

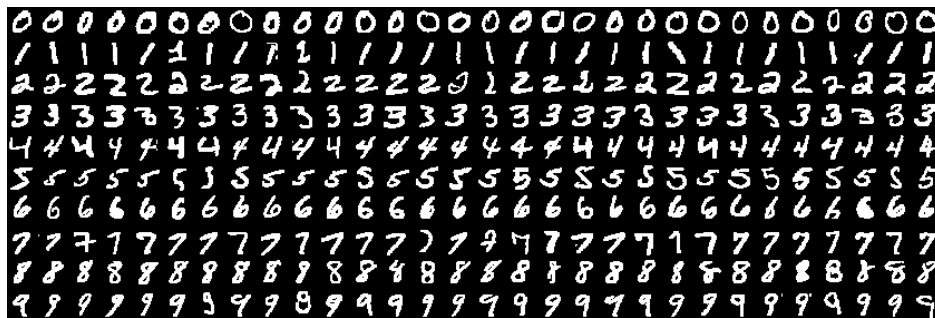
## COM322 LAB 10

In this lab you will work on the problem of hand written digit recognition. The [MNIST database](#) (Modified National Institute of Standards and Technology database) is provided in MATLAB format and it contains both training and testing data. The digits have been preprocessed, digitized and cropped. The start code shows how to access the individual images.

After the code is run the cell array `D_all{d+1}` will hold all the training samples (images) for digit `d` (e.g. index 1 for digit 0). You can extract a single sample using the following syntax:

```
squeeze( D_all{d+1}(j,:,:) )
```

This will return the `j`'th sample for digit `d`. Here are the first 30 samples for all 10 digits.



In this lab, you will use the training set to learn properties of the classes (digits in this case) and then test them on the labeled test set to measure the accuracy of the recognition.

**P1.** Implement a digit recognition system based on directly matching the images. Pick a sample for each digit (to act as a template or prototype) in the training set and use them to find the best match for a given sample in the test set.

You can calculate the degree of match using correlation between the pairs.

The correlation between two same size images `A` and `T` can be found as follows:

```
aa = corrcoef(A(:),T(:));  
cc = aa(1,2);           % cc will be between -1 and 1
```

**P2.** Repeat P1 by averaging all the samples for a digit in the training set to obtain the template for that digit.

**P3.** Solve the same problem using HOG features. Use the MATLAB function called **extractHOGFeatures** to find the features for each sample in the training and test sets. Use a cell size of [4 4]. You can use the correlation again to calculate the degree of match between the HOG features of the template and HOG features of the test sample.