MATH-449

Biostatistics

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Cursus	Sem.	Type
Civil & Environmental Engineering		Opt.
Computational biology minor	E	Opt.
Ing.-math	MA2, MA4	Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Mathématicien	MA2	Opt.
Statistics	MA2, MA4	Opt.

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

Summary

This course covers statistical methods that are widely used in medicine and biology. A key topic is the analysis of longitudinal data: that is, methods to evaluate exposures, effects and outcomes that are functions of time. While motivated by real-life problems, some of the material will be abstract

Content

- Analysis of time-to-events (survival analysis / failure time analysis)
  - Censoring
  - Likelihood functions for censored data
  - Martingales
  - Identification of parameters with a clear interpretation
  - Non-parametric and semi-parametric estimators
  - Discrete vs continuous time

- Longitudinal data analysis
  - Parametric regression models
  - Semi-parametric models

- Interpretation and evaluation of statistical parameters
  - Description, Prediction and Causal inference
  - Biases
  - Sensitivity analyses

- Precision medicine
  - Identification and estimation of optimal regimes
  - Optimal time-varying treatment regimes

Keywords

Biostatistics; statistical inference; survival analysis; longitudinal data; research synthesis

Learning Prerequisites

Required courses

The students are expected to have taken introductory courses in statistical theory, probability theory and regression modeling.

Recommended courses

Undergraduate courses in statistics.

Important concepts to start the course

Likelihood theory, statistical testing. Experience with R is an advantage, but is not required.

Learning Outcomes

By the end of the course, the student must be able to:

- Identify statistical methods that are suitable for answering a given scientific problem.
- Justify why a statistical method is applied to given problem.
- Apply methods that have been taught in the course.
- Critique evaluate published studies and methodologies.

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Access and evaluate appropriate sources of information.
- Demonstrate the capacity for critical thinking

Teaching methods

Classroom lectures, where I will use Beamer slides and the blackboard. Exercises and take-home projects that will require programing in R.

Assessment methods

Final written exam and continuous assessment.
Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Teaching resources

- Aalen, O., Borgan, O. and Gjessing, H., 2008. Survival and event history analysis: a process point of

view. Springer
• Andersen, P.K., Borgan, O., Gill, R.D. and Keiding, N., 2012. Statistical models based on counting processes. Springer

Ressources en bibliothèque

• Andersen Statistical models
• Aalen survival and event history

Moodle Link

• https://go.epfl.ch/MATH-449