Title: Chinese handwriting recognition software with Real-time GUI

Team Members: Yue Li, Lizhe Chen

In our project we would like to do real time Chinese handwriting recognition (include alphanumeric and symbols) with a GUI for user's handwriting matching. So far, there are many excellent solutions for the recognition of handwritten letters and numbers. However, due to the large number of categories, the recognition and detection of Chinese or Japanese characters are still being studied by many researchers or organizations such as Apple's Handwriting Recognition Team. Therefore, we want to learn and study the principles and limitations behind this task through implementation.

It mainly contains these steps:

1. Using the chinese handwriting dataset HWDB1.1 from CASIA, which include 1,172,907 samples for 3755 common Chinese character, and 171 alphanumeric and symbols. Separate the dataset for training, validation and testing.
2. Performing data preprocessing and image transformation for data augmentation. Which include random rotation, random brightness adjustment etc.
3. Build the network through PyTorch for the recognition task. We are planning to use the a fast and compact CNN architecture from this paper 'Building Fast and Compact Convolutional Neural Networks for Offline Handwritten Chinese Character Recognition'.
4. Training model and validation. Visualize and analyze the outputs and internal layers, tuning the hyperparameters. Evaluate the performance through testing set.
5. Create a GUI for users to write Chinese character and pass the input to our model. Display several matches with high confidence for the character that user just wrote. Record user's handwriting and selection as new data.

There are several major difficulties we may have to face：

1. The most obvious one is with Chinese characters. Compare to English characters, have far more classes as there are more than 3000 common characters in daily use. It requires a gigantic data set to train the model and it could take a tremendously long time since we do not have strong calculation power. Thus, we are going to see how many classes we could cover based on the time constraint.
2. Compared to English, Chinese characters have more strokes, which are more complicated than numbers and English characters. And many Chinese characters are composed of multiple Chinese characters, which is easy to cause confusion to the model. Also sometimes Chinese ligatures have a lot of distortion compared to the original look, which are hard to recognize.
3. As newcomers to machine learning, We need to learn relevant knowledge especially in how to improve training speed and analysis results. Due to limited time, learning to use CUDA and GPU to complete tasks can help us succeed.
4. We also need to figure out how to create a gui for real time handwriting and how to pass our handwriting input to the model.

There are several papers about how to recognize Chinese character we found might be helpful :

1. Building Fast and Compact Convolutional Neural Networks for Offline Handwritten Chinese Character Recognition
2. http://yuhao.im/files/Zhang_CNNChar.pdf