

Advanced Statistical Methods

Homework 5

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Overview

- 1 Q1A: Issues/mistakes with cross-validation
- 2 Q1B: Issues/mistakes with bootstrap?
- 3 Q2: Hastie and Tibshirani Summary

Issues/mistakes with cross-validation

- K-fold cross validation biases toward increased prediction error.



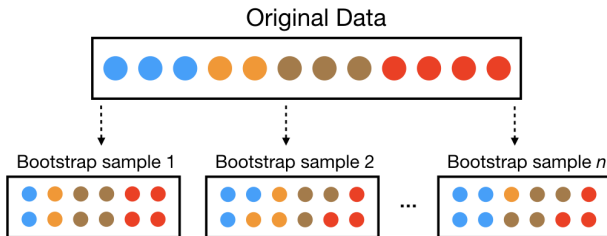
Issues/mistakes with cross-validation

- K-fold cross validation biases toward increased prediction error.
- Filtering data before placing into validation groups can cause problems with fitting; over-fitting to 0% training error.



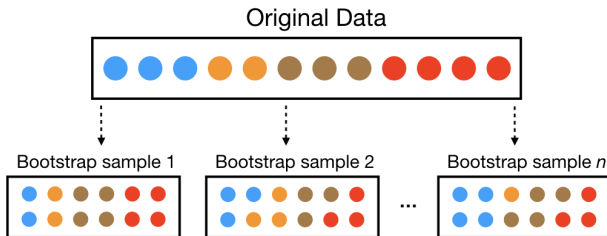
Issues/mistakes with bootstrap

- Datasets possess significant overlap.



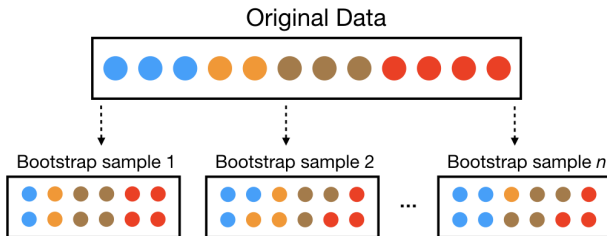
Issues/mistakes with bootstrap

- Datasets possess significant overlap.
- Severely underestimates the prediction error.



Issues/mistakes with bootstrap

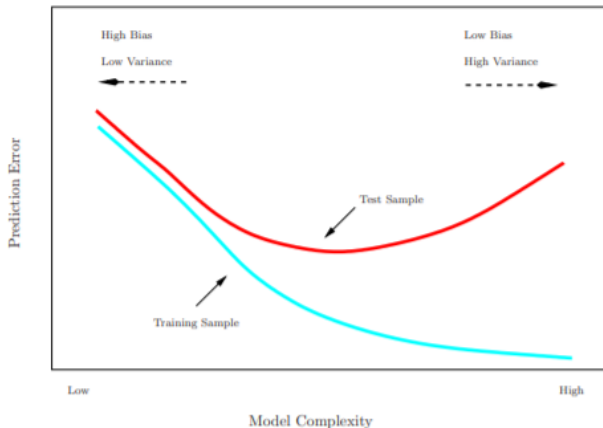
- Datasets possess significant overlap.
- Severely underestimates the prediction error.
- May be improved if validated with samples that did not end up in any of the bootstrap samples.



Hastie and Tibshirani Lecture: Resampling Methods

Testing the accuracy of our model.

The goal is to minimize testing error:



Hastie and Tibshirani Lecture: Resampling Methods

Possible approaches:

Validation Set Random splitting of data to provide a set for testing error.

K-fold Cross Validation Splitting data into K parts, using one as the validation set, and the other $K - 1$ as training sets. Afterward select the model that provided the lowest test error.

Bootstrap Multiple data sets produced from the original by sampling from the original with some data replaced with random selections from the original data-set.

Hastie and Tibshirani Lecture: Permutation v. Bootstrapping

Bootstrap

- Sample from estimated population

Permutation

- Sample from estimated *null* distribution

Hastie and Tibshirani Lecture: Permutation v. Bootstrapping

Bootstrap

- Sample from estimated population
- Great for estimating population stats

Permutation

- Sample from estimated *null* distribution
- Is simpler and generally performs just as well as bootstrap

Hastie and Tibshirani Lecture: Permutation v. Bootstrapping

Bootstrap

- Sample from estimated population
- Great for estimating population stats
- Great for testing certain null hypotheses

Permutation

- Sample from estimated *null* distribution
- Is simpler and generally performs just as well as bootstrap
- More practical with modern computing