Summary
Regression modelling is a basic tool of statistics, because it describes how one variable may depend on another. The aim of this course is to familiarize students with the basis of regression modelling, and of some related topics.

Content
• Properties of the multivariate Gaussian distribution and related quadratic forms.
• Gaussian linear regression: likelihood, least squares, geometrical interpretation.
• Distribution theory, confidence and prediction intervals.
• Gauss-Markov theorem.
• Model checking and validation: residual diagnostics, outliers and leverage points.
• Analysis of variance.
• Model selection: bias/variance tradeoff, stepwise procedures, information-based criteria.
• Multicollinearity and penalised estimation: ridge regression, LASSO.
• Robust regression and M-estimation.
• Other topics as time permits: logistic and Poisson regression, nonparametric regression.

Learning Prerequisites
Recommended courses
Analysis, Linear Algebra, Probability, Statistics

Learning Outcomes
By the end of the course, the student must be able to:
• Recognize when a linear model is appropriate to model dependence
• Interpret model parameters both geometrically and in applied contexts
• Estimate the parameters determining a linear model from empirical observations
• Test hypotheses related to the structural characteristics of a linear model
• Construct confidence bounds for model parameters and model predictions
• Analyze variation into model components and error components
• Contrast competing linear models in terms of fit and parsimony
• Construct linear models to balance bias, variance and interpretability
• Assess / Evaluate the fit of a linear model to data and the validity of its assumptions.
• Prove basic results related to the statistical theory of linear models

Teaching methods
Lectures ex cathedra, exercises in class, take-home projects

Assessment methods
Continuous control, final exam.
Seconde tentative : 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

Ressources en bibliothèque
• Statistical Models / Davison
• Applied Regression Analysis / Draper
• Methods and Applications of Linear Models / Hocking