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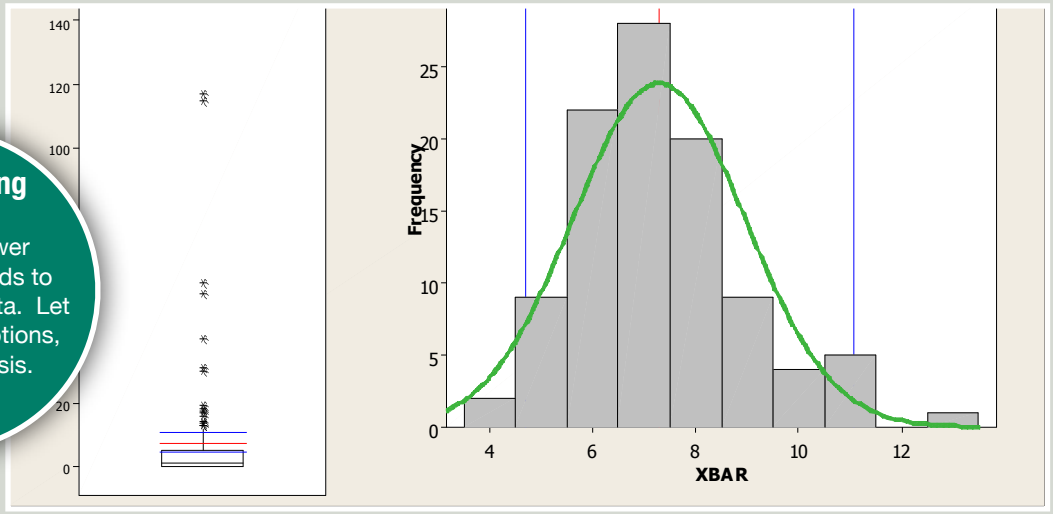

Bootstrapping

One of the newer statistical methods to analyze messy data. Let data, not assumptions, drive the analysis.

Applied Environmental Statistics

Statistics, down to earth

This 4.5 day course develops hands-on expertise for all environmental scientists who interpret data and present their findings to others. A complete understanding of how statistical methods work unfolds through applications to field-oriented problems in water quality, air quality, and bio contaminants. Statistical methods are explained in the light of data with nondetects, outliers, and skewed distributions. Methods for estimation and prediction are illustrated along with their common pitfalls. Emphases include nonparametric methods, including permutation tests and bootstrapping.

Course Content:

- Trend analysis -- is it getting better or worse?
- Confidence, prediction, tolerance & equivalence intervals.
- How hypothesis tests work.
- Parametric, nonparametric and permutation tests. When to use which.
- How to build a good regression equation.
- Dealing with outliers.
- When are transformations OK?
- How many samples do I need?
- and more.

Interactive and relevant

Student exercises follow each lecture to ensure that when you return to the office, so does your new knowledge

www.practicalstats.com/training/aes/

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Applied Environmental Statistics

Course Outline

DAY 1

Describing Data in a Group
When to use a median vs a mean
Dealing with skewed, non-normal data
Dealing with outliers
When to transform the scale
Seven urban legends in env. statistics

How Hypothesis Tests Work
Their common denominators
Their jargon explained
1-sided and 2-sided tests
Parametric, nonparametric and permutation tests

Statistical intervals
Confidence, prediction, tolerance intervals
Coping with skewed data
Intervals for small data sets
Bootstrap intervals — better than t-intervals

DAY 2

Comparing Two Groups of Data
Are means, medians different?
Parametric, nonparametric and permutation tests
Have standards been met?
Testing paired data
Permutation tests - test the mean of non-normal data

How many observations do I need? *[if there's time]*
Weaknesses of standard formulae
Interactions between variation, power, and dollars
Software available

Comparing Three or More Groups
One- and two-factor ANOVA
Nonparametric Kruskal-Wallis test
Multiple comparison tests: who's different?
Permutation tests - testing means for non-normal data

Testing differences in Variability/Precision
Characterizing differences in variability
Levene's & Fligner-Killeen tests
Why NOT to use Bartlett's test

DAY 3

Correlation
Linear and monotonic correlation
r, rho and tau
Permutation test for Pearson's r
The Theil-Sen line: a linear median

Linear Regression
Building a good regression model
Measures of quality better than r-squared
Hypothesis tests, confidence and prediction intervals
Consequences of transforming the Y variable
Bootstrapping tests for significance

Multiple Regression
How to build a good multiple regression model
Why plots of Y vs X don't work, and what to do instead
Dealing with multi-collinearity
Model selection methods better than stepwise
Bootstrapping tests for significance, not transforming

Which test to use?
Get the answer from the guide on our website.

www.practicalstats.com/training/aes/

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Applied Environmental Statistics

Course Outline

DAY 4

Analysis of Covariance
- Do two lines differ?
- Modeling seasonal changes
- Testing differences in slope and intercept

Trend Analysis
- Selecting a trend test
- Regression vs. Mann-Kendall approaches
- Monotonic and step trends
- Dealing with seasonality: the Seasonal Kendall test
- Detecting consistent regional trends
- R routines for trend testgin

Final Exam

Download the free course textbook Statistical Methods in Water Resources. Published by the US Geological Survey in 2002, it can be downloaded from the course page at: http://practicalstats.com/training/aes/

DAY 5

Handling Nondetect Data Correctly
- Why not substitute 1/2 the detection limit?
- Simple methods without substitution
- Introduction to survival analysis methods

Contingency Tables
- Does the frequency change between groups?
- Application to nondetect and other categories
- Bootstrapping contingency tables

Logistic Regression
- Regression for categorical responses
- Effect of X variables on the odds
- Modeling nondetects, qualitative methods, more
- Multicollinearity and hypothesis tests