4.1: Penalized Regression

Dr. Bean - Stat 5100

1 Why Penalized Regression?

What are some undesirable consequences of having estimates of β_k's with inflated variance?

- Interpretation: the sign/magnitude of the estimated coefficients could be misleading or non-intuitive
- Stability: Coefficients could change drastically for small changes in the training data, which makes it hard to persuade others that the model form is correct.
- Variable selection: When the number of candidate explanatory variables is large, inflated variance may cause us to throw the "best" predictor variables out in a stepwise search.

Why is it critical that we standardize our variables prior to using any of the penalized regression techniques?

The penalty terms do not respect differences in the **scale** of variables. Variables with a small range of values will be unfairly punished if we do not standardize.

Which of the following is NOT a good scenario to used penalized regression techniques? Why?

1. **Facebook is trying to create a model to predict the likelihood of a user responding positively to a certain type of ad.**
2. **The Huntsman Cancer institute is trying to determine which active genes in a person's DNA increase the likelihood of Pancreatic cancer.**
3. **The USU Agriculture Experiment Station is trying to determine if a change in the composition of feed significantly influences the milk output of dairy cows.**

3 is the correct answer because:

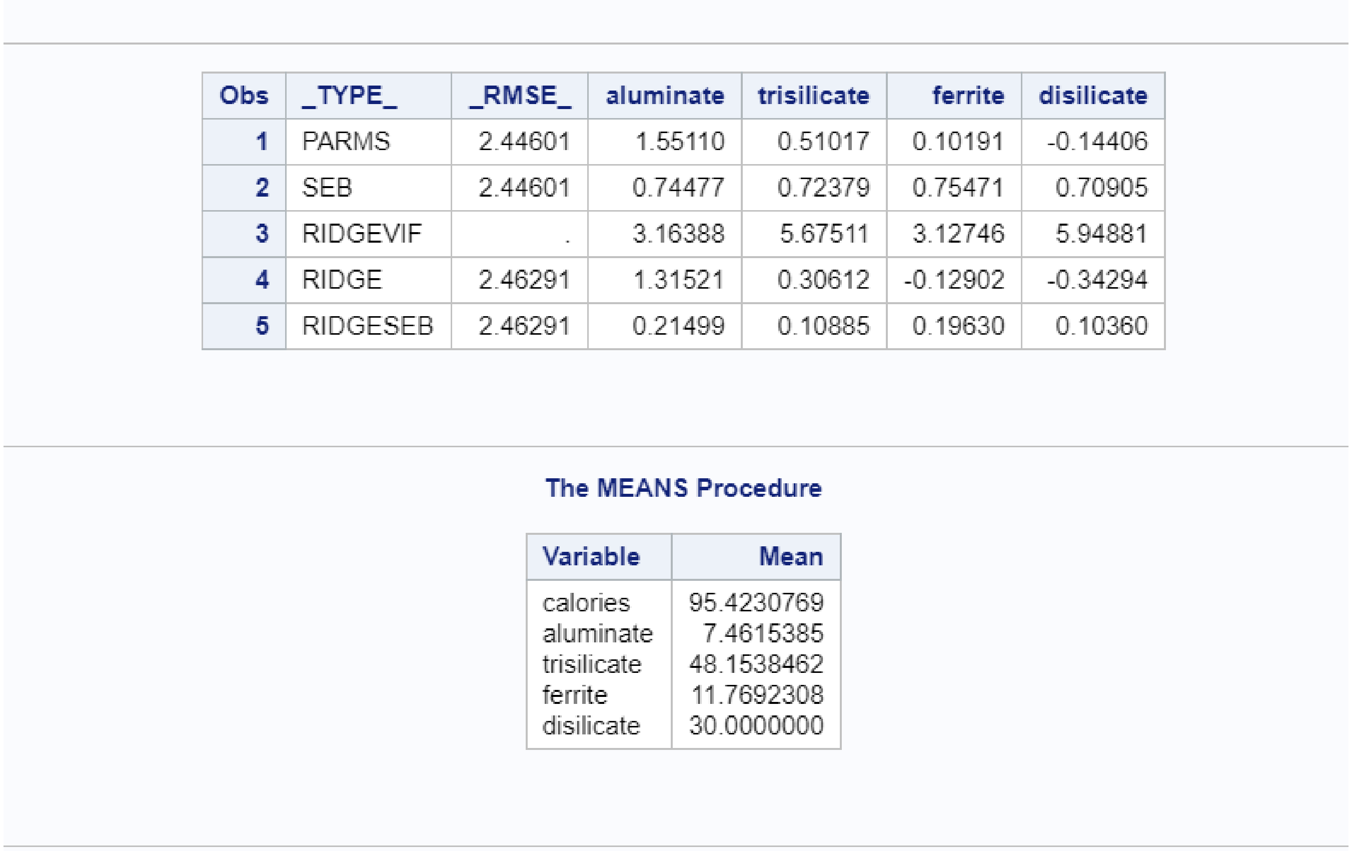
- This scenario is an experiment rather than an observational study.
- We are interested in the significance of an effect, rather than accurate predictions.

Which method does NOT get estimated coefficients exactly equal to zero as the penalty parameter increases? Why?

- **Ridge Regression**
- **LASSO**
- **Elastic Net**

Ridge Regression: The use of the squared penalty term makes it nearly impossible for coefficients to converge to be exactly equal to zero as the penalty parameter increases.

Given the following output, determine the value of the intercept for the following ridge regression model.



Obs	_TYPE_	_RMSE_	aluminate	trisilicate	ferrite	disilicate
1	PARMS	2.44601	1.55110	0.51017	0.10191	-0.14406
2	SEB	2.44601	0.74477	0.72379	0.75471	0.70905
3	RIDGEVIF	.	3.16388	5.67511	3.12746	5.94881
4	RIDGE	2.46291	1.31521	0.30612	-0.12902	-0.34294
5	RIDGESEB	2.46291	0.21499	0.10885	0.19630	0.10360

The MEANS Procedure

Variable	Mean
calories	95.4230769
aluminate	7.4615385
trisilicate	48.1538462
ferrite	11.7692308
disilicate	30.0000000

$$95.423 - 1.315 * 7.462 - 0.306 * 48.154 + 0.129 * 11.769 + 0.343 * 30 = 82.684$$