PREDICTIVE PRINCIPAL COMPONENT ANALYSIS

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ABSTRACT: This work introduces a multi-group Principal Component Analysis, in analogy with the linear predictor as in the general linear mixed model approach.

Estimating PCs simultaneously in different groups provides a joint dimension reduction solution (Flury, 1988, Härdle and Simar, 2015), representing the so-called Common Principal Components (CPC). The literature proposes two types of CPC - one for independent groups (Flury, 1984), and the other for dependent groups (Neuenschwander and Flury, 2000).

The CPC basic assumption is that the space spanned by the eigenvectors, that leads to a joint eigenstructure across the structure, is identical across groups, but in practice variances associated with the components are allowed to vary. Some recent approaches address this issue incorporating the analysis of the differences among groups in the Structural Equation Modeling (SEM) framework (Bechger et al., 2014). Gu and Wu ()2016) propose to exploit a state-space model analysis (Dolan et al, 1999).

We present a model-based solution to some of the issues of the multi-group PCA. We refer to this approach as *Predictive* PC (PPC) as the PC loadings and scores are based on the results of a Singular Value Decomposition of the matrices of a linear model predicted values. The empirical predictor is given by an extension of the distribution-free variance least squares method to an iterative multivariate response algorithm.

KEYWORDS: Principal components, linear mixed model, empirical best linear unbiased predictor, variance least squares.

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