

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**

14D001

## Statistical Modelling and Inference

6 ECTS

### • 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, weekly homework, project

#### 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