EPFL

MATH-408	**Regression methods**

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Cursus	Sem.	Type
Financial engineering	MA1, MA3	Opt.
Ing.-math	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.
Statistics	MA1, MA3	Opt.

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

Summary

General graduate course on regression methods

Content

Linear regression and analysis of variance. Geometric interpretation. Properties of estimators. Orthogonality and balance. Diagnostics. Transformations. Variable selection and post-selection inference. Robustness and estimating equations. Quantile regression.
PIWLS algorithm and general regression models. Generalized linear models: variance and link functions; proportion and binary responses; logistic regession; count data and Poisson responses; log-linear models; overdispersion.
Penalised regression: ridge, lasso, thresholding.
Components of variance: nested and crossed effects, mixed models. REML.
Spline smoothing, estimation and inference. Additive models. Generalised additive models.

Keywords

Binary response. Count data. Deviance. Least squares. Likelihood. Mixed model. Overdispersion. Penalised regression model. Random effects. Ridge regression.

Learning Prerequisites

Required courses

Courses on basic probability and statistics (e.g., MATH-240, MATH-230) and a first course on the linear model (e.g., MATH-341).

Important concepts to start the course

Linear regession. Likelihood inference. Use of computer package R.

Learning Outcomes

By the end of the course, the student must be able to:
- Develop elements needed in a regression analysis
- Apply the statistical package R for the analysis of data
- Assess / Evaluate the quality of a model
- Formulate a suitable regression model and assess its validity

Transversal skills

- Demonstrate the capacity for critical thinking
- Demonstrate a capacity for creativity.
- Write a scientific or technical report.

Teaching methods

Ex cathedra lectures; homework both theoretical and applied; mini-project

Expected student activities

Attending lectures; solving theoretical problems; solving applied problems using suitable software

Assessment methods

Written final exam. Mini-project.
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	Yes

Resources

Virtual desktop infrastructure (VDI)
No

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

Ressources en bibliothèque

- Statistical Models / Davison

Notes/Handbook
See moodle page

Moodle Link

- https://go.epfl.ch/MATH-408