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Project: 2-Neural Networks for MNIST Classification from scratch

How to run 2 Neural Networks with my code

a/ Preparation and libraries import:

S1: The package is recommended to be generated from Visual Studio Code (VSCode). Open folder in VSCode. Go to the Extension 🔲 button on the most left bar of VSCode, and enable the Python Package (Figure 1).
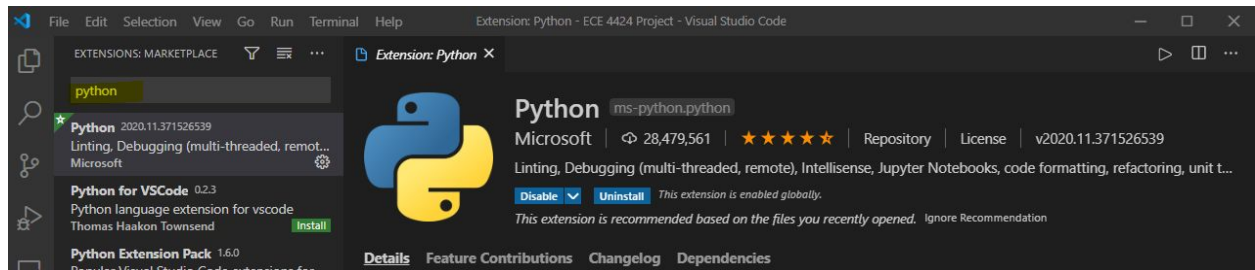

Figure 1. VSCode - Python Installation

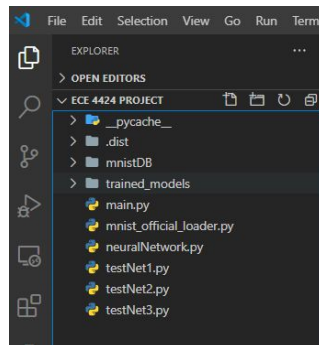**S2:** Click the Explore button 🗗 and you should see my submission directory (Figure 2)
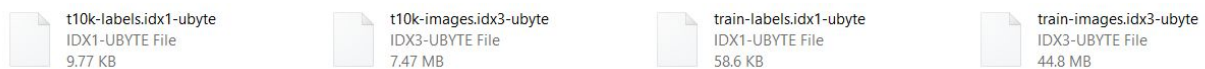

Figure 2. VSCode Submitted Directory.

Figure 3. Datasets in mnistDB Directory.

S3: Make sure your Python version is 3.7 or above.

S4: Import necessary Python package beside the Python Standard Library

+ **psutil** library: https://pypi.org/project/psutil/ [5]

+ **matplotlib** library: https://matplotlib.org/3.1.1/faq/installing_faq.html [2]

S5: Download the dataset that I downloaded from the MNIST website
https://drive.google.com/drive/folders/1coms3ARgbH4-u5emWuJnPMZY0urCtk3M?usp=sharing
Then put the four files into the mnistDB directory (Figure 3).

b/ Running main.py

S1: In VSCode like in Figure 2, right-click and choose "Open the Integrated Terminal" and make sure that you are in the "ECE 4424 Project" directory.

S2: Double-click on the main.py file. In VSCode Terminal, type "python ./main.py", press Enter, then wait for the code to be trained 30 epochs. Wait for a couple seconds until you see the print statement "========First Run: [784,30,10] 30 epochs=========" on the Terminal. Wait for the model to be trained. You then should be able to see the result of the first trained model (Figure 4) and it's corresponding guess figure (Figure 5). You have completed the running of *neural network model 1*.


```
========== Prediction 29 ==========
Current training accuracy is: 94.89%
Current training error is: 5.1100000000000003%

The training time is: 280.6428966522217 s
The memory usage is: 2.0999999999999943 bytes
Image number 6006 in the testing set is a 7, and the current network predicted a 7
```
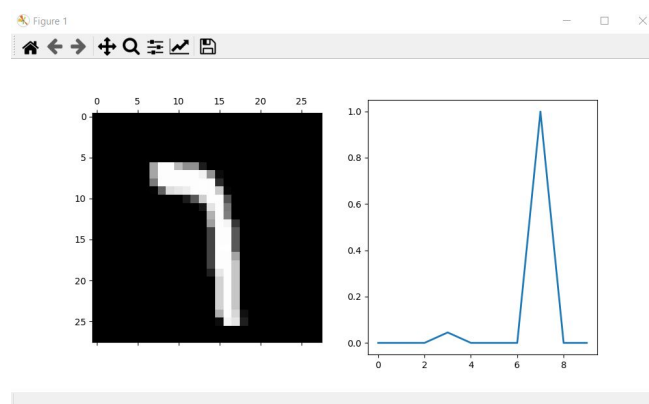
Figure 4. First Model's Result.

Figure 5. First Model's Random Number Guesser.

S3: Exit the window in Figure 5. In the main() method in main.py, comment out from line 41 to line 60 using CTRL + "/"; then, uncomment line 62 to line 81 using CTRL + "/". In theVSCode Terminal, type "python ./main.py", press Enter, then wait for the code to be trained 30 epochs. You should see similar formatted results in Figure 4, 5 for the second model. You have completed the running of *neural network model 2*.

S4: Exit the window in Figure 5. In the main() method in main.py, comment out from line 62 to line 81 using CTRL + "/"; then, uncomment line 83 to line 102 using CTRL + "/". In theVSCode Terminal, type "python ./main.py", press Enter, then wait for the code to be trained 40 epochs. You should see similar formatted results in Figure 4, 5 for the second model. You have completed the running of *neural network model 3*.

c/ Running testNet1.py, testNet2.py, testNet3.py (optional)

Since these models have been pre-trained and pickled, running these files and getting similar formatted results in Figure 5 should be instantaneous.

S1: In your VSCode terminal, type "python testNet1.py" to test pre-trained *neural network model 1* (part b/S2 above) random input from the testing dataset.

S2: In your VSCode terminal, type "python testNet2.py" to test pre-trained *neural network model 2* (part b/S3 above) random input from the testing dataset.

S3: In your VSCode terminal, type "python testNet3.py" to test pre-trained *neural network model 3* (part b/S4 above) random input from the testing dataset.