STAT 532: Bayesian Data Analysis Fall 2016

Mon, Wed, Fri, 10:00 - 10:50, Wilson 1-144

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Office Hours: Monday & Wednesday 2:15 - 3:15 or by appointment

Course Description: This course will introduce the basic ideas of Bayesian statistics with emphasis on both philosophical foundations and practical implementation. The goal of this course is to provide a theoretical overview of Bayesian statistics and relevant computation tools along with the knowledge and experience to use them in a research setting.

Course Objectives:

At the completion of this course, students will be able to:

1. Describe fundamental differences between Bayesian and classical inference,
2. Select appropriate models and priors, write likelihoods, and derive posterior distributions given a research question and dataset,
3. Make inferences from posterior distributions,
4. Implement Markov Chain Monte Carlo (MCMC) algorithms, and
5. Read, understand, and explain techniques in publications implementing Bayesian methods.

Prerequisite(s): STAT 422 or STAT 502, and STAT 506

Textbook:

1. *A First Course in Bayesian Statistical Methods*, by Peter Hoff

Additional Resources:

1. *Bayesian Data Analysis* (3rd Edition), by Gelman, Carlin, Stern, & Rubin (Optional)
2. R project for Statistical Computing: `http://www.r-project.org/`
3. R Studio: `http://www.rstudio.com/`

Grade Distribution:

Component	Percentage
Quizzes & Homework	40%
Midterm Exam	20%
Final Exam	20%
Presentation	20%

Course Policies:

- **Quizzes & Homework**
  - Short quizzes will be periodically be given in class. While there is no formal attendance policy for class, quizzes will be straightforward for students attending class regularly.
  - Homework assignments will be assigned roughly every two weeks. Students are allowed *and encouraged* to work with classmates on homework assignments, but each student is required to write their own homework.
- **Exams**
  - Exams will have two components: an in-class exam and a take home portion. The in-class portions will be largely conceptual including some short mathematical derivations. The take home portions will focus on analysis of data and implementation of Bayesian computational methods.
  - The final exam take home portion will be due by midnight on the day of the scheduled exam period (December 12).
  - All take home exams are to be completed strictly on an individual basis.
- **Presentation**
  - For the presentation students will lead a class discussion on a paper focused on Bayesian modeling and/or computation.

Tentative Course Outline: The course will cover the following topics:

1. Bayesian Thinking,
2. Statistical Computing and Monte Carlo Integration,
3. 1- Parameter Models,
4. Normal and Multivariate Normal Models,
5. Hierarchical Modeling,
6. Bayesian Regression,
7. Gibbs Sampling, and
8. Possibly Other Topics (Latent Variable Models, Bayesian Model Selection, Bayesian Trees, Sequential Monte Carlo Procedures).