STAT 207 Intermediate Bayesian Statistical Modeling

Lecture 0: Overview

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The Bayesian approach

Why

- Quantify uncertainties
- Use prior information
- Hierarchical models
- Model checking and evaluation
- ...

Potential drawbacks

- Subjectivity and sensitivity of prior choices
- Computation

$$\mathbb{E}_{\theta|y}[g(\theta)] = \int p(\theta|y)g(\theta)d\theta$$

- Implementation

What to take away in this course

- “Intermediate” Bayesian methodology
- Analyzing scientific data
- Designing and Implementing your own model for inference
  - We will talk about some automatic tools briefly too (INLA and STAN)
- Being familiar with the workflow of Bayesian modeling
- Being prepared to work with Bayesian models in research settings
- Both deep understanding of some key Bayesian concepts, and ‘broad’ understanding of topics from more current(-ish) research
- The ultimate goal is to let you be comfortable with designing and implementing Bayesian methods to model scientific problems

Textbook

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

Logistics

Evaluation

- *Homework (20%):* 4 homework sets. A subset of the questions will be graded.
- *Take-home quizzes (15%):* 2 take-home problem sets (Week 4 and Week 8)
  - Case study with real data. A short written report is expected.
- *Midterm (30%):* In person 90 minutes midterm in Week 6.
- *Final (35%):* In person 90 minutes final in Week 10.

Office hour options (via ZOOM)

1. Wed 1:00-2:00
2. Wed 1:30-2:30
3. Wed 2:30-3:30

In-person supplement office hour by appointment.

The plan: see Canvas home page (subject to continuous update!)