Syllabus

Help

Course Description

This class presents fundamental concepts in data analysis and statistical inference, focusing on one and two independent samples. Students having taken this class should be able to summarize samples, perform relevant hypothesis tests and perform a collection of two sample comparisons. Classical non-parametric methods and discrete data analysis methods are discussed. The class is taught at a master's of biostatistics introductory level and requires Mathematical Biostatistics Boot Camp 1 as a prerequisite.

Learning Objectives

The goal of this course is to equip biostatistics and quantitative scientists with core applied statistical concepts and methods:

- The course will refresh the mathematical, computational, statistical and probability background that students will need to take the course.
- The course will introduce students to the display and communication of statistical data. This will include graphical and exploratory data analysis using tools like scatterplots, boxplots and the display of multivariate data. In this objective, students will be required to write extensively.
- Students will learn the distinctions between the fundamental paradigms underlying statistical methodology.
- Students will learn the basics of maximum likelihood.
- Students will learn the basics of frequentist methods: hypothesis testing, confidence intervals.
- Students will learn basic Bayesian techniques, interpretation and prior specification.
- Students will learn the creation and interpretation of P values.
- Students will learn estimation, testing and interpretation for single group summaries such as means, medians, variances, correlations and rates.
- Students will learn estimation, testing and interpretation for two group comparisons such as odds ratios, relative risks and risk differences.
- Students will learn the basic concepts of ANOVA.

Schedule

Each module begins at 12:01 AM Eastern Time on a Monday and ends at 11:59 PM Eastern Time on a Sunday. Each quiz and homework is due BEFORE 11:59 PM Eastern Time on its designated due date. Modules 1-3 are 2 weeks long, and Module 4 is 1 week long.

Module 1 (Two Weeks Long)

A. View Video Lectures

- Hypothesis Testing
- Power
- Two Sample Tests

B. Complete Optional Homework 1 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 2
C. Take Quiz 1 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 2

Module 2 (Two Weeks Long)

A. View Video Lectures

- Two sample binomial tests
- Relative Risks & Odds Ratios
- Delta method

B. Complete Optional Homework 2 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 4

C. Take Quiz 2 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 4

Module 3 (Two Weeks Long)

A. View Video Lectures

- Fisher's exact tests
- Chi-squared tests

B. Complete Optional Homework 3 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 6

C. Take Quiz 3 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 6

Module 4 (One Week Long)

A. View Video Lectures

- Simpson's paradox, confounding
- Retrospective case-control studies, exact inference for the odds ratio
- Methods for matched pairs, McNemar's, conditional versus marginal odds ratios
- The sign test and rank sum test

B. Complete Optional Homework 4 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 7

D. Take Quiz 4 - Due BEFORE 11:59 PM Eastern Time on Sunday at the end of Week 7

Grading Policy

Grades will be based on student performance on the four module Quizzes.

Module Quizzes: Each weekly quiz question is worth one point if answered correctly. Students will be allowed to attempt each quiz three times, and the most successful attempt will be taken as the student's effective score.

Homework: Homework assignments are optional. Although they are graded, your homework grades will have no impact your final course grade. You are encouraged to complete the homework assignments because they will help you master the material covered within this course.

Students who earn 70% or more of the total quiz points will receive a Statement of Accomplishment.

Students who earn more than 90% of the total quiz points will receive a Statement of Accomplishment with Distinction.

Discussion Forums

All students are encouraged to participate in the Discussion Forums by asking and answering questions and providing feedback.

The instructor will also participate in the Forums by answering the questions that receive a large number of up-votes or are generating a considerable amount of discussion. The instructor is not able to personally respond to every questions, so students are strongly encouraged to help one another by answering questions and by up-voting the questions that they would like to see Dr. Caffo answer.

All students are expected to be civil when participating in the Discussion Forums.

- Be friendly and considerate when talking to your fellow students.
- Use up-votes to bring attention to thoughtful, helpful posts.
- Search before you post.
- Post in the appropriate sub-forum.
- Use the flag icon to report inappropriate content or highlight posts related to platform issues.

Online Office Hours

There will be four opportunities to interact in live office hours with Dr. Caffo and your classmates. These sessions will be held by using Google Hangouts on the Air. Details about the online office hours schedule are available on the Office Hours page.

During these sessions, you will be able to submit questions directly to Dr. Caffo and +1 your classmates' questions. Dr. Caffo will do his best to answer as many of the top-ranked questions as possible.

You do not need a Google+ or Gmail account to participate. We will send out an announcement with the appropriate link as the date of the event approaches. If you miss the live event, you will be able to view a recording afterwards.

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