Johnny Nguyen

Student ID: 801119047

Homework #1

GitHub Link: https://github.com/Norumai01/Intro_Machine_Learning/tree/main/HW_1

Problem 1:

- Comparing the convergence of gradient descent from 1a and 1b, they have similar converging rate in the loss over iterations graph. This is likely the case that areas have a large range of data (can also be considered outliers) as compared to the smaller values from other x-variables. So due the large range of data from different thetas, the dataset cannot produce a proper minimal loss in a generalized manner.

Problem 2:

- Comparing the gradient descent of Min-Max Scaling and Standardization of 2a to 1a, the Min-Max scaling produces the least cost loss and shows better scaling with the graph of loss over iterations.
- Comparing the gradient descent of Min-Max Scaling and Standardization of 2b to 1b, the Min-Max scaling also produces the least cost loss and shows more accuracy between the training and validation sets.
- Overall, it seems that the Min-Max normalization technique is the better scaling for the house datasets. Though it could also be debatable that the standardization scaling may provide the better “over-fitting under control”, if the training sets loss does continue to decrease.

Problem 3:

- The most optimized input scaling that was chosen is: Min-Max Scaling. The parameter penalties were added to the loss function for problem 3. Comparing loss over iterations of 2a and 3a, the loss function with the parameter penalties has slightly increases the cost loss in the loss history. As a result, the increases are still under controlled in terms of over-fitting.
- Comparing the loss over iterations of 2b and 3b, the parameter penalties reduced the large data and has a slight increase in the cost loss of the lost history. In the graph of 3b, the loss over iterations can be considered under controlled.
- Overall, for both datasets, it looks that the parameter penalties might not be necessary, as the dataset has already been scaled from Min-Max technique.

However, the parameter penalties could help make the training sets more accurate to other validation sets, if necessary, by increasing the lambda’s value. It is to be careful that a high lambda’s value can cause the loss function to increase marginally for the training set.