STAT 207
Intermediate Bayesian Statistical Modeling
Spring 2022

Instructor: Zehang "Richard" Li
Office Hours: Wednesday via Zoom, time TBD
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Course Meeting Times: 1:30 - 3:05 Tuesday/Thursday
Location: Merrill Acad 003
Website: Through `Canvas`

Course Description: This is an intermediate level statistics course covering the theory and the methods used to build statistical models from a Bayesian perspective. It will be assumed that the student is familiar with the basic ideas of Bayesian methods, including computations using Monte Carlo. It will also be assumed that the student is familiar with a programming language (C, R, Python, or similar) at a level that allows the writing of relatively complex code to fit models with multiple parameters. Good familiarity with R is strongly recommended. Some of the topics that will be covered are: Hierarchical modeling, linear models (regression and analysis of variance), multivariate models, mixture models, predictive inference, model comparison.

Textbook:

Our main textbook is

- *Bayesian Data Analysis, Third Edition* by A. Gelman, J. B. Carlin, H. S. Stern, D.B. Dunson, A. Vehtari and D. B. Rubin. *PDF available at* `http://www.stat.columbia.edu/~gelman/book/`

Other References

- *Bayesian and Frequentist Regression Methods*, by Jon Wakefield

- *Bayesian Ideas and Data Analysis*, by Ronald Christensen, Wesley Johnson, Adam Branscum, and Timothy Hanson

- *Monte Carlo Statistical Methods, Second Edition*, by Christian Robert and George Casella

Assessment and Grading:

- *Homework (20%):* There will be 4 homework sets. Some of the questions will be graded.

- *Take-home quizzes (15%):* There will be two take-home problem sets (around Week 4 and Week 8) that involve the analysis of a case study and/or the application of some methods taken from a published article. You will turn in your answer as a short written report.

- *Midterm (30%):* In person 90 minutes midterm in Week 6.

- *Final (35%):* In person 90 minutes final in Week 10.

List of Topics:

- Bayesian inference foundations

  - Single-parameter models (Ch 2)
  - Multiparameter models (Ch 3)
  - Hierarchical models (Ch 5)

- Bayesian computation

  - MCMC (Ch 10 and 11)
  - Advanced Markov chain methods (Ch 12)
  - Deterministic algorithms (Ch 13)

- Bayesian data analysis

  - Model checking (Ch 6)
  - Model comparison (Ch 7)
  - Accounting for data collection models (Ch 8)

- Modeling

  - Mixture models (Ch 22)
  - Regression (Ch 14)
  - Robust inference (Ch 17)
  - Gaussian Markov Random Field

Support for students with disabilities: UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by appointment, preferably within the first two weeks of the quarter. At this time, I would also like us to discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

Support for students with other difficulties While we sincerely hope that you will be able to pursue your studies peacefully and worry-free, we are aware that in some cases difficulties happen that are beyond your control. You should always feel free and comfortable to bring up any problem with the instructor, but if this is not sufficient, or if you prefer professional help, here are several campus resources that you may want to consider contacting:

- UC Care which is a confidential space to discuss issues of dating violence, sexual assault and stalking.

- Slug Support where you can ask for help on many practical issues, including dealing with a financial crisis, problems with your living situation, computers, books, etc.

- CAPS, which provides counseling and psychological services to students.

Campus advocacy resources & education: Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the Campus Advocacy Resources and Education (CARE) Office by calling (831) 502-2273. In addition, Counseling and Psychological Services (CAPS) can provide confidential, counseling support, (831) 459-2628. You can also report gender discrimination directly to the University's Title IX Office, (831) 459-2462. Reports to law enforcement can be made to UCPD, (831) 459-2231 ext. 1. For emergencies call 911. Faculty and Teaching Assistants are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Office should they become aware that you or any other student has experienced sexual violence or sexual harassment. If you prefer to speak to someone confidentially, please contact UC Care (see above).

Academic Integrity: Academic integrity is the cornerstone of a university education. Academic dishonesty diminishes the university as an institution and all members of the university community. It tarnishes the value of a UCSC degree. All members of the UCSC community have an explicit responsibility to foster an environment of trust, honesty, fairness, respect, and responsibility. All members of the university community are expected to present as their original work only that which is truly their own. Plagiarism of any kind is unacceptable. All members of the community are expected to report observed instances of cheating, plagiarism, and other forms of academic dishonesty in order to ensure that the integrity of scholarship is valued and preserved at UCSC. Any student found in violation of the UCSC Academic Integrity policy may face both academic sanctions imposed by the instructor of record and disciplinary sanctions imposed by the graduate division. Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript. For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the Academic Integrity page at the Division of Undergraduate Education or Graduate Division.