

## Xihao Zhu's COMP502 Project Proposal

### Statement of Problem:

In this project I hope to build classifiers that can classify and recognize handwritten English digits.

The handwritten English digits are from 0 to 9 in the form of pixel image (illustrated in last part of this proposal). Therefore I hope my classifier can take image digit as inputs and output the class of digit(0-9), like what digit it is. I think this project will be fun. I will practice skills learned in class to solve real world problem. If possible I wish to extend digit to English characters later on~

### Objectives:

My purpose for this project is pattern recognition, specifically handwritten English digits recognition.

I hope to design 3 main classifiers that can recognize English characters well enough with good precision. The main algorithms involving 3 different method in pattern recognition are Associative memory, NML with BP, and SOM. And also I want to compare their performance. Moreover on MNIST database of handwritten digits website, researchers test on MNIST data with different methods and got different test rate. I can compare my results with theirs at the end.

### Technical Approach:

Well I mainly will use algorithms learned in class: Associative memory, NML with BP, and SOM. I will try to compare my precision to MNIST website precisions. I think I will use average percent error to get the precision. Moreover, I will try to use different threshold criteria to get the output and compare outputs with different thresholds. For example, 1 output with 0.6 will be round to 1 if threshold is 0.5 and will be round to 0 if threshold is 0.8. This will effect precision of cause, but I want to compare their differences.

### Data Description:

I am going to use the MNIST database of handwritten digits, which has a training set of 60,000 examples, and a test set of 10,000 examples. It is a subset of a larger set available from NIST. The MNIST database was constructed from NIST's Special Database 3 and Special Database 1 which contain binary images of handwritten digits. The digits have been size-normalized and centered in a fixed-size image. The data is available at this website <http://yann.lecun.com/exdb/mnist/>. There are 4 files totally: train image file, train label file, test image file and test label file.

The training set contains 60000 examples, and the test set 10000 examples. The first 5000

examples of the test set are taken from the original NIST training set. The last 5000 are taken from the original NIST test set. The first 5000 are cleaner and easier than the last 5000.

To read the data from image file, I tried these matlab cmd:

```
fid=fopen('t10k-images-idx3-ubyte','r')
```

```
[t1,N]=fread(fid,[28 28],'uchar');
```

```
imshow(t1);
```

...

This will take out digit one by one from source file.

Some digit examples are shown here:



They are 9, 0, 2 and 8.