

40046 Computational Statistics

PhD in Statistics & Computer Science

Bocconi University

Instructor: Omiros Papaspiliopoulos

The course aims at discussing computational methods commonly used in the context of statistical inferences. It will cover topics in numerical linear algebra, optimization, and simulation-based methods, with a focus on statistical applications. Students will be introduced to the use of software for the implementation of the computational methods shown during the course.

Module A: High-dimensional Gaussian distributions

Topics: sparse linear algebra, graphical models, PCA, SVD, factor models, backfitting/Gauss-Seidel/Gibbs sampling and rate of convergence of iterative schemes

Module B: Regression models

Topics: QR/SVD/Cholesky incremental linear algebra, GLMs and gradient-based learning, penalized likelihood for high-d regression, lasso, coordinate-wise descent, intro to fundamentals of convex optimization, non-convex penalties and methods, Bayesian variable shrinkage and selection

Module F: Particle methods

Topics: Markov kernels and Feynman-Kac models, connections to HMMs and Kalman Filter, importance sampling, particle filters, sequential methods for static problems