



Statistics 927

Spring 2021

Course Description: Bayesian Modeling and Computation

This graduate course will cover the modeling and computation required to perform advanced data analysis from the Bayesian perspective. We will cover fundamental topics in Bayesian probability modeling and implementation, including recent advances in both optimization and simulation-based estimation strategies. Key topics covered in the course include hierarchical and mixture models, Markov Chain Monte Carlo, hidden Markov and dynamic linear models, tree models, Gaussian processes and nonparametric Bayesian strategies.

Prerequisites: Probability (Statistics 930 or 510 or equivalent). Experience with the statistical software R and mathematical typesetting language LaTeX will also be assumed.

Professor:

Dr. Shane Jensen
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JMHH 463
215-573-2211

Lectures: TTh 10:30-12:00pm (Virtual: links will be posted on Canvas)

Office Hours: Wed 1:30-2:30pm (Virtual: links will be posted on Canvas)

Required Textbook:

Bayesian Data Analysis (3rd Edition) by Gelman, et.al.

Required Software:

The R statistical package is needed and can be downloaded at www.r-project.org

Course Website:

All course materials will be available on Canvas

Evaluation

Your course grade will be calculated from four homeworks (which includes a final project). Homeworks will be assigned every four weeks or so and will be turned in for grading. *No late homework will be accepted, for any reason whatsoever.*

Course Topics

1. Introduction to Bayesian Probability Modeling (Ch.1,2,3)
2. Regression Models from the Bayesian Perspective (Ch. 14,15)
3. Hierarchical and Mixture Models (Ch. 5,22)
4. Optimization for Model Estimation: EM and Variational Inference (Ch. 13)
5. Markov Chain Monte Carlo for Model Estimation (Ch. 10,11)
6. Recent Advances in Monte Carlo Simulation (Ch. 12)
7. Model Checking (Ch. 6,7)
8. General Linear Models (Ch. 16)
9. Hidden Markov Models
10. Dynamic Linear Models
11. Nonparametric Bayesian models (Ch. 23)
12. Gaussian Processes (Ch. 21)
13. Bayesian Tree Models

Important Dates

Thursday, January 21
Thursday, March 11
Thursday, April 29

First day of class
No Class -- Spring Break
Last day of class