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)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
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<tbody>
<tr>
<td>5.0</td>
<td>150 h</td>
<td>62.5 h</td>
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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

| Brugprogramma 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 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

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 %