BSTA 771: Applied Bayesian Analysis
Spring 2021

Instructor:	Changgee Chang
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	Cell: (815) 908-7112
Class time:	M/W 9:00 – 10:30am
Location:	Zoom (Link will be provided.)
Office Hour:	W 10:30-11:30am
TA:	Qiyiwen Zhang
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TA Office Hour:	TBD

Overview: This course will focus on modern Bayesian methods for analyzing biomedical data. Once students have learned the basics, we will cover more advanced topics, including: computational algorithms (Gibbs; Metropolis Hastings; rejection sampling; slice sampling); model checking using posterior predictive distributions; model averaging; shrinkage priors; and, especially, Bayesian non-parametric methods. These ideas will be illustrated using data that are especially relevant for biostatistics graduate students.

By the end of the course students should be able to:

- Determine what type of prior distributions to use (non-informative, weakly informative, or informative)
- Be able to fit complex models by either writing their own Gibbs sampler, using available software, or some combination of the two
- Be able to implement non-parametric Bayesian methods
- Know how to check modeling assumptions
- Understand the strengths and limitations of Bayesian inference
- Understand how Bayesian methods can be used to deal with common problems in biomedical data such as: missing data; censoring; multiple comparisons; sparse cells

Required book

Bayesian Data Analysis, 3rd Edition, Gelman, Carlin, Stern, Dunson, Vehtari and Rubin

Software

R (http://www.r-project.org/), OpenBUGS (http://www.openbugs.info/w/FrontPage), Stan (http://mcstan.org/)

Grading

60% homework (3 HWs)
40% final project

While students are encouraged to discuss homework problems together, the actual document that is turned in (including computer code) must be each student's own work.

Tentative Syllabus

Date		Topic	Chapters
Mar	15	Overview, Basics (single parameter models)	1,2
	17	Multiparameter models, Jeffreys prior	3
	22	Large sample theory/ Grid method / Inverse CDF	4
	24	**No class** (DBEI Research Day)	
	29	Hierarchical models	5
	31	Model checking /examples	5,6
Apr	5	Importance, rejection	10
	7	MCMC, Gibbs, Metropolis-Hastings	10,11
	12	**No class**	
	14	Effective sample size, autocorrelation, convergence	11
	19	Slice sampling, Hamiltonian, Reversible Jump	12
	21	Linear regression	14
	26	Hierarchical linear models	15
	28	Generalized linear models	16
May	?	Final project presentation	