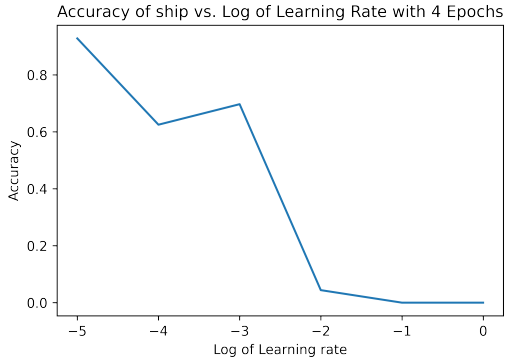
✓ 0.6s Python

```
'1.11.0+cpu'
```

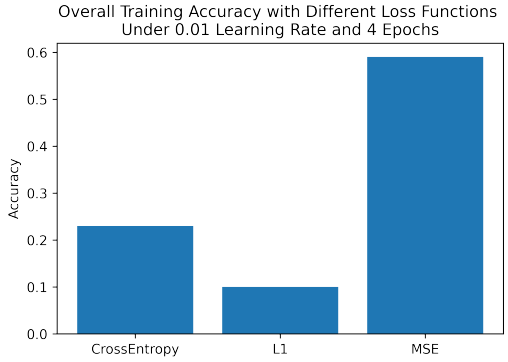
The relation between the accuracy of plane and the number of training epochs is shown in the following figure, note that the learning rate is set to 0.01.



The relation between the accuracy of shop and learning rate is shown in the following figure, note that the training epoch number is set to 4.



The performances of the models using different loss functions are shown in the following figure. We set the number of epochs to 4 and learning rate to 0.01. Here we find that the MSE gives the best



performance while L1 gives the worst performance. Also note that we use one-hot encoder to encode the labels in order to enable the L1 loss function and MSE loss function.