

Topics Overview

MIT 18.443
Statistics for Applications

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Classic Derived Distributions (from Gaussian)

- Chi-square distribution
- Student's t distribution
- Fisher F distribution
- Distributions of sample statistics

Note: Distribution theory pervasive in motivating/interpreting statistical methods

Probability Distributions

- Poisson
- Exponential/Gamma
- Gaussian/Normal
- Binomial/Multinomial

Parameter Estimation Methods

- Method of Moments (MOM)
- Method of Maximum Likelihood (MLE)
- Bayesian approach

Estimation Theory

- Large-sample (asymptotic) distributions of estimates
- Point estimates vs interval estimates
 - Confidence intervals
 - Bayesian credible intervals
- Bootstrap methodology

Hypothesis Testing

- The Neyman-Pearson Paradigm
- Duality of hypothesis tests and confidence intervals
- Generalized likelihood ratio tests

Assessing Goodness of Fit

- Likelihood ratio tests for multinomial distributions
- Probability plots

Summarizing Data

- Methods based on cumulative distribution function (empirical cdf; quantile-quantile plots)
- Histograms, density curves, Stem-and-Leaf Plots
- Measures of location (mean, median, M-estimates, trimmed mean)
- Measures of dispersion
- Box plots
- Scatterplots of bivariate data

Linear Least Squares

- Simple linear regression
- Matrix approach to linear least squares
- Distribution theory of least-squares estimates
- Multiple linear regression

Analysis of Categorical Data

- Fisher's Exact Test
- Chi-Square test of Homogeneity
- Chi-Square Test of Independence
- Odds ratios

Comparing Two Samples

- Comparing two independent samples
- Comparing paired samples
- Principles of Experimental Design
(placebos, randomization)

Text Book: Mathematical Statistics and Data Analysis, Third Edition, John A. Rice

Statistics Package: R and RStudio Desktop.

See:

<http://www.rstudio.com/products/rstudio/download/>
<http://cran.rstudio.com/>

MIT OpenCourseWare
<http://ocw.mit.edu>

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