Assignment 2: Basic Optimization and Machine Learning

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1 Task 1

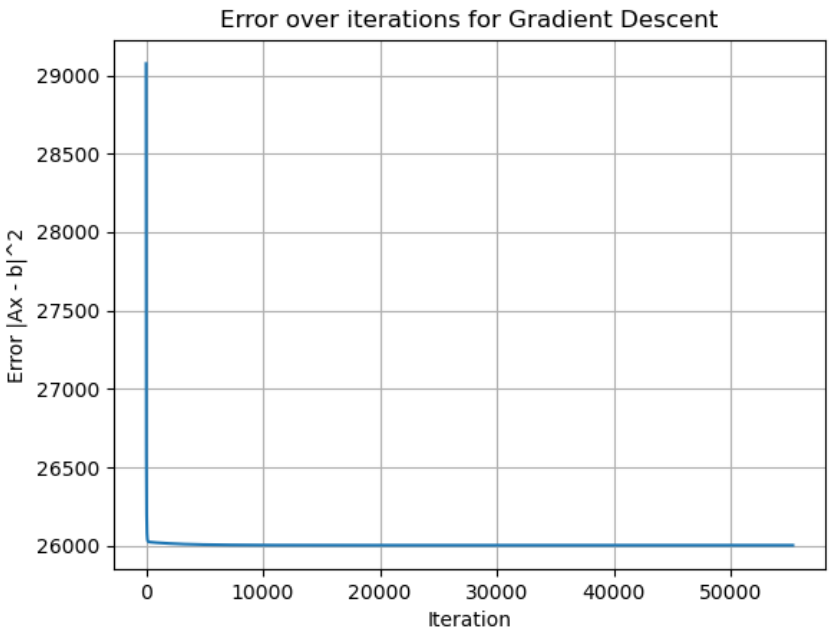

Figure 1: Error plot for Task 1.

2 Task 2

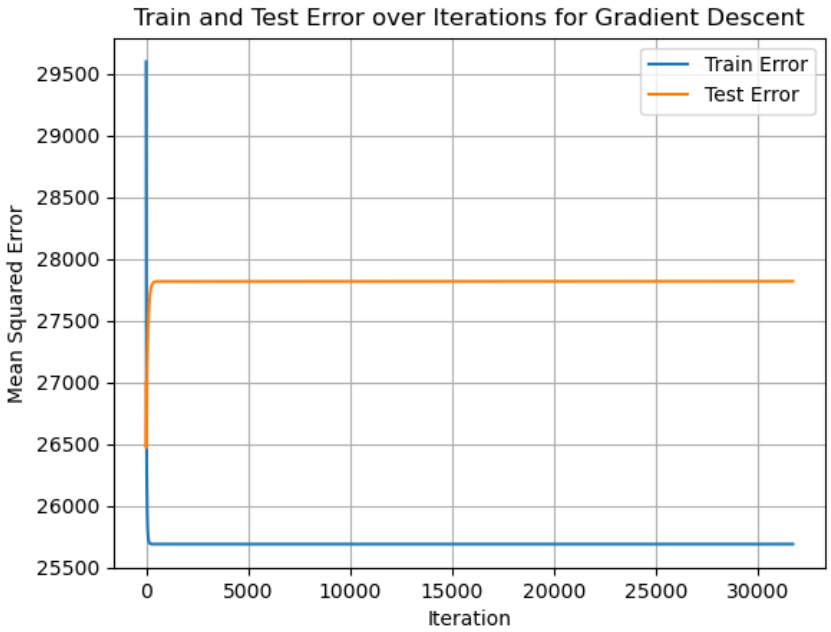

Figure 2: Train and test error plots for Task 2.

The graph reveals that both training and test errors hover around 25,500-28,000. When we checked the predicted values (the mean of the vector b), the average was around 150, close to the square root of the error we got, which suggests the error might be high (an error of 150 when the values are around 150 can be high, twice of the results in the vector b). Both the training and test errors are pretty high and close to each other, showing that the model isn't really capturing the patterns in the data well. This means the model is underfitting.

3 Task 3

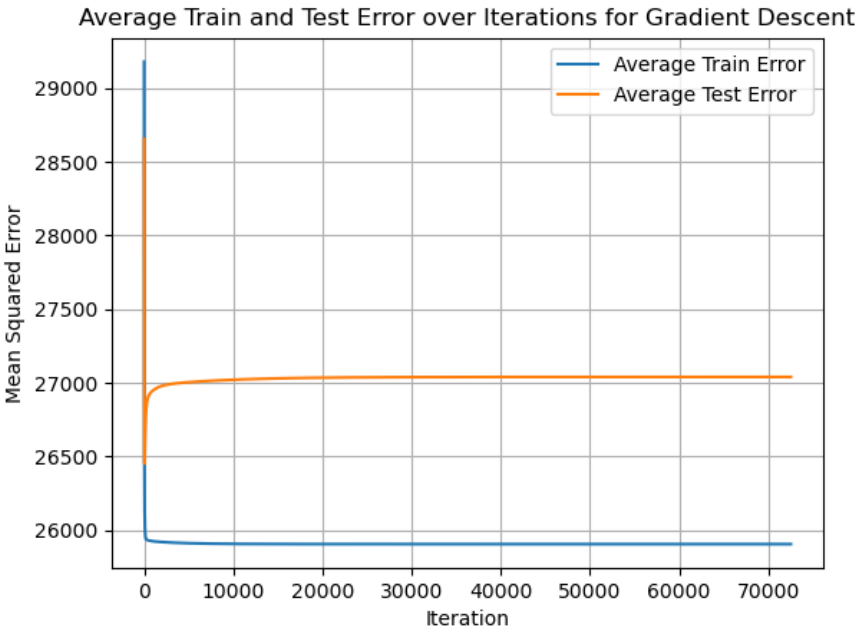

Figure 3: Average error plot for Task 3.

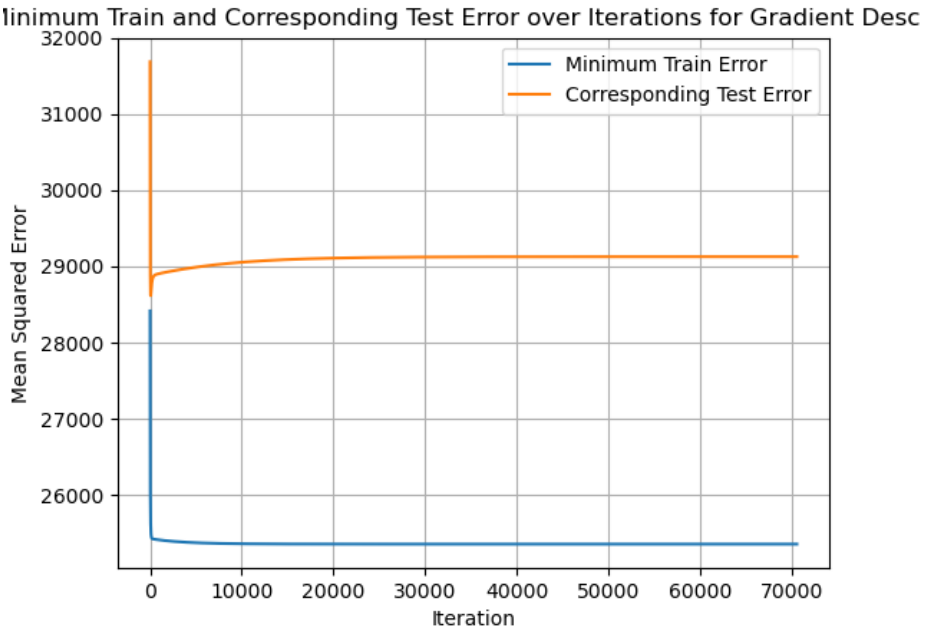

Figure 4: Minimum error plot for Task 3.

Conclusions

Like in the previous part, we can see that the results are still not capturing the patterns in the data well, and the errors are still lying in the same area. This consistency in high error rates across both models suggests that neither approach is effectively capturing the patterns in the dataset.

Behavior of Average Error Graph

The average error graph shows that in this case, the train and test errors are a bit closer to each other compared to the minimum error graph. While the training error is higher than the minimum, the test error is better. We see that it captures the patterns in the data a bit better than single train and test measurements.

Behavior of Minimum Error Graph

The minimum error graph represents the best-case scenario for the training error at the end of the process but not for the test results. It highlights the model's potential under optimal conditions, showing the lowest possible error the model can achieve on the training data, but it doesn't provide better results on the test data. The difference between the train and test errors becomes bigger but still not significantly, so it's not clearly overfitting.