

Digit Classification

Dataset: The MNIST Database of handwritten digits

- You need to download the database.
 - <http://yann.lecun.com/exdb/mnist/>
- **Please use a subset of training images, because many student do not have a powerful computer.**
 - **Randomly select 300 samples for each digit from the all training samples for training (3000 training samples in total).**
 - **DO NOT select samples from the testing set.** Too good classification performance than it should be is not a good news for you.

MNIST

- <http://yann.lecun.com/exdb/mnist/>
- 70,000 images
 - 10 classes
 - Each image has 28x28 pixels
 - 60,000 training images
 - 10,000 testing images



- Step 1: Make sure each image is of the size 32 pixels x 32 pixels.
- Step 2: Rescale pixel values from the range [0-255] (or the range of [0-1]) to the range of [-0.5,+0.5].
- Step 3: Design a DNN with the following structure
 - Input (28*28*1)
 - Conv 1 (output size: 24*24*16)
 - Kernel size 5*5, Padding size 0, Stride 1, Kernel number 16
 - ReLU (output size: 24*24*16)
 - maxPooling (output size: 12*12*16)
 - Size 2*2, Stride 2
 - Conv 2 (output size: 8*8*32)
 - Kernel size 5*5, Padding size 0, Stride 1, Kernel number 32
 - ReLU
 - maxPooling (output size: 4*4*32)
 - Size 2*2, Stride 2
 - Fully connected layer (第一个全连接层可以实现为一个4*4*32的卷积操作 output size 100-d vector)
 - Kernel size 4*4, Padding size 0, Stride 1, Kernel number 100
 - ReLU
 - Fully connected layer (output size 100-d vector)
 - ReLU
 - Fully connected layer (output size 10-d vector)
 - Softmax
 - Cross entropy loss

- Train the CNN
- Try to adjust some hyper-parameters to avoid a too bad performance
 - Batch size, learning rate, etc.
 - **But DO NOT** waste your time in pursuing higher accuracy. As long as your code does not have a bug (e.g., the classification accuracy is significantly lower than usually), I do not care about the accuracy, if the performance is not significantly lower than others. It is not a competition of the accuracy.
- Report
 - Submit your code along with the report
 - **Make sure your code can run**
 - **I will randomly run codes of 30% students.**
 - Report curves of the training loss and the testing loss
 - Report the testing accuracy