**Handwriting Recognition**

MET CS521 A3 Information Structures with Python (2019 Fall)

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**What the program does:**

The program downloads handwriting images with 28 x 28 pixels, that can be divided into training data and test data, learns what the numbers are from the training data with their labels, then predict what the numbers are from the test data, shows the graph of accuracy on the learning process, and prints out all parameters of neural network.

A screenshot of a cell phone

Description automatically generated

Figure 1. Example of learning progress

Neural network is used to learn handwriting images. The structure is as follows.

Input layer: 28 x 28 pixels(array of 784 elements) with 256 gray scale.

Layer1: 50 fully-connected neurons.

Layer2: Activation function of Rectified Liner Unit.

Layer3: 10 fully-connected neurons.

Output layer: Softmax-with-Loss of an one-hot array from 0 to 9.

The output layer is used only for learning. When predicting numbers, the program only needs to take the maximum value (which number, from 0 to 9, is the most possible.) from the layer4.



Figure 2. Structure of neural network

**Why it is useful:**

This program is useful because when you want to import handwriting images into text file, you don’t need to check and type all the handwriting images.

Also, it is helpful for learning how neural network works.

PLEASE READ readme FOR MORE INFORMATION.