Neural Network and Deep Learning

Kuang Yaming Honors School
171240510 Ma Yuheng

2019.8.28

In the unzipped package, five files are presented.

- mnist.pkl.gz, contains all MNIST data we will use
- mnist_loader.py, for reading the MNIST data
- network.py, the main work we have done for network training
- exe.py, execution of training and digits recognition
- 1.png, an example picture of 0

In this document, I will present what I did based on knowledge from summer school, basically as following:

- apply stochastic gradient descent for feedforward network, which makes the SGD self-adjustable
- apply cross-entropy method to avoid slowing down when outputs greatly differs from expectation
- apply regularization to cost function to avoid overfitting as well as uncommon large weights
- apply adjusted initialize way to weights to prevent hidden layers to be saturated
- figure out the structure of MNIST and write a program to read and classify input hand-written digit

I have to admit that the codes are directly copied from Github of Michal Daniel Dobrzanski[1]. I read through it and made some adjustments for detail. The first four improvements are talked about in chap. 3 of the book. The codes are self-descriptive and there are fairly comments in the line so I am not going to explain much here. What I want to do is to show that I can recognize a hand-written digit by myself. The process needs the third-party library **cv2**, which can be acquired by entering $pip install opencv - python$ in console(if you have installed pip) or follow the website here[2].

Open exe.py, and assign the index of folder you unzipped the package onto index in console, for example:

$$\$ \quad index =' /Users/mayuheng/Desktop/deeplearning'$$

then run the file. As you can see the results coming out, the final accurancy on training data is about 97.664% and we are confident that overfitting barely happened because this percentage keeps growing in 30 epoch trainings. After the training results, I have the recognition answer of the self-given picture. You can replace it to verify but please write clearly because it's about my grades of summer school.

[1] https://github.com/MichalDanielDobrzanski

[2] https://pypi.org/project/opencv-python/