Department of Decision Sciences

Statistics Seminar

Università Commerciale Luigi Bocconi

Scalable Bayesian variable selection and model averaging under block orthogonal design

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12:30pm Room 3-E4-SR03 Via Rontgen 1 Milano

Abstract

We show how to carry out fully Bayesian variable selection and model averaging in linear models when both the number of observations and covariates are large. We work under the assumption that the Gram matrix is block-diagonal, and carry out fully Bayesian inference where the residual variance is integrated out when computing posterior model probabilities. Our approach returns the most probable model of any given size without resorting to any integration, posterior probabilities for any number of models by evaluating a single one-dimensional integral, and other quantities of interest such as variable inclusion probabilities and model averaged regression estimates by carrying out an adaptive, deterministic one-dimensional numerical integration. Our approach, albeit fully Bayesian, does not require Markov Chain Monte Carlo sampling. The overall computational cost scales linearly with the number of blocks, which can be processed in parallel, and exponentially with the block size, rendering it most adequate in situations where predictors are organized in many moderately-sized blocks. When the design is not block-diagonal we show how our approach combined with block-diagonal approximations, such as spectral clustering, to identify high-probability models. In the talk we will also link this approach with interesting current developments in high-dimensional variable selection, such DECO and related screening methods.

(joint work with David Rossell, UPF)

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