STAT 535A – COMPUTATIONAL STATISTICS
2017/18 - Term 2
Instructor: Alexandre Bouchard-Côté

Time and Place: M/W 1:30-3:00 PM, Feb 26- Apr 6, 2018. ESB 4192

Calendar entry*:* Computationally intensive statistical methodologies and their theoretical foundations. Design, implementation and analysis of correct, scalable inference software.

For Term 2 of 2017-2018, the course will focus on Monte Carlo methods, from foundations to recent advances. If time permits, topics at the interface with optimization will be covered.

a) Motivations and foundations of Monte Carlo inference (pseudo randomness, simple exact sampling, simple approximate sampling via importance sampling, basic asymptotic theory, correctness, debugging and performance evaluation of randomized algorithms, control variates, limitations and failure cases of simple methods);
b) Scalable inference methods for sequences and their generalizations (motivation: hidden and state space models, exact recurrences such as Kalman filters and dynamic programming, Sequential Monte Carlo algorithms, evidence estimation, SMC samplers and change of measure, correctness, debugging and performance evaluation, failure cases);
c) Scalable inference in high-dimensional models (motivation taken from random effect models, spatial statistics, genetics, Metropolis Hastings framework and its theoretical analysis, auxiliary variable methods, correctness, debugging and performance evaluation, failure cases);
d) Inference in intractable models (motivation, pseudo-marginal methods, Approximate Bayesian Computation);
e) Selected advanced topics, such as non-reversible methods, piecewise-deterministic Markov processes, topics in probabilistic programming, topics in variational inference, other advanced MCMC/SMC methods.

Homeworks, labs and project will consist of implementation, analysis and comparison of various computationally intensive statistical methodologies.

Textbooks: none; will use sources that are electronically available.