

14D001

Statistical Modelling and Inference

6 ECTS

Course Outline

• **PART A: Regression**

Regression: likelihood estimation and residuals
SVD regression
Bayesian linear regression: basics
Bayesian prediction
Prior modelling
Model complexity
Setting up, displaying and interpreting a regression model
GLMs

• **PART B: Latent variables and algorithms**

Robust regression and the EM algorithm
Monte Carlo sampling
Mixtures and factors

• **PART C: Graphical and hierarchical models**

Graphical models
Two-stage hierarchical models
Multilevel models and algorithms

• **PART D: Some advanced regression techniques**

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• PART E: Big Data challenge workshops

Every year there are 1-2 workshops on important topics in the statistical analysis with Big Data. During 2015-2016 there will be the following two workshops:

- Big GLM: learning GLMs with massive amounts of data; jointly delivered with Ioannis Kosmidis, UCL, <https://www.ucl.ac.uk/statistics/people/ioanniskosmidis>
- Ultra-high dimensional variable selection; jointly delivered with David Rossell, Warwick, <https://sites.google.com/site/rosselldavid/>

Required Activities

Weekly exercises, projects

Evaluation

Final exam 50%, weekly homework 30%, project 20%

Materials - Main refs

[Bishop] Bishop, Pattern Recognition and Machine Learning

[Hastie et al.] Hastie, Tibshirani, Friedman, The elements of statistical learning

[Gelman&Hill] Gelman and Hill, Data analysis using regression and multilevel/hierarchical models

Supplementary refs

Wasserman, All of Statistics

Hoff: A First Course in Bayesian Statistical Methods

Venables & Ripley : Modern Applied Statistics with S

Strang: Linear Algebra and its applications

Bernardo and Smith: Bayesian theory