CS 613 - Machine Learning

Assignment 2 - Linear Regression
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1 Theory

1. Consider the following data:

$$\begin{bmatrix} -2 & 1 \\ -5 & -4 \\ -3 & 1 \\ 0 & 3 \\ -8 & 11 \\ -2 & 5 \\ 1 & 0 \\ 5 & -1 \\ -1 & -3 \\ 6 & 1 \end{bmatrix}$$

   (a) Compute the coefficients for the linear regression using global least squares estimate (LSE) where the second value is the dependent variable (the value to be predicted). Show your work and remember to add a bias feature and to standardize the features (10pts).

2 Closed Form Linear Regression

1. Final Model: $y = 3343.27586207 + 1036.63016523x_{:,1} - 295.66859639x_{:,2}$
2. Root Mean Squared Error: 653.76012597

3 S-Folds Cross-Validation

1. With S = 5 (as required), RMSE = 636.315054765
2. With S = 6 (to test other values), RMSE = 621.823391267
3. With S = 7 (to test other values), RMSE = 640.86061133

4 Locally-Weighted Linear Regression

1. With k = 1 (as required), RMSE = 895.876676714
2. With k = 2 (to test other values), RMSE = 637.726596574
3. With k = 3 (to test other values), RMSE = 616.643575718
4. With k = 4 (to test other values), RMSE = 625.745432869

5 Gradient Descent

Results when $\alpha = 0.01$

- Final model: $y = 3343.27574946 + 1036.63010327x_{:,1} + -295.66858438x_{:,2}$
- After 1712 iterations
- RMSE = 653.760066367

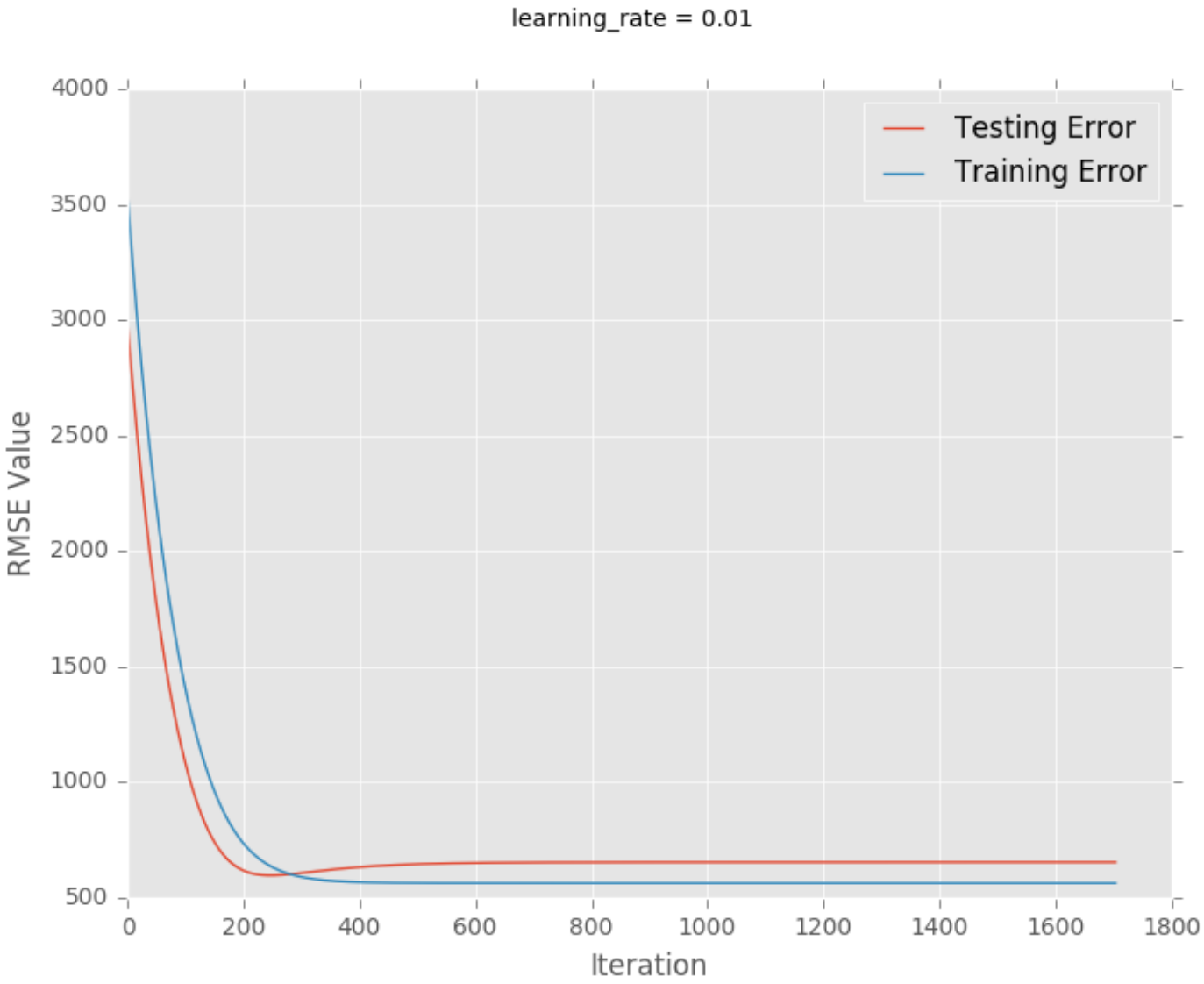

Figure 1: Gradient Descent Progress

Results when $\alpha = 0.1$

- Final model: $y = 3343.27584461 + 1036.63015469x_{:,1} + -295.66859449_{:,2}$
- After 181 iterations
- RMSE = 653.760097303