Stats 579

Intermediate Bayesian Modeling

Basic Course Information

Course:	Stats 579	SMLC 356	TuTh	2:00–3:15pm
Instructor:	Fletcher Christensen	Assistant Professor of Statistics		
Contact:	ronald@stat.unm.edu	http://www.stat.unm.edu/∼ ronald/		
Office Hrs:	TuTh	12:30–1:30pm		
Prerequisites:	STAT 577 (Introduction to Bayesian Modeling)			

Course Summary

This class will cover more advanced ideas in Bayesian statistics, focusing most heavily on Bayesian inference methods and MCMC methods. Students are expected to have already had one class in Bayesian methods, and to have fluency with concepts in probability and linear models.

Texts and Tools

Textbook: *Bayesian Ideas and Data Analysis* Christensen, Johnson, Branscum, & Hanson

In addition to the textbook, we will make some use of statistical analysis software in this course. This is primarily for the purpose of coding MCMC algorithms—and thus our work will focus on R, which provides a sufficient coding foundation to allow us to do this type of work. As we cover topics in Bayesian modeling, we may also make use of other analysis software packages.

Software:	R	https://www.r-project.org/
	RStudio	https://www.rstudio.com/products/rstudio/

Course Calendar

Tuesday	20	Aug	Course introduction	
Thursday	22	Aug	Exchangeability	Chapter 4.2
Tuesday	27	Aug	De Finetti's Theorem	
Thursday	29	Aug	Statistical Testing	Chapter 4.1
Tuesday	3	Sep	Likelihood Functions	Chapter 4.3
Thursday	5	Sep	Sufficient Statistics	Chapter 4.4
Tuesday	10	Sep	Analysis Using Predictive Distributions	Chapter 4.5
Thursday	12	Sep	Flat Priors	Chapter 4.6
Tuesday	17	Sep	Jeffreys Priors	Chapter 4.7
Thursday	19	Sep	Model Selection Concepts	
Tuesday	24	Sep	Bayes Factors	Chapter 4.8
Thursday	26	Sep	Other Model Selection Criteria I	Chapter 4.9
Tuesday	1	Oct	Other Model Selection Criteria II	
Thursday	3	Oct	Other Model Selection Criteria III	
Tuesday	8	Oct	*TBD*	
Thursday	10	Oct	**Fall Break** – No class	
Tuesday	15	Oct	Topics in Inference I	Chapter 4.10–4.14
Thursday	17	Oct	Topics in Inference II	
Tuesday	22	Oct	Midterm review	
Thursday	24	Oct	**Midterm exam**	
Tuesday	29	Oct	Project Introduction	
Thursday	31	Oct	Traditional Monte Carlo Methods	Chapter 6.1–6.2
Tuesday	5	Nov	Markov Chain Monte Carlo	Chapter 6.3–6.3.1
Thursday	7	Nov	Gibbs Sampling	Chapter 6.3.2
Tuesday	12	Nov	The Metropolis Algorithm	Chapter 6.3.3
Thursday	14	Nov	The Metropolis Algorithm	
Tuesday	19	Nov	Slice Sampling	Chapter 6.3.4
Thursday	21	Nov	**Thanksgiving Break** – No class	
Tuesday	26	Nov	Other MCMC Methods	
Thursday	28	Nov	Other MCMC Methods	
Tuesday	3	Dec	*TBD*	
Thursday	5	Dec	*TBD*	
Friday	**13**	**Dec**	**Final Projects Due by 11pm**	

Assessment

There will be three components to your grade in this class:

1. Homework Assignments (20%)

   We will have a small number of homework assignments for this class, primarily covering questions from the textbook. These will be graded for completion only, but solutions will be provided so that you can check your own work.

2. Midterm Exam (40%)

   The midterm exam will provisionally be held on **Thursday, October 24$^{\text{th}}$**, and will cover material from Chapter 4 in the textbook as well as supplemental material I assign and/or cover in lecture. The focus of this exam will be on statistical inference and how the Bayesian paradigm handles inference.

3. Final Project (40%)

   Instead of a final exam, I will be asking you to complete a project showcasing what you've learned in this class. You can think of this like a take-home final exam. Your projects will be assigned toward the end of the class, and will be due by **Friday, December 13$^{\text{th}}$ at 11pm**. The primary focus of this project will be on MCMC methods, but other material from the course may be included as well.

In addition to these, I expect you to complete the assigned textbook readings before each class session.

Policies and Expectations

Class attendance:

You are responsible for knowing material covered in the book and in class. These two elements of the course complement each other, but they will not overlap completely. For example, the book will cover some topics that I won't discuss in class but that you may see on class assessments. My lectures will cover some topics that the book doesn't get into—and elements of those may show up on assignments and exams as well.

Be respectful to your fellow students in class. Keep your cell phones and laptops muted. If you know you'll have to arrive to class late or leave early, try to sit near the doors so you can minimize the disturbance you cause.

Students with disabilities:

In accordance with University Policy 2310 and the American Disabilities Act (ADA), students who need academic accommodations and/or assistance in emergency evacuations should contact me as soon as possible to ensure their needs are met in a timely manner.

Missed assignments and exams:

In this class, I expect you to attempt to complete every homework assignment, especially since homework will be graded for completion only. Homework is a tool to help you practice the material we're learning in class, so I will provide solution sets for you to check your work against, to help you see if you're on the right track. Except for a brief submission grace period around deadlines, *late homework and projects will not be accepted.*

If you're in danger of missing the midterm exam (e.g. if you're sick, or if you get into a car accident on the way to school), *contact me by email ASAP*. If I'm aware of the issue, I can make arrangements for you to take the exam at an alternate time. But if you miss the exam without contacting me about your situation, I *will* give you a zero on the exam.

Academic misconduct:

For the purposes of this class, academic misconduct is defined as submitting someone else's work and pretending it's your own. More detail on academic misconduct is provided by the Dean of Students' (https://dos.unm.edu/images/dean-of-students-academic-integrity-guidelines.pdf) and in the UNM Student Code of Conduct (http://pathfinder.unm.edu/code-of-conduct.html).

Cheating doesn't help you learn statistics better. Don't cheat.