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2019 Fall EE5183 FinTech - Homework 1

1a

I use a build-in function called 'train_test_split' which it helps spilt the data in random. After split the data, I find the mean and standard deviation of the training set (80%) and use it to normalize both training set and test set that already splited. Then use the normal equation to solve the optimal weight.

1c

I'm using the normal equation to find the optimal weight. The normal equation come from the partial derivative of cost function with respect to individual theta or weight and then setting them to zero

$$J(\theta_0, \theta_1, \cdots, \theta_n) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)} \right)^2$$

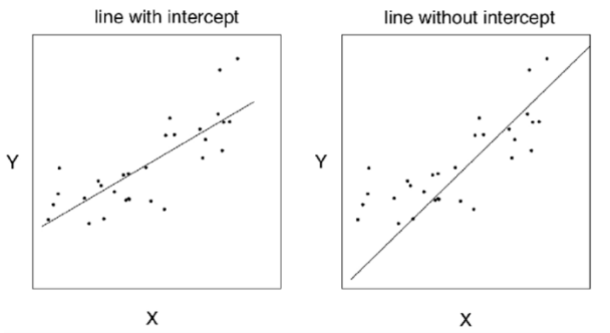
Cost function

$$\theta = \left(X^T X \right)^{-1} X^T y$$

Normal equation

1f

As the picture shown below, the model with bias will have an error much less than the one without bias. The bias that added to the model perform like y-intercept; it helps the linear line can move along the y-axis to best fit the data.



If no bias the y-intercept will be at 0 or at the origin point which make the linear line have the constraint to fit the data