Computational Statistics

Single subject and programme course

6 credits

Datorintensiva statistiska metoder

732A90

Valid from: 2017 Spring semester

Determined by
The Quality Board at the Faculty of Arts and Sciences

Date determined
2016-04-13

Main field of study
Statistics

Course level
Second cycle

Advancement level
A1X

Course offered for
- Master's Programme in Statistics and Machine Learning

Entry requirements
A bachelor’s degree in one of the following subjects: statistics, mathematics, applied mathematics, computer science, engineering, or equivalent. Completed courses in calculus, linear algebra and programming are required.
The student should also have passed the following courses at advanced level:
- a course in Statistics;
- a course including multiple linear regression.
Documented knowledge of English equivalent to Engelska B/Engelska 6.

Intended learning outcomes
After completion of the course the student should be able to:
- account for how computer arithmetics affects statistical computations,
- develop computer implementations of standard methods for simulating from complex statistical distributions
- develop computer implementations of commonly used deterministic and stochastic optimization methods in statistics and machine learning
- select a suitable computer intensive uncertainty estimation methods for a given problem, and develop an implementation of the algorithm in a programming language
- interpret the results obtained by various simulation and estimation methods

Course content

The course comprises a set of computational models and mathematical tools that enables performing computationally intensive statistical inference for complex challenging problems in statistics, machine learning and engineering.

The following topics are included in the course:
- effect of computer arithmetics on statistical computations,
- basic methods for random number generation, including inverse CDF method and acceptance/rejection method,
- Monte Carlo methods for simulation and inference, including bootstrap and jackknife,
- Markov Chain Monte Carlo (MCMC) simulation, including Metropolis-Hastings and Gibbs samplers,
- introduction to unconstrained optimization and stochastic optimization.

Teaching and working methods

The teaching comprises lectures, computer exercises and seminars complemented by self-studies. The lectures are devoted to presentations of theories, concepts, and methods. Computer exercises provide practical experience of statistical analysis. Seminars are devoted to discussions of the computer exercises and student presentations.
Language of instruction: English.

Examination

Written reports on the computer assignments. Active participation in the seminars. One final written examination. Detailed information about the examination can be found in the course's study guide.

If the LiU coordinator for students with disabilities has granted a student the right to an adapted examination for a written examination in an examination hall, the student has the right to it. If the coordinator has instead recommended for the student an adapted examination or alternative form of examination, the examiner may grant this if the examiner assesses that it is possible, based on consideration of the course objectives.

Students failing an exam covering either the entire course or part of the course twice are entitled to have a new examiner appointed for the reexamination.

Students who have passed an examination may not retake it in order to improve their grades.

Grades

ECTS, EC

Other information

Planning and implementation of a course must take its starting point in the wording of the syllabus. The course evaluation included in each course must therefore take up the question how well the course agrees with the syllabus.

The course is carried out in such a way that both men´s and women´s experience and knowledge is made visible and developed.

Department

Institutionen för datavetenskap