Assignment19

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R Markdown

1. As we increase s from 0, the training RSS wil:

iv. Steadily decrease

The training RSS measures how well our model does on training data. When S = 0, all the coefficients _j are forced to be 0. As a result, our model will not fit the data at all and the RSS will be very large. As s increases, we include more and more larger coefficients, which help the model fit the training data, so the RSS decreases. As s increases more, we willbe including so many coefficients that our model will overfit the data and the RSS will decrease further, as the more we increase s, the more freedom the model has for fitting the training data better.

2. Repeat 1. for test RSS.

i. Decrease initially, and then eventually start increasing in a U shape

The test RSS is how well our model performs with unseen data. In essence, we want to make sure our OLS model generalizes well, so that it can capture unseen data and thus have a low RSS.

When S = 0, our model does not fit the data at all. Thus, our test RSS will start very high, as our model will be too simple to capture the essence of the data. As s increases, the model starts to fit the data better. Eventually at some point, the model's complexity will be perfect enough to generalize the data so well that the RSS will reach the lowest score possible. However, if s becomes too large, then the model will overfit the training data and not generalize well to new unseen data, thus causing the test RSS to increase again.

3. Repeat 1. for variance

iii. Steadily increase

When it comes to regularization, we sacrifice variance in order to achieve better results. So when s is a large number, we infact have very little variance, as the model will overfit the data and fits to the noise in the data. However, as s decreases, the model is allowed less and less freedom, thus making the model less flexible, reducing variance. Therefore for s = 0 -> inf, variance will steadly increase.

4. Repeat 1. for (squared) bias

iv. Steadily decrease.

When it comes to bias, regularization focuses on improving our bias. Thus, when s = 0, our model does not fit our data well, we do not work with any coefficients. As a result, our bias

is high, as the model does not capture the pattern in the data. As s increases, the model's complexity increases, thus slowly becoming more flexible and capture the generalization of the data, reducing bias. Eventually as s gets larger and larger, we overfit the data and the bias decreases even more,

Repeat 1. for the irreducible error

Irreducible error, as the name suggests, stays constant, as it is the error due the inherent noise in the data. This error exists regardless of how well the model is trained, how complex it is. As a result, whether s decreases or increases will have an impact only on the model itself, not the irreducible error.