

Tentative syllabus of STAT:6970:Topics in Statistics Spr. 2019

Fundamentals and modern topics in Bayesian statistics

Lectures MWF 4:30P - 5:20P, 15 SH

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Prerequisites. The course prerequisites include mathematical statistics courses (e.g. STAT:5101 based on Casella&Berger, or equivalents), applied statistics courses that cover regression (e.g. STAT:5200, or STAT:4540, or equivalents). Prior experience in Bayesian Statistics (e.g. STAT:4520, STAT:7520) will be very helpful but not required. The ability to program in R and to read statistical papers are expected.

In general, the more prepared your are, the more details you will understand. But most students with decent statistical background will benefit from “tasting a sample” of modern topics, techniques, and open problems in Bayesian inference and computing.

Contents. Possible contents for lectures, readings, and projects include:

- Theory: Decision-Theoretic foundations of Bayesian methods, Bayesian inference, Model Choice (e.g. Bayes Factor and its computing), Model averaging, etc.
- Bayesian Models: General hierarchical models, Generalized linear mixed models (GLMM), infinite and finite mixture models, Hidden Markov models, Topic modeling, Neural networks, Nonparametric Bayesian models, etc.
- Computing: Markov chain Monte Carlo (MCMC), Sequential Monte Carlo (SMC), Approximate Bayesian computing (ABC), Variational method, etc.

Books. Instead of one textbook, we will sample materials from several books and a list of seminal papers. A few books we will extract learning materials from are:

- The Bayesian Choice – From Decision-Theoretic Foundations to Computational Implementation. Robert, Christian. Springer, 2007. (Free access to ebook through UI library.)
- Handbook of Markov Chain Monte Carlo. Edited by Brooks, Gelman, Jones and Meng. Chapman and Hall/CRC, 2011. (Free access to most chapters.)
- Pattern Recognition and Machine Learning. Bishop, Christopher. Springer, 2006. (Free online access.)

Grading. Your semester grade will be based on a few homework assignments (every 2 to 3 weeks) and a final project.