Modelling Matrix Time Series via a Tensor CP-Decomposition

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We consider to model matrix time series based on a tensor CP-decomposition. Instead of using an iterative algorithm which is the standard practice for estimating CP-decompositions, we propose a new and one-pass estimation procedure based on a generalized eigenanalysis constructed from the serial dependence structure of the underlying process. To overcome the intricacy of solving a rank-reduced generalized eigenequation, we propose a further refined approach which projects it into a lower-dimensional full-ranked eigenequation. This refined method significantly improves the finite-sample performance of the estimation. The asymptotic theory has been established under a general setting without the stationarity. It shows, for example, that all the component coefficient vectors in the CP-decomposition are estimated consistently with certain convergence rates. The proposed model and the estimation method are also illustrated with both simulated and real data, showing effective dimension-reduction in modelling, and forecasting matrix time series.

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