

CHAPTER OVERVIEW

19: Distribution-free methods

Introduction

We introduced the concept of permutation tests in our chapter on parameter estimates and statistical error ([Chapter 3.3](#)). **Jackknife** and **bootstrapping** are permutation approaches to working with data when the **Central Limit theorem** is unlikely to apply or, rather, we don't wish to make that assumption. The jackknife is a sampling method involving repeatedly sampling from the original data set, but each time leaving one value out. The **estimator**, for example, the sample mean, is calculated for each sample. The repeated estimates from the jackknife approach yield many estimates which, collected, are used to calculate the sample variance. Jackknife estimators tend to be less biased than those from classical asymptotic statistics. Bootstrapping, and not jackknife resampling, is now the preferred permutation approach (add citations).

Bootstrapping

Bootstrapping involves large numbers of **permutations** of the data, which, in short, means we repeatedly take many samples of our data and recalculate our statistics on these sets of sampled data. We obtain statistical significance by comparing our result from the original data against how often results from our permutations on the resampled data sets exceed the originally observed results. By permutation methods, the goal is to avoid the assumptions made by large-sample statistical inference. Since its introduction, "bootstrapping" has been shown to be superior in many cases for statistics of error compared to the standard, classical approach (add citations).

Permutation vs classical NHST approach

There are many advocates for this approach, and, because we have computers now instead of the hand calculators our statistics ancestors used, permutation methods may be the approach you will take in your own work. However, the classical approach has its strengths; when the conditions, that is, when the assumptions of asymptotic statistics are met by the data, then the classical approaches tend to be less conservative than the permutation methods. By conservative, statisticians mean that a test performs at the level we expect it to. Thus, if the assumptions of classical statistics are met they return the correct answer more often than do the permutation tests.

[19.1: Jackknife sampling](#)

[19.2: Bootstrap sampling](#)

[19.3: Monte Carlo methods](#)

[19.4: References and suggested reading](#)

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