ASSIGNMENT 2

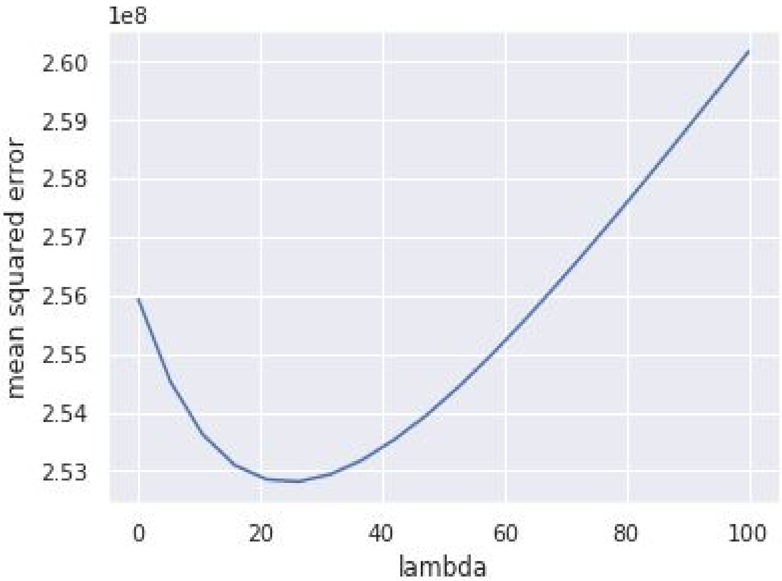
Linear Regression with Regularization and Locally Weighted Regression

In this assignment, we have applied Linear Regression with Regularization (Normal Equation and Gradient Descent) and LWR to Housing Price Dataset.

1)Using Regularization

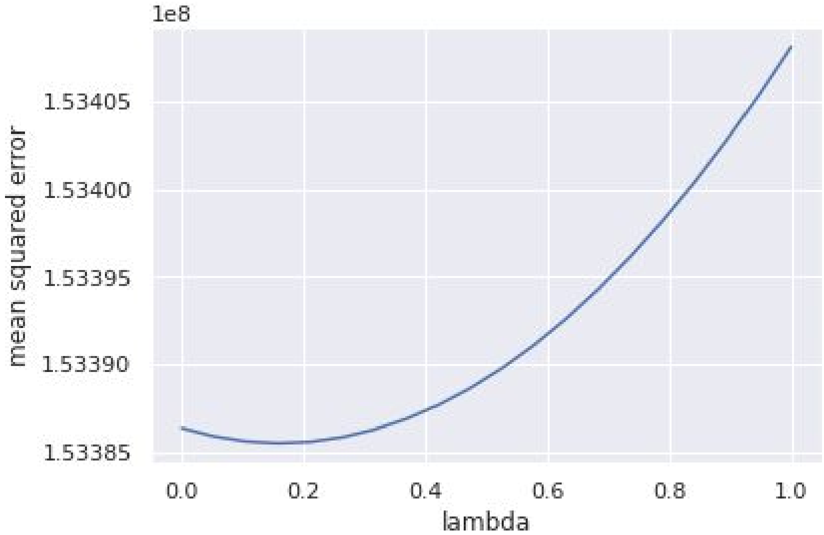
Using 70% training and 30% testing data

Mean Square Error vs lambda (Normal Equation)



The above graph shows the relation between the mean squared error of the test data set with the regularization parameter lambda when using normal equation to fit the parameters to the data set. By analysing the graph we can conclude that as we increase the value of lambda, the mean squared error first decreases, reaches a minimum value, and the consequently increases again. Thus for a particular optimal value of lambda, the mean squared error becomes minimum. We can find this value by the trial and error method.

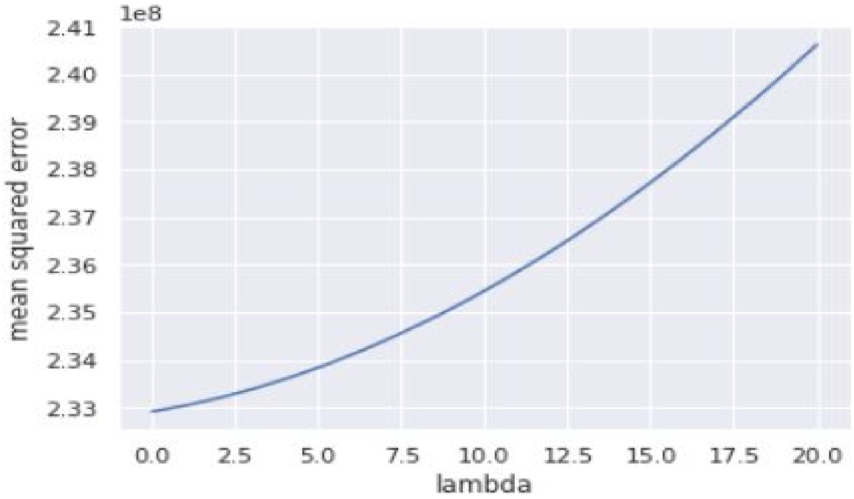
Mean Square Error vs lambda (Gradient Descent)



The above graph shows the relation between the mean squared error of the test data set with the regularization parameter lambda when using the gradient descent method to fit the parameters to the data set. By analysing the graph we can conclude that as we increase the value of lambda, the mean squared error first decreases, reaches a minimum value, and the consequently increases again. Thus for a particular optimal value of lambda, the mean squared error becomes minimum. We can find this value by the trial and error method.

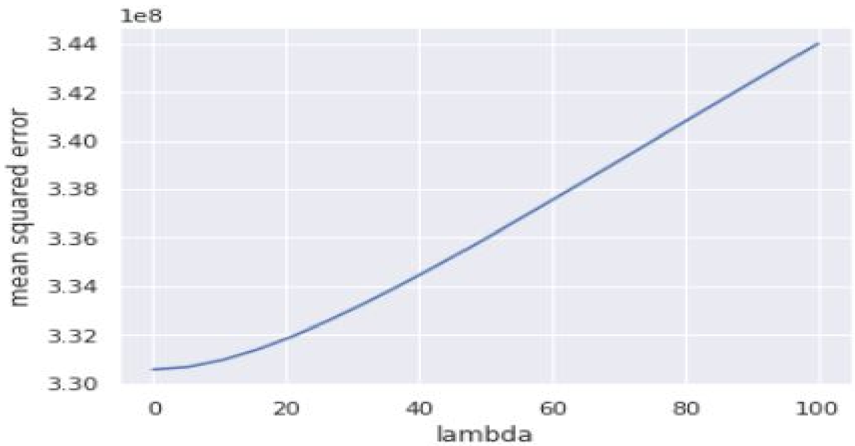
Using all training data :

Mean Square Error vs lambda (Gradient Descent)



The above graph shows the relation between the mean squared error of the test data set with the regularization parameter lambda when using the gradient descent method to fit the parameters to the data set. By analysing the graph we can conclude that as we increase the value of lambda, mean square error monotonically increases, this is due to the fact that we have used all the data for training and furthermore we are using the same data for testing also. So, the chances are that our data will overfit resulting in getting better results without regularization but as we increase lambda we will approach towards a more generalized solution which is not beneficial here as training data and testing data is same.

Mean Square Error vs lambda (Normal Equation)



The above graph shows the relation between the mean squared error of the test data set with the regularization parameter lambda when using the normal equation method to fit the parameters to the data set. By analysing the graph we can conclude that as we increase the value of lambda, mean square error monotonically increases, this is due to the fact that we have used all the data for training and furthermore we are using the same data for testing also. So, the chances are that our data will overfit resulting in getting better results without regularization but as we increase lambda we will approach towards a more generalized solution which is not beneficial here as training data and testing data is same.

2) Locally Weighted Regression

The below graph shows the variation of mean squared error with varying values of tau(variance).From the graph we can conclude that the greater the value of tau, the greater is the mean squared error and vice versa.This happens because the smaller the tau, the more quickly the weights decrease as the distance increases from the fixed point. Thus, the error is smaller because the points further away from the selected points have low weights associated with them.

VARIANCE VS MEAN SQUARE ERROR