MATH-339

Bayesian statistics

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Cursus	Sem.	Type
Computational science and Engineering	MA2, MA4	Opt.
Computational science and engineering minor	E	Opt.
Mathematics	BA6	Opt.
Minor in statistics	E	Opt.
Statistics	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

A first introduction to Bayesian statistics, assuming knowledge from first courses in statistics and probability. We will focus on foundational statistical and mathematical aspects such as the decision theoretic background, consistency for large sample sizes, and algorithms for Bayesian computation.

Content

Probabilistic foundations and the Bayesian paradigm

- Bayes's formula
- Bayesian estimation, testing and credible regions

Decision-theoretic foundations

- Minimax and Bayes methods, admissibility
- Complete class theorem

Conjugate models
Frequentist analysis of Bayesian methods

- Consistency of Bayesian methods
- Bernstein-von Mises theorem

Bayesian computation via Monte Carlo methods

- Introduction to Markov Chains
- Markov Chain Monte Carlo (MCMC) algorithms

Relevant literature:

- Aad van der Vaart, Botond Szabo: Bayesian Statistics
- Christian Robert: The Bayesian Choice (2007)
- Peter Hoff: A First Course in Bayesian Statistical Methods (2009)

Keywords

Bayes' theorem
Decision theory
Minimax estimation theory
Bernstein-von Mises theorem
Markov Chain Monte Carlo (MCMC)

Bayesian computation

Learning Prerequisites

Required courses

Introductory courses in statistics and probability are necessary. Knowledge of measure-theoretic probability is beneficial.

Assessment methods

Written exam

Resources

Moodle Link

- https://go.epfl.ch/MATH-339