

## **ID5030- Machine learning for Engineering and science applications**

### **Homework 3 – Gradient Descent and its variants**

**Assignment Given on : Feb 2 , 2023**

**Due Date : Feb 9, 2023 (Online submission)**

**Context :** The purpose of this assignment is to

- a) Understand gradient descent and its variants
- b) Understand gradient descent application in linear regression

We will use the same example as Assignment 1 & 2 and try modifying it with gradient descent.

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Consider the Concrete Compressive Strength dataset from the first assignment ((For the downloading of the dataset please refer to this [Link](#).)

1. Write a Python program to solve the linear regression problem batch gradient descent.
  - a. Implement batch gradient descent from scratch in Python, without input data normalization. Experiment with various learning rates. State your observations.
  - b. Implement batch gradient from scratch in Python, with input data normalization. Experiment with various learning rates to determine optimal learning rate. State your observations in this case.
  - c. Repeat a & b using Pytorch's implementation of gradient descent and compare your results.
2. Repeat 1b and 1c for stochastic gradient descent and mini-batch gradient descent.
3. Implement gradient descent with momentum from scratch in Python, with data normalization. Compare your results with Pytorch implementation for the same.
4. Repeat question 3 with Nesterov Accelerated Gradient Descent.