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**ECGR 4105: Intro to Machine Learning**

**Homework #0**

**GitHub Link:** https://github.com/Norumai01/Intro_Machine_Learning/tree/main/HW_0

**Problem 1:**

- Based on all the linear regression line models that was individually plotted for X1, X2, or X3, X1 has a more accurate regression line for the training model. X2 and X3 had many different training data points that can be called the outliers, and that can affect the training in an unintended outcome.
- X1 had the lowest cost loss as shown as the loss history goes down to 0.985. The lower the cost loss, a better representation of the linear regression line for the training model.
- From testing different ranges of learning on X1, X2, X3, it is found that the best optimal learning rate range around 0.001 – 0.01 depending on when its finish iterating before its iteration limit. For example, for variable X1, if the learning rate was 0.001, it will result in the plot converging in a steady paste and may not end up finishing iterating as 1600 iterations is the limit. As a result, may end up in a inaccurate values of theta. Higher learning rate than 0.1 would result in a exponentially steep decreases in a less amount of iterations needed on the plot. As a result, the high learning rate may end up producing inaccurate thetas' values.

**Problem 2:**

- Variable X1 had a better linear regression model because the regression line is more accurate with the relationship between the X and Y variables.
- A learning rate of 0.01 (if not around 0.008 - 0.01) for the multivariable regression was chosen to have an optimal pacing of the loss over iterations. Any lower would requires more iterations, which is not optimal, and possibly unfinished gradient descend. Any higher would result in exponentially decreases and may output inaccurate of thetas.
- Formula shown at the end of the code in the multivariable regression:
  - H(1,1,1) is 3.34279542031987
  - H(2,0,4) is 0.18806109519189196
  - H(3,2,1) is 0.06000797936338653