

## EE6530 Neural Networks

### HW4: Handwritten digit recognition

Due April 30, 2015 in class

In this homework, you are asked to implement a hand-written digit classifier, using **any of the methods covered in class**. You are provided with 8000 images of handwritten digits ('0'-'9', 800 images each). The images are in binary format; that is, each pixel is either on or off.

The sample code <Hw4\_naiive.m> contains my way of loading up the images and calculating their average. You can see that, by comparing the distance between a test image and every mean image and using the shortest-distance criterion for classification, we can achieve an accuracy of about 80%. This is a naïve method, so I expect your method to perform better. The following link contains a list of methods that have been tried by others and their respective performance.

<http://yann.lecun.com/exdb/mnist/>

Here are a few issues you may need to consider thoroughly.

1. Sufficiency of training data: we have 8000 images and the number of weights would be at least 784 for every hidden neuron. The ratio might be not enough to prevent over-fitting.
2. Therefore, you might need to consider *dimension reduction* (e.g. down-sampling the images) before passing the pixel values into your neural net; I am not entirely sure.
3. In any case, evaluate your system with the technique of *cross validation*. Your report must include cross-validated accuracy of classification. You will need report the performance gap between the accuracy using the validation set vs. the accuracy within the training set itself. Hopefully, the gap is tolerable and you will have certain confidence that your method is capable of generalization.

On April 30, after you turn in the report, I will announce another 200 test images for you to judge how well your method generalizes. Hw5 will be dedicated to any further ideas you want to try on the same task.

Cheers!

Yi-Wen