Ex4 part (j)

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Part (j)

Now add some noise to the response. That is, replace **Salary** by **Salary** $+ \epsilon$ where $\epsilon \sim N(0, \sigma^2)$ for some chosen value of σ. Again, try a standard linear model, ridge, lasso and elastic net where each model is optimally tuned. Repeat this for several increasing values of σ^2. On one plot, plot the error of each model against the amount of additional noise. Does one model or a certain subset of models tend to perform better or worse for large or small values of σ? Is there some intuition for this? Discuss.

For part (j) I decided to not scale 'Salary'. I just scaled the features and then I added the noise to 'Salary'. Noise was added as $\epsilon \sim N(0, \sigma^2)$ to 'Salary' for several values of σ. I made two plots of σ vs MSE, one for small values of σ and the other one for big values.

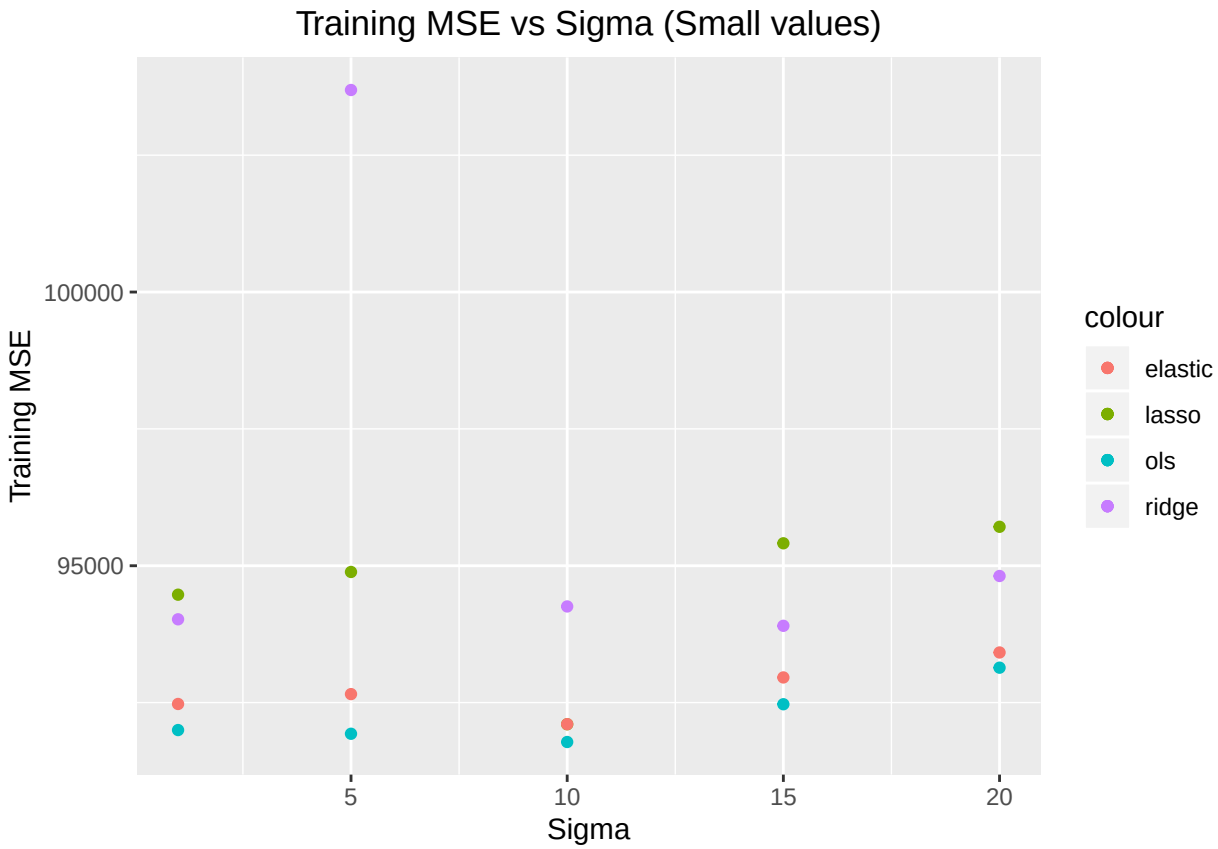
Interestingly, the results were similar to what I got in part (g). OLS and elastic net performed better than ridge regression and lasso for both small and large values of σ. Moreover, for large values of σ all regularization methods start performing way worse than OLS, even elastic net.

After our discussions now I get this happened because I used *training error* to compare the models. Using *test error* OLS should perform better for smaller values of σ and the regularization methods should perfom better than OLS for large values of σ.

Notes:

- Here I'm using quite a bit of code here, but I'm esentially using the same functions as in parts (b)-(i). I'm omitting the code here but you can find it on the Rmd file 'part_j.Rmd' I'm attaching.
- For this part I ran all the models using all the original features, i.e., the models were the same as parts (b) and (d)-(f) with additional noise.
- I continued using seeds for reproducibility.

This is the plot for small values of σ, selected values were 1, 5, 10, 15, 20.



This is the plot for large values of σ, selected values were 25, 30, 35, 40, 45.


Training MSE vs Sigma (Large values)
105000
100000
95000
Training MSE
25
30
35
40
45
Sigma
colour
elastic
lasso
ols
ridge