Office Hours: Room PGH 214, TuTh 12:00PM - 12:50PM, or by appointment.

Main References: Two books that will serve as cornerstones for the course are


Dalgaard presents a very nice introduction to \textit{R statistical programming} and guides you through various examples for some of the ubiquitous (and not so ubiquitous) statistical modeling tasks, all while using \textit{R} as the main tool. Meanwhile, Rizzo emphasizes using \textit{R} for the statistical computing techniques in particular, such as bootstrapping, Monte Carlo simulations, probability density estimation, etc.

Objectives: Course will consist of two parts: 1) getting acquainted with \textit{R statistical programming} (introducing syntax, writing functions, making graphs, conducting basic statistical analysis), 2) outlining the most renown statistical computing methods and implementing them via \textit{R}. The first part serves an introductory purpose and may prove useful for any student having to deal with data in his or her research (be it medicine, marketing, agricultural/biological engineering, etc), as it touches upon such popular topics in statistical analysis as t-tests, group comparisons, linear and logistic regression, among others. Second part is tilted slightly more towards the graduate students from technical fields (e.g. statistics, computer science, engineering, mathematics) who want to familiarize themselves with some statistical computing techniques that may aid them in research. In particular, methods are introduced for numerical integration and hypothesis testing (e.g. Monte Carlo approach), random variable generation, probability density estimation (e.g kernel methods), constructing confidence intervals (bootstrap, jackknife). All-in-all, at the end of the course, a successful student should be able to:

- use \textit{R statistical programming} as a tool for conducting research and data analysis
- comprehend and implement the main statistical computing techniques for their research goals
- writing their own \textit{R} functions and potentially developing new computational methods in the future

Prerequisites (more like encouragements): Being familiar with at least one programming language. An undergraduate-level understanding of probability, statistics, calculus and linear algebra is assumed.

Software: Make sure to download \textit{R} and \textit{RStudio} (which can’t be installed without \textit{R}) before the course starts. Use the link https://www.rstudio.com/products/rstudio/download/ to download it from the mirror appropriate for your platform. Let me know via email in case you encounter difficulties.
Tentative Course Outline:

- R syntax (expressions, objects, functions, vectors, etc)
- R coding basics (R environment, flow control)
- Importing/exporting data, working with data frames in R
- Probability and distribution functions in R
- Graphics in R (histograms, boxplots, tables and others)
- Descriptive statistics and hypothesis testing in R (e.g. one-/two-sample and paired t-tests)
- Linear regression and ANOVA in R
- Linear models and regression diagnostics in R
- Logistic regression in R
- Time series analysis in R
- Methods for generating random variables
- Monte Carlo numerical integration
- Monte Carlo methods in statistical inference
- Bootstrap and Jackknife estimation methods
- Probability density estimation

Grading Policy: Attendance and participation (10%), Homework (30%), Project (30%), Final (30%).

Course Policy:

- Use of laptops during the class, especially the first part of the course, is encouraged solely for the purpose of practicing your R programming skills. Refrain from using your laptop for anything else.

- There will be bi-weekly homework. Late homework will warrant a $d \times 25\%$ penalty (subtracting $d \times 25\%$ of full possible points from your actual score), where $d$ - number of days past due.

- Homework solutions must be typeset in a form of a report (using LATEX or Word).

- Most outstanding work may be considered for demonstration to the rest of the class as an exemplary standard, upon student’s permission (with implied bonus mark for the student).

- All homework solutions must be submitted in class (along with the quiz).

- You may discuss homework problems with other students, but you must write up your homework independently in your own words.

- Your lowest homework-quiz score will be dropped when calculating your final homework-quiz grade.

- The exams may or may not be take-home. If not, by default, all exams (midterms and final) are closed book, and you are not allowed to use any electronic devices such as mobiles and tablets.

Class Policy:

- Regular attendance is essential and expected. A student who incurs an excessive number of absences may be withdrawn from the class at the instructor’s discretion.

- Be courteous when using mobile devices. Make sure your cell phone is turned fully off, or silent.

Academic Honesty: Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

I certainly impose a sanction on the student committed to any academic fraud. It varies depending
upon the instructor’s evaluation of the nature and gravity of the offense. Possible sanctions include but are not limited to, the following: (1) Require the student to redo the assignment; (2) Require the student to complete another assignment; (3) Assign a grade of zero to the assignment; (4) Assign a final grade of zero for the whole course.

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