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The analysis of coupled data

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In many fields of science, researchers are often faced with the challenging problem of integrating different pieces of information, possibly stemming from different sources, about the same set of research objects. For example, in contextualized personality psychology, the structure of individual differences in personality may be revealed by integrating for a set of persons information with respect to their situation-specific behavior profiles to information regarding traits/dispositions that characterize these persons. As a second example, from the field of decision making in psychiatric diagnosis, to reveal the underlying syndromes of a set of patients, the profiles of diagnoses and the symptom profiles of the different patients need to be integrated. In both examples the data consist of a set of *N*-way *N*-mode data blocks, one for each piece of information, that share one mode (i.e., the persons/patients). To disclose the structure underlying such a coupled data set, a global model is needed in which each *N*-way *N*-mode data block may be represented by a multi-way decomposition (sub)model, with the parameters for each common mode being the same for the decomposition (sub)models to which that common mode belongs. To represent the coupled data set in this way, an integrated modeling strategy, with the parameters for the common mode(s) being estimated based on the information in all data blocks, may be most appropriate.

In this presentation, first global models will be introduced for an integrated analysis of a binary or a real-valued coupled data set consisting of two data blocks, which may be two-way or three-way, that have one mode in common. Further, two questions concerning the analysis of coupled data will be tackled. The first question deals with coupled data sets that consist of several data blocks that differ (considerably) in size, while the second question focuses on coupled data sets for which the different data blocks may be subject to different amounts of noise. To tackle these problems in the analysis weights could be applied to the different data blocks, with each weight indicating the importance of the corresponding data block in the analysis. The challenge then is to find optimal weights with respect to uncovering the underlying structure of the common mode(s). The performance of these weighting techniques will be evaluated by means of extensive simulation studies and by applying them to empirical coupled data. Finally, some perspectives for further research will be sketched.

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