Calligraphy

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Objective:

Chinese calligraphy has many fonts, such as running script, regular script, and cursive script. I am a fan of calligraphy and always practice by myself. After learning Machine Learning, I often think of if I could create a project that can identify the fonts of the calligraphy or generate the new styles of the fonts, which I can modify it freely instead of practicing for hundreds of hours. This project mainly uses the Convolutional Neural Network technology in supervised learning to complete the classification of new picture fonts, and further, we want to put a picture of a word, and then let the program generate some new different styles of fonts.

Initial solution idea:

1. Assuming the resolution of each picture is only 100*100, then we need 100*100*3 pixels to describe the picture.

2. Assuming the first hidden layer has 1000 neurons, then there are 30000*1000 parameters. So, we need to process the data first.

3. To process the picture, Convolution and Max Pooling would be applied multiple times to decrease the numbers of the parameters.

4. In the Convolution, we could define the degree of the activation of the k-th filter as:

   $a^k = \sum_{i=1}^{n} \sum_{j=1}^{n} (a^k)_{ij}$ and use gradient ascent to find $x^* = \text{argmax}(x)\, a^k$.

5. Flatten the output from the previous step.

6. Take the result from step 5 as the input into the Fully Connected Feedforward network for processing.

7. In the Fully Connected Feedforward network, we define the output of j-th neuron as a_j. Then we need to find an image maximizing the output of neuron $x^* = \text{argmax}(x)\, a^j$.

8. At this point, we could have the parameters that we need to classify the image. For the program generating some new different styles of fonts, which is hard we might need further discussion in the progress report.

Data/tools needed:

1. Torch
2. Torch.nn
3. Keras
4. Dataset: 13.48 GB uncompressed file containing 15 million 28x28 PNG files of 52,835 characters. (https://blog.usejournal.com/making-of-a-chinese-characters-

dataset-92d4065cc7cc)