ELEN 4903: Machine Learning
Homework 3

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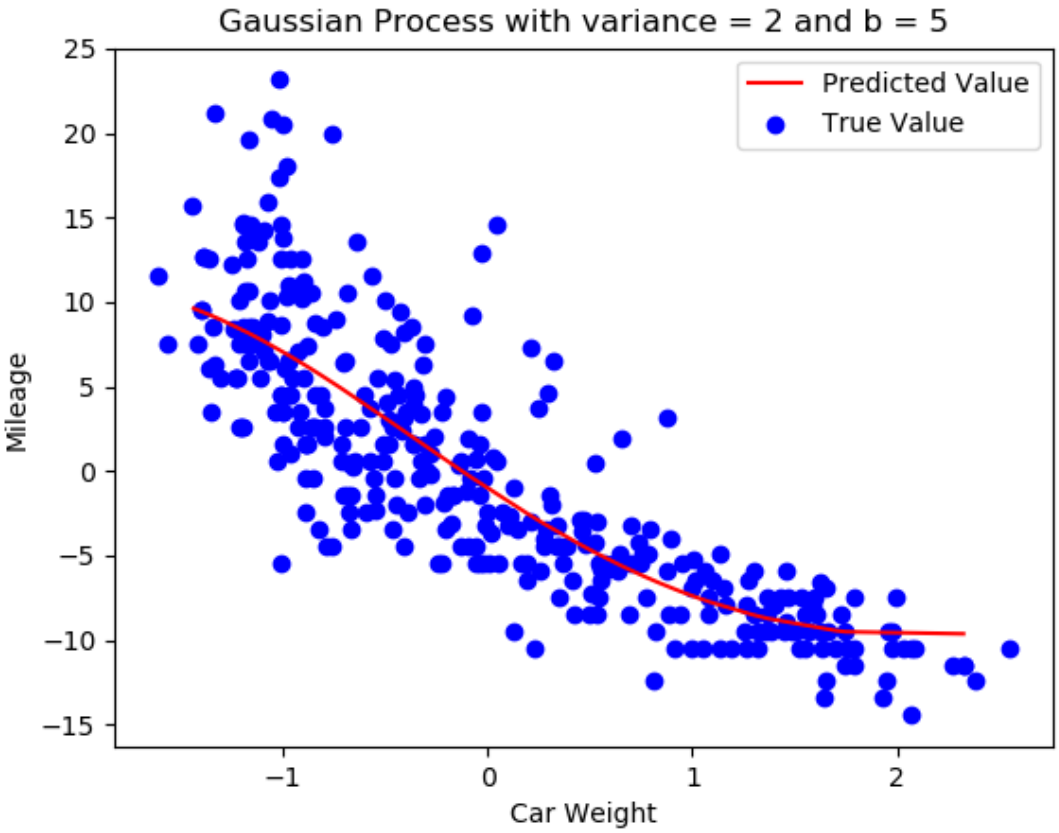
Problem 1

1 b.)

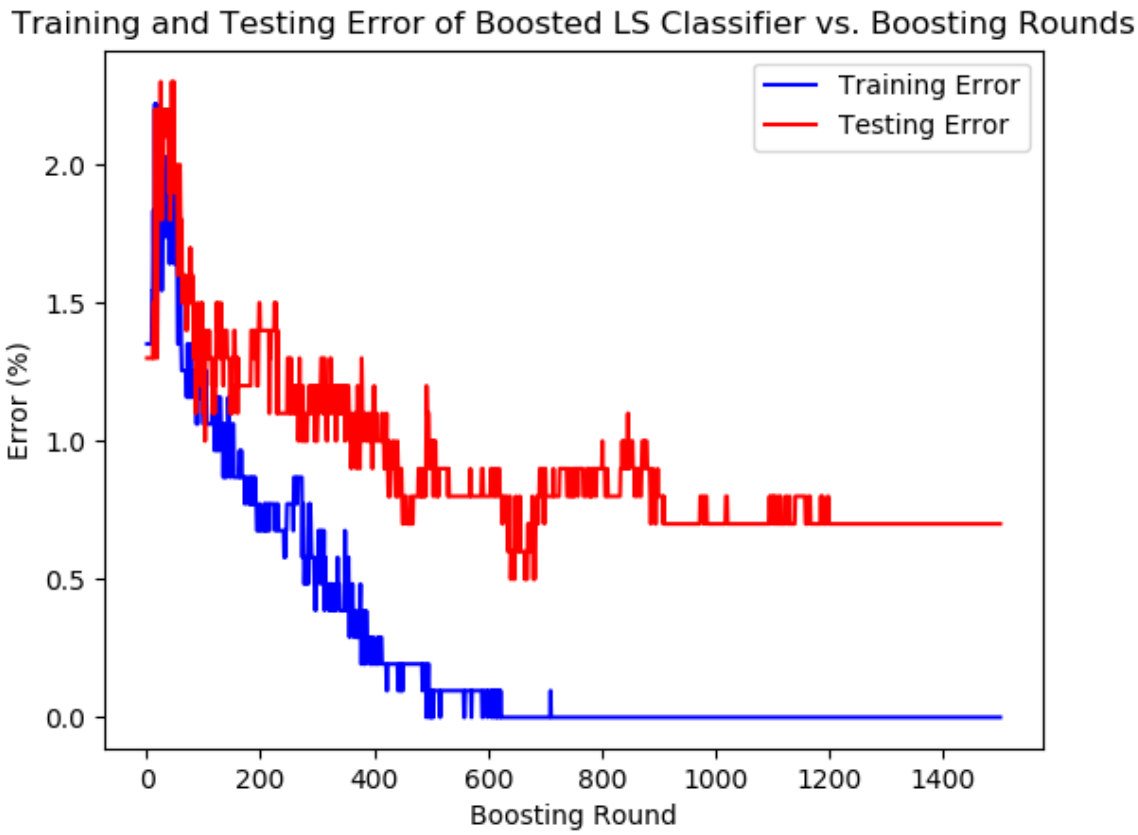
RMSE											
		σ^2									
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
b	5	1.966	1.933	1.923	1.922	1.925	1.929	1.935	1.941	1.947	1.953
	7	1.92	1.905	1.908	1.916	1.925	1.934	1.942	1.95	1.958	1.965
	9	1.898	1.903	1.918	1.933	1.946	1.957	1.967	1.976	1.985	1.992
	11	1.891	1.915	1.939	1.958	1.973	1.986	1.996	2.006	2.014	2.021
	13	1.896	1.936	1.965	1.986	2.001	2.014	2.024	2.033	2.041	2.049
	15	1.91	1.96	1.991	2.012	2.027	2.039	2.049	2.058	2.066	2.073

1 c.) The values that produced the lowest RMSE of 1.891 were b = 11 and $\sigma^2 = 0.1$. This is a lower RMSE than was achieved earlier with polynomial regression with regularization in homework 1. A drawback of this approach compared with the linear regression approach of homework 1 might be that it's difficult to interpret relationships between the individual indicators and the output in the Gaussian process model like you can with linear regression.

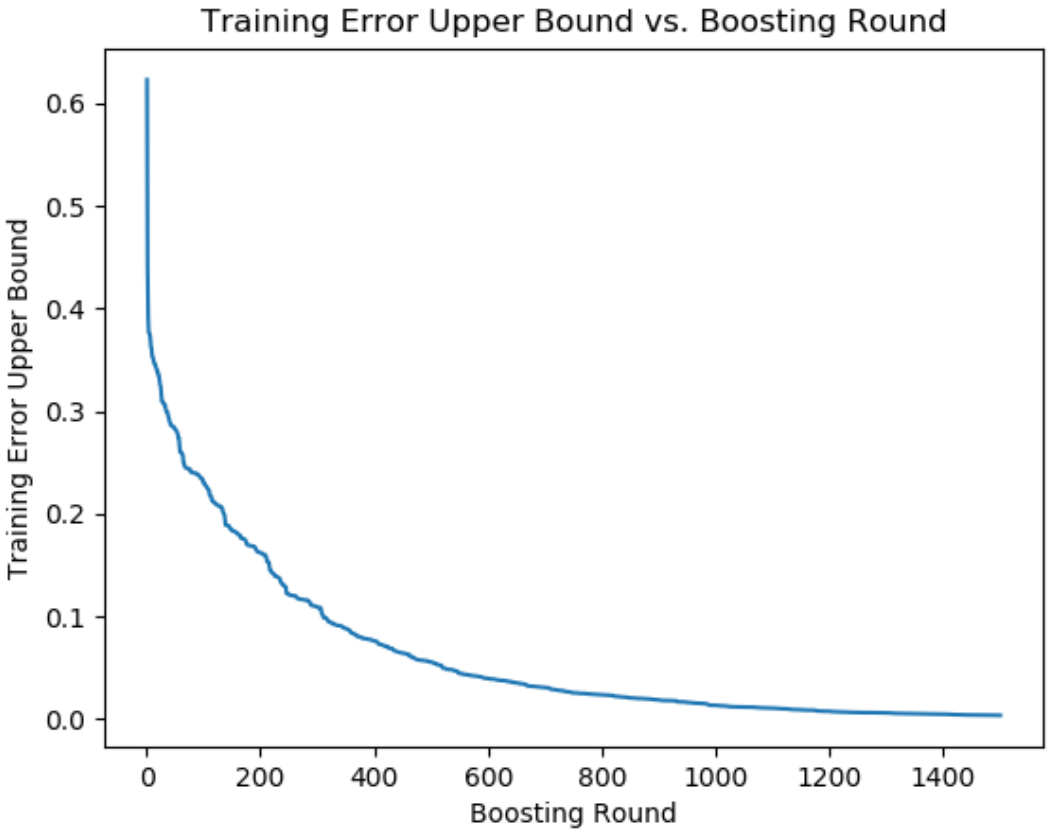
1 d.)


Gaussian Process with variance = 2 and b = 5
Predicted Value
True Value
Mileage
Car Weight
25
20
15
10
5
0
−5
−10
−15
−1
0
1
2

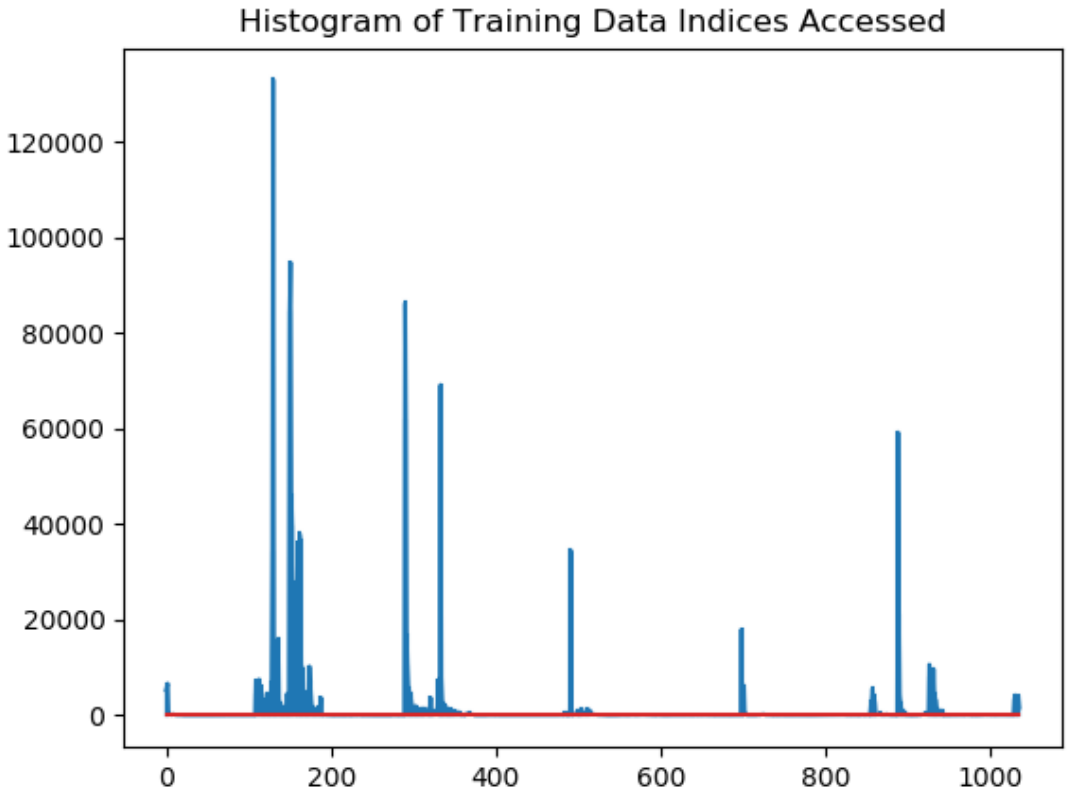
2 a.)


Training and Testing Error of Boosted LS Classifier vs. Boosting Rounds
Training Error
Testing Error
Error (%)
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
1400
Boosting Round

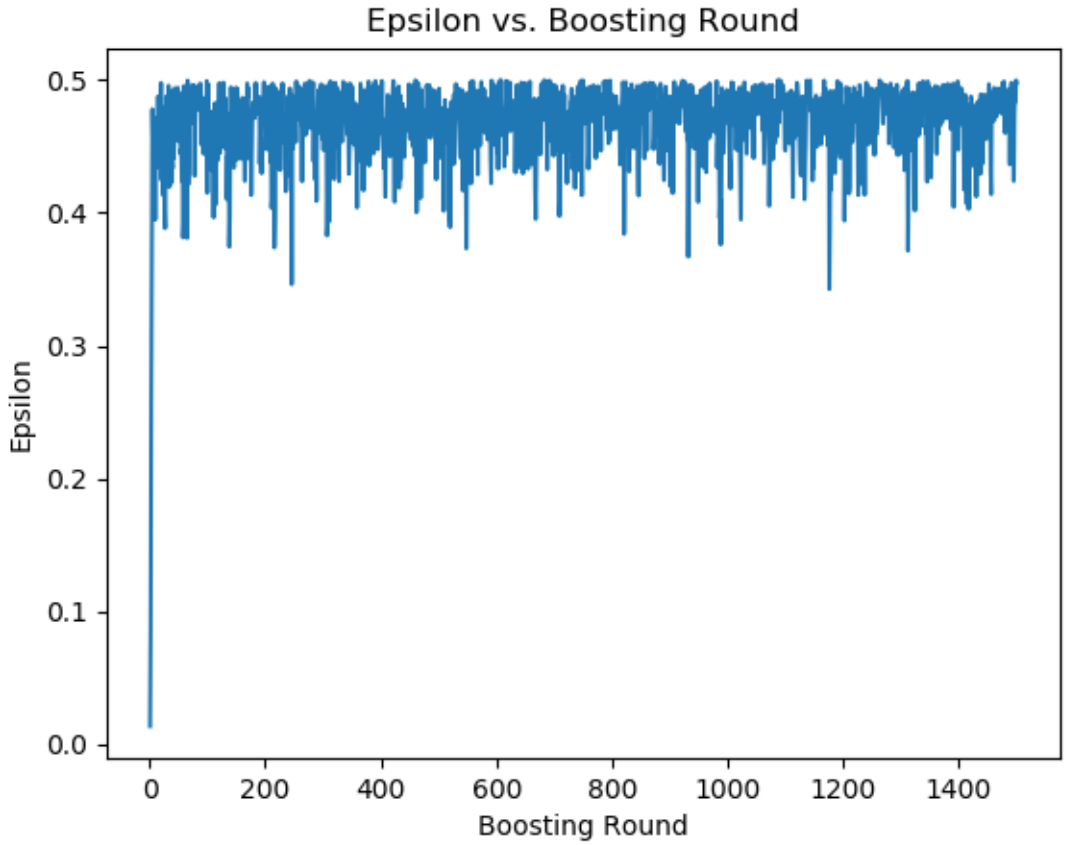
2 b.)

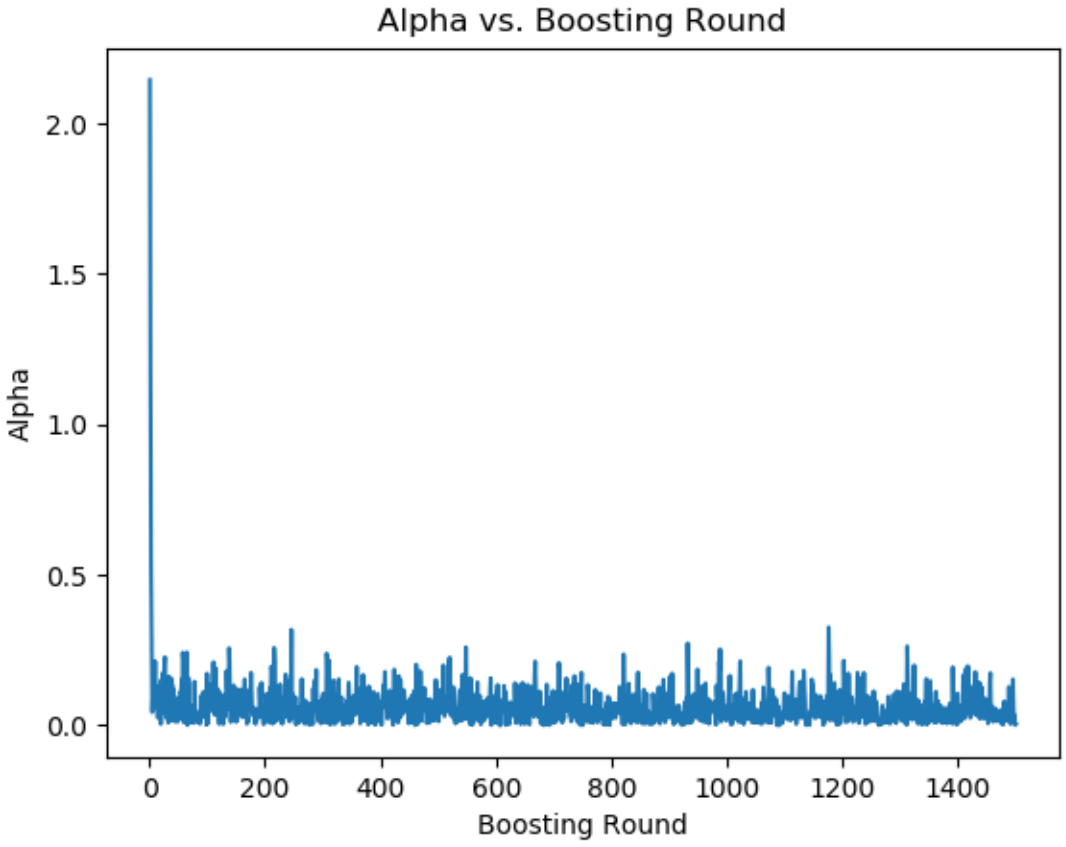

Training Error Upper Bound vs. Boosting Round
Training Error Upper Bound
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
200
400
600
800
1000
1200
1400
Boosting Round

2 c.)


Histogram of Training Data Indices Accessed
120000
100000
80000
60000
40000
20000
0
0
200
400
600
800
1000

2 d.)


Epsilon vs. Boosting Round
Epsilon
0.0
0.1
0.2
0.3
0.4
0.5
0
200
400
600
800
1000
1200
1400
Boosting Round


Alpha vs. Boosting Round
Alpha
0.0
0.5
1.0
1.5
2.0
0
200
400
600
800
1000
1200
1400
Boosting Round