STAT 608B: Monte Carlo methods in Statistics

Winter 2019

Basic information.   Lecture Time: 4–5:30 PM MW, EH 1068
Instructor: Long Nguyen, xuanlong@umich.edu, WH 461, office hours: by appointment
Teaching Assistant: Yun Wei, cloudwei@umich.edu, office hours: tba

Course description.   This course is an introduction to Monte Carlo sampling and integration methods that arise in statistics. Course topics include: basic Monte Carlo methods (random number generators, variance reduction techniques, importance sampling and its generalizations), an introduction to Markov chains and Markov Chain Monte Carlo (Metropolis-Hastings and Gibbs samplers, data-augmentation techniques, convergence diagnostics). Optional topics include: sequential Monte Carlo, Hamiltonian Monte Carlo, advanced computational methods (approximate Bayesian computation, variational inference) for complex statistical models such as latent variable and hierarchical or nonparametric Bayesian models.

Textbook.   We will use Jun Liu's text "Monte Carlo strategies in scientific computing", Springer, 2008, which is supplemented with relevant research papers.

   We will use Canvas class page for announcements, resources and assignments.

Tentative topics.

- Motivations and problems

- Rejection sampling methods and variable reduction

- Importance sampling and weighted methods

- Sequential Monte Carlo methods

- Markov Chain Monte Carlo methods: Metropolis, Metropolis-Hasting, Gibbs samplers

- General conditional sampling

- Hybrid Monte Carlo methods

- Applications in context of hierarchial modeling and nonparametric Bayesian methods

Evaluation.   There will be a final project involved data analysis or evaluation of algorithms and an oral presentation.