

Estimation of structured transition matrices in high dimensions

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Abstract

This talk considers the estimation of the transition matrices of a (possibly approximating) VAR model in a high-dimensional regime, wherein the time series dimension is relatively large compared to the sample size. Estimation in this setting requires some extra structure. The recent literature has given much attention to the case of sparse transition matrices and penalized estimation which adapts to the unknown sparsity pattern. In this talk, the transition matrices are well approximated by matrices with a common and low dimensional column space and smooth singular vectors. This scenario is motivated by a (static) factor model for a spatio-temporal process whose spatial domain amounts to a given weighted graph. Therein, the vector of loadings of the individual nodes with a single (static) factor expresses this factor's influence and is assumed to be smooth in space, that is, on the graph. The proposed estimator amounts to the unique minimum of a penalized least-squares criterion with penalty term given by the (scaled) composition of the nuclear norm—sum of the singular values—and a linear weighting function. The two factors of this penalty term reflect its twofold objective: firstly, the nuclear norm promotes low rank estimates—to match the parameter reduction due to the factor structure, and the linear weighting function encourages smoothness on the graph. The talk presents a non-asymptotic upper bound on the estimation error, which holds with high probability provided that the scaling parameter in the penalty term is sufficiently large. Numerical experiments illustrate the theoretical result.