SF2955 Computer Intensive Methods in Mathematical Statistics 7.5 credits

Datorintensiva metoder inom matematisk statistik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SF2955 valid from Autumn 2020

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mathematics

Specific prerequisites

- Completed basic course in mathematical statistics (SF1918, SF1922 or equivalent).
- Completed basic course in numerical analysis (SF1544, SF1545 or equivalent)

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course, the student shall be able to

- formulate and apply Monte Carlo simulation techniques,
- apply Monte Carlo simulation to frequentist and Bayesian statistics,
- design and implement an SMC algorithm simulating from a given sequence of probability distributions, and
- design and implement an MCMC algorithm simulating from the posterior distribution of a complex Bayesian model and analyse the output.

Course contents

This course provides an introduction to modern **Monte Carlo simulation** and its applications to mathematical statistics.

Sequential Monte Carlo (SMC) **methods** (alternatively termed particle filters) form a class of genetic-type sampling techniques that simulate recursively from sequences of probability distributions. These methods are widely used in a variety of engineering and scientific disciplines such as signal processing, robotics, and financial mathematics.

Markov chain Monte Carlo (MCMC) **methods** constitute a collection of simulation techniques that use cleverly selected Markov chains to generate samples from complicated, possibly high-dimensional distributions. MCMC is successfully applied in Bayesian statistical methods—which allow prior knowledge to be included in the inferential analysis—but also areas like optimization, statistical mechanics, and machine learning.

Examination

- OVNA - Assignments, 3.0 credits, grading scale: P, F
- TENA - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.

- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.