Estimating standard errors in feature network models for proximity data

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Abstract

In an attempt to learn more about how human cognition processes stimuli, a typical psychological approach consists of analyzing the ratings of perceived similarity of these stimuli. In certain situations, it is useful to characterize the objects of the experimental conditions as sets of binary variables, or features (e.g. voiced vs. voiceless consonants).

If N respondents evaluate the dissimilarity of m stimuli and t binary features characterize the stimuli, the number of features in which two stimuli are distinct yields a dissimilarity coefficient that can be used as a structural model to be fitted to the data. Feature network models (Heiser, 1998) are a particular subclass of graphical structures that represent proximity data in a discrete space while using the same formalism that is the basis of least squares methods used in multidimensional scaling.

Existing methods to derive a network model from empirical data only give the best fitting network and yield no standard errors for the parameter estimates. The additivity properties of networks make it possible to consider the model as a linear regression problem with positivity restrictions on the parameters. Segmental additivity holds in all networks and distinct feature additivity is specific for networks based upon a set of known or unknown features. In the present study, standard errors are obtained for the regression parameters of a network model with known features using Monte Carlo techniques.

References

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