# Assignment 4: Multi-Class Classification with Neural Networks

*Loyola Marymount University*                             *Professor Alex Wong*
*CSMI-533: Data Science and Machine Learning*

Implement the neural networks for multi-class classification

The main goal of the assignment is to the effects of neural networks in the multi-class classification problem

We will be doing the following in the assignment:
1) Creating a neural network
2) Training on the digits dataset
3) Evaluating performance on validation set to tune parameters and network structure
4) Evaluating performance on testing set

A skeleton of the classes is provided in assignment4.py

You will complete all locations marked with TODO in the assignment.

You will also write a report detailing every step you took to complete the assignment, it will be comprised with the following sections
1) Introduction
   This section should give an overview of a neural network and how it can be used to perform multi-class classification
2) Network Architecture
   This section tell us how your network architecture (e.g. how many layers with number of neurons, activations)
3) Results
   This section should report your mean accuracy and show images with your predictions and ground truth labels. You should also report your hyperparameters such as batch size, learning rates, decay function, any preprocessing, etc.

As a comparison, linear methods (Perceptron and Logistic Regression) are included.

Note: you should reach at least 90% in accuracy since Perceptron and Logistic Regression both hit 89% and they are only linear methods.

Submission:

You will submit the following to Bright Space

1) <last_name>_<first_name>_assignment4.py
2) <last_name>_<first_name>_report4.pdf

Grading:

I will be executing the assignment using the following command:

```
python <last_name>_<first_name>_assignment4.py
```

Your code must run for me to assign points!

Your assignment will be graded on:

1) the correctness of your implementation of the assignment
2) the performance of your network (should at least reach 90% accuracy)
3) the quality of your report

Late Policy:

For each day the assignment is late, 50% of its worth will be deducted, e.g. 100% on time, 50% 1 day late, 25% 2 days late, etc.