Due to 27 April 2020, 11:39 PM

You are required to design a Fisher's linear discriminant classifier that can recognize scanned images of the 10 digits (0 to 9) provided in the file "Assignment 1 Dataset.zip". The zip file contains two folders: "Train" and "Test". The "Train" folder contains 240 images for each digit while the "Test" folder contains 20 images for each digit. The images in the "Train" folder should be used to train a classifier for each digit using the method given at the bottom of slide 9 in Lecture 2.pdf. The folder contains a filed named "Training Labels.txt" which includes the labels of the 2400 images in order. After the classifiers are trained, test each classifier using the images given in the "Test" folder. Use the following equation for Fisher's Linear Discriminant $\mathbf{w} = \mathbf{S}_W^{-1}(\mathbf{m}_2 - \mathbf{m}_1)$. The folder also contains a text file named "Test Labels.txt" which include the labels of the 200 images in order.

Deliverables:

- Your code.
- A confusion matrix showing the number of images of the Test folder of each digit that were classified to belong to different digits (For example: Number of images of 0 that were classified as 0, 1, 2, …, 9, and so on for other digits). Convert the confusion matrix to an image and save it as "Confusion.jpg".

Important Notes:

- **Do not use Python built-in functions for mean, covariance or the Fisher's linear discriminant. You have to implement your own version of all needed functions. You are only allowed to use functions that load images into Python.**
- This is an individual assignment. It is not a team assignment.
- To compute the bias term for Fisher's linear discriminant, you can use the following equation:

$$w_0 = -\mathbf{w}^T(\mathbf{m}_1 + \mathbf{m}_2)/2$$