

Bootstrap Confidence Intervals for Three-way Methods:

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Abstract

The two most common methods for the analysis of three-way data, CANDECOMP/PARAFAC and Tucker3 analysis, are used to summarize a three-mode three-way data set by means of a number of component matrices, and, in case of Tucker3, a core array. Almost always the analyses are applied to data pertaining to a sample from a larger population, and usually, the results for the sample are assumed to be, at least to some extent, generalizable to the population from which the sample was drawn. In the practice of three-way analysis, the generalizability issue is usually dealt with by means of cross-validation or by means of split-half comparisons. However, neither procedure gives concrete estimates of the uncertainties (due to sampling fluctuations) of our solutions. Here, it will be discussed how such uncertainty estimates, in the form of confidence intervals or ellipsoids, can be obtained. For this purpose the bootstrap will be used (see Efron & Tibshirani, 1993).

Having chosen to define confidence intervals or ellipsoids by means of the bootstrap is only the first step in the process of obtaining such uncertainty estimates. At least the following issues deserve attention: Which mode is the sampling mode? How to deal with the transformational nonuniqueness of the three-way methods? How can computations remain feasible? These three issues will be treated in the presentation, and (preliminary) solutions to the ensuing problems will be mentioned.

Reference

Efron, B., & Tibshirani, R.J. (1993) *An introduction to the bootstrap*. New York: Chapman & Hall.