Course Specifications

Valid as from the academic year 2019-2020

Computerintensive Statistical Methods (C003399)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)

Credits	5.0	Study time	150 h	Contact hrs	62.5 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 2)	English	Gent	guided self-study	40.0 h
			lecture	22.5 h
B (semester 2)			guided self-study	40.0 h
			lecture	22.5 h

Lecturers in academic year 2020-2021

Fiems, Dieter	TW07	lecturer-in-charge
De Turck, Koen	TW07	co-lecturer

Offered in the following programmes in 2020-2021	crdts	offering
Bridging Programme Master of Science in Bioinformatics (main subject Engineering)	5	A
Master of Science in Bioinformatics (main subject Engineering)	5	A
Master of Science in Statistical Data Analysis	5	B

Teaching languages

English

Keywords

Bayesian inference; Simulation of stochastic processes; Monte Carlo integration; Markov chain Monte Carlo.

Position of the course

This course addresses computer intensive methods in statistics. In particular, the foundations and the use of computer experiments (simulation) in statistics will be discussed.

Contents

Chapter 1: Bayesian inference Decision-theoretic foundations; Prior distribution; Posterior distribution; Bayes rule; Non-informative priors; Conjugate priors; Maximum entropy priors; Point Estimation; Confidence regions; Hypothesis testing.
Chapter 2: Simulation of stochastic processes Quasi-random generators; Generation of random variables; Generation of trajectories of Markov processes; Monte Carlo integration; Variance reduction techniques: antithetic variables, control variables, importance sampling; Perfect simulation.
Chapter 3: Bayesian calculations Markov chain Monte Carlo; Metropolis–Hastings algorithm; Gibbs sampler; Particle filters; Factor graphs; Sum-product algorithm.

Initial competences

Elementary statistics, probability and computer programming

Final competences

1 Have advanced knowledge of a wide range of computer intensive statistical methods for designing studies and analysing data.
2 The student can use specialized software in order to correctly and efficiently perform statistical calculations, and to critically validate the conclusions obtained through this analysis.
3 The student can report accurately on the design, conduct, analysis, and conclusions of statistical studies.
4 The student can express clearly the assumptions on which conclusions are based,

by performing a Monte Carlo study that systematically and critically investigates the assumptions underlying the analysis approach.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, lecture

Learning materials and price

Lecture notes from lecturer are available in electronic form. Cost: 10 EUR

References

S. Ross: Simulation (Academic Press, 1999)

Course content-related study coaching

The practical assignments are supervised by the lecturer.

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Calculation of the examination mark

Examination: 100 %