

MATH-413

Statistics for data science

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| Cursus | Sem. | Type |
|---|----------|------|
| Computational science and Engineering | MA1, MA3 | Opt. |
| Data Science | MA1, MA3 | Obl. |
| Data science minor | H | Opt. |
| Electrical Engineering | | Opt. |
| Electrical and Electronical Engineering | MA1, MA3 | Opt. |
| Managmt, tech et entr. | MA1, MA3 | Opt. |
| SC master EPFL | MA1, MA3 | Opt. |

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| Language of teaching | English |
| Credits | 6 |
| Session | Winter |
| Semester | Fall |
| Exam | Written |
| Workload | 180h |
| Weeks | 14 |
| Hours | 6 weekly |
| Courses | 4 weekly |
| Exercises | 2 weekly |
| Number of positions | |

Summary

Statistics lies at the foundation of data science, providing a unifying theoretical and methodological backbone for the diverse tasks encountered in this emerging field. This course rigorously develops the key notions and methods of statistics, with an emphasis on concepts rather than techniques.

Content**Keywords**

Data science, inference, likelihood, regression, regularisation, statistics.

Learning Prerequisites**Required courses**

Real analysis, linear algebra, probability.

Recommended courses

A first course in statistics.

Important concepts to start the course

Students taking the course will need a solid grasp of notions from analysis (limits, sequences, series, continuity, differential/integral calculus) and linear algebra (linear subspaces, bases, dimension, eigendecompositions, etc). Though the course will cover a rapid review of probability, a first encounter with the subject is necessary (random variables, distributions/densities, independence, conditional probability). Familiarity with introductory level notions of statistics would be highly beneficial but not necessary.

Learning Outcomes

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

- Derive properties of fundamental statistical procedures
- Estimate model parameters from empirical observations
- Test hypotheses related to the structural characteristics of a model
- Construct confidence bounds for model parameters and predictions
- Contrast competing models in terms of fit and parsimony

Teaching methods

Slides and whiteboard.

Assessment methods

Final exam and a midterm counting for 15%.

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

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| Office hours | No |
| Assistants | Yes |
| Forum | No |

Resources

Bibliography

Davison, A.C. (2003). Statistical Models, Cambridge.

Panaretos, V.M. (2016). Statistics for Mathematicians. Birkhäuser.

Wasserman, L. (2004). All of Statistics. Springer.

Friedman, J., Hastie, T. and Tibshirani, R. (2010). Elements of Statistical Learning. Springer

Ressources en bibliothèque

- [Elements of Statistical Learning](#)
- [All of Statistics.](#)
- [Statistics for Mathematicians](#)
- [Statistical Models](#)

Moodle Link

- <https://moodle.epfl.ch/course/view.php?id=15506>