MATH-408 **Modern regression methods**

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Cursus	Sem.	Type
Financial engineering	MA2, MA4	Opt.
Ing.-math	MA2, MA4	Opt.
Mathématicien	MA2	Opt.

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

Summary

An advanced course on regression modelling.

Content

Revision of likelihood inference, linear regression and analysis of variance. Tall and wide regression settings.
Model/variable selection methods (AIC, BIC, etc.)
Regularised regression (ridge, lasso, splines and variants). Effective degrees of freedom.
Mixed models and smoothing.
Iterative weight least squares algorithm and related diagnostics.

Generalised linear models; variance and link functions; roportion and binary responses; logistic regession; count data and Poisson responses; log-linear models; overdispersion.

Generalised additive models.
Nonlinear models and neural networks.

Keywords

Binary response; Count data; Deviance; EM algorithm; Iterative weighted least squares algorithm; Lasso; Logistic regression; Mixed model; Overdispersion; Poisson distribution; Quasi-likelihood; Random effects; Ridge regression.

Learning Prerequisites

Required courses

Knowledge of basic probability and statistics, at, for example, the levels of MATH-240 and MATH-230

Linear models (MATH-341) or equivalent

Important concepts to start the course

Linear regression; likelihood inference; R

Learning Outcomes

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

- Develop theoretical elements needed in regression analysis

- Apply the statistical package R to the analysis of data
- Assess / Evaluate the quality of a model fitted to regression data, and suggest improvements
- Choose a suitable regression model

Transversal skills

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

Teaching methods

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

Expected student activities

Attending lectures; solving theoretical problems; solving applied problems using statistical 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

Bibliography

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

Ressources en bibliothèque

- Statistical Models / Davison