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Order-preserving factor analysis (OPFA)

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We present a novel factor analysis method that can be applied to the discovery of common factors shared among trajectories in multivariate time series data. These factors satisfy a precedence-ordering property: certain factors are recruited only after some other factors are activated. Precedence-ordering arise in applications where variables are activated in a specific order, which is unknown. The proposed method is based on a linear model that accounts for each factor's inherent delays and relative order. We present an algorithm to fit the model in an unsupervised manner using techniques from convex and non-convex optimization that enforce sparsity of the factor scores and consistent precedence-order of the factor loadings. We illustrate the Order-Preserving Factor Analysis (OPFA) method for the problem of extracting precedence-ordered factors from a longitudinal (time course) study of gene expression data.

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