

STATS 211: Statistical Methods II

UCI, Winter 2012

Objective

The objective of this course is to go beyond linear models where the observations are dependent, the relationships are nonlinear, and the response variable is categorical. We will also discuss strategies for controlling model complexity. Students will learn how to build multilevel and nonlinear models. They will also learn to build regression models with constraint on model parameters. Throughout the course, students will be exposed to some relevant theory, but the main focus of this course is on **application**.

Instructor

Babak Shahbaba, 2224 Donald Bren Hall

Class location and hours

ICS 243, MWF 08:00AM to 08:50AM

Office hours

MW 9AM to 10AM

Evaluation

There are 3 assignments: 10% each; one project: 20%; one mid-term: 25%; one final: 25%.

Syllabus

- **A brief review of linear models**

Linear regression models; Least squares; Maximum likelihood estimation; Likelihood ratio, Wald and score tests.

- **Model assessment and selection**

Model complexity; Bias-variance tradeoff; Data splitting; Cross-validation

- **Controlling complexity**

Principal component analysis; Principal component regression; Partial least squares; Shrinkage; Ridge regression; Lasso

- **Basis expansions**

Basis functions; Piecewise linear models; Piecewise polynomial models; Splines

- **Generalized additive models**

Smoothing; Nonparametric transformation; Backfitting; Local Scoring

- **Multilevel models**

Clustered data; Repeated measurements; Linear mixed effect models; Generalized least squares

- **Longitudinal data analysis**

Exploring longitudinal data; Linear models for longitudinal data; Covariance patterns; Linear mixed effects models for longitudinal data

- **Classification models**

Linear discriminant analysis; Quadratic discriminant analysis; Naive Bayes classifiers

References

Main textbooks

- “Regression modeling strategies,” by Harrell, F. E.
- “The elements of statistical learning,” by Hastie, T., Tibshirani, R., and Friedman, J. (<http://www-stat.stanford.edu/~tibs/ElemStatLearn>)

Other relevant references

- “Data Analysis Using Regression and Multilevel/Hierarchical Models,” by A. Gelman and J. Hill.
- “Applied longitudinal analysis,” by Fitzmaurice, G. M., Laird, N. M., and Ware, J. H.