Reviews, recent extensions and outlook on dimension reduction

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Abstract

Summarizing the effect of many covariates through a few linear combinations is an effective way of reducing covariate dimension and is the backbone of (sufficient) dimension reduction. Because the replacement of high-dimensional covariates by low-dimensional linear combinations is performed with a minimum assumption on the specific regression form, it enjoys attractive advantages as well as encounters unique challenges in comparison with the variable selection approach. We review the current literature of dimension reduction with an emphasis on the two most popular models, where the dimension reduction affects the conditional distribution and the conditional mean, respectively. We discuss various estimation and inference procedures in different levels of detail, with the intention of focusing on their underneath idea instead of technicalities. We also discuss some unsolved problems in this area for potential future research.