**Mechatronics Engineering Program**
**CSE473: Computational Intelligence**
**Spring 2023**

**Major Task Project: Optimization & Image Classifiers**

**Students are encouraged to work in groups. Each group has at most three students.**

**Due Date: Milestone (1): TBD - Milestone (2):TBD**

## Milestone (1):

You will compare between the performance of the following optimization algorithms: -

1- Stochastic gradient descent
2- Gradient descent with momentum
3- Adagrad
4- Adadelta
5- Adam

You can use the well-known test functions for optimization listed in (https://www.sfu.ca/~ssurjano/optimization.html). Your comparison must consider the different types of functions such that: -

a- Many local minima.
b- Bowl-shaped
c- Plate-shaped
d- Or other shapes.
e- Also, with global minimum or with a saddle point.

## Milestone (2):

The aim of this project is to create and train a multilayer Neural Network to classify an image into its corresponding category.

1- First select at least 100 visual objects and construct a data set for each object with suitable number of images.

2- You may divide the data sets to be 70% for training, 15% for validation, and 15% for testing.

3- Normalize your data using the techniques explained in the course lectures by subtracting from the mean and dividing by the standard deviation at each dimension. Visualize your data after normalization.

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4- Using tensor-flow, design a multilayer neural network to handle this classification case.

5- Using cross validation, what will be the best number of hidden layers as well as number of nodes per layer?

6- You need to visualize the training process (loss vs iterations).

7- What will be the best accuracy you get?

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**Important: You need to write a neat report for each milestone with the following contents:**

- Problem definition and importance (1 Page).
- Methods and Algorithms (2-3 Pages).
- Experimental Results (samples of your trails) and discussions.
- Appendix with codes.

**Warnings: (1) Plagiarism is prohibited. (2) Assignments with no reports and or no presentations will not be graded.**

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