Lab 6

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The purpose of the lab is to implement linear regression and ridge regression. When the model is trained, the gradient descent algorithm is used to calculate the value of w. When the model is tested, the value of w is used to calculate the predicted value of y.

5-fold cross validation, which is used to optimize the value of lambda, chooses $\lambda = 25$ because the value of λ minimizes RMSE. When ridge regression using the closed form solution is performed, the train RMSE is 0.12879701459879792.

When linear regression and ridge regression using the gradient descent algorithm are performed, the following are the RMSEs:

	Train RMSE	Test RMSE
Linear Regression	0.12961985914977267	0.14684236592330094
Ridge Regression	0.1289001107103207	0.14494105074840355

The train RMSE is less than the test RMSE. Because the model is trained on the training data, the model fits the training data better than the testing data. The ridge regression RMSE is less than the linear regression RMSE. Because the value of λ is optimized for ridge regression, and ridge regression avoids overfitting, ridge regression fits the data better than linear regression.

The error rates are greater when the gradient descent algorithm is used to calculate the value of w than when the closed form solution is used to calculate the value of w. While the closed form solution calculates the exact value of w, the gradient descent algorithm calculates the approximate value of w. The closed form solution is more accurate than the gradient descent algorithm. However, the value of w is approximated because the gradient descent algorithm runs faster than the closed form solution.