

Nonparametric IRT: multivariate isotonic probabilistic models (d-ISOP)

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Abstract

A d-ISOP is an isotonic IRT model with d jointly isotonic dependent variables (components, aspects,...) which measure the same unidimensional latent dimension. As for ISOP (or 1-ISOP, Scheiblechner, 1995) a weak subject independence axiom (W1) postulates that the subjects are ordered similarly or isotonicly by all items of a psychological test and a weak item independence axiom (W2) postulates that the order of the items is invariant over subjects. Unlike ISOP where there is only one variable to measure performance e.g. accuracy of the response (rating 0,1,2,... m) in d-ISOP there are d jointly isotonic variables e.g. accuracy and speed of the response in a 2-ISOP to characterise the response. Local independence (LI or W3) is assumed in all models. With these axioms sample-free ordinal measurements of items and subjects become feasible. Depending on further axioms, e.g. cancellation of items and subjects (Co) or independence of the dependent variable rating (W4), interval scales for items and subjects or additional interval scales for the ratings of the responses or of the single variates can be constructed. The most well known problem is the speed-accuracy trade-off problem where 2-ISOP offers several solutions.

Reference

Scheiblechner, H. (1995). Isotonic ordinal probabilistic models (ISOP). *Psychometrika*, 60, (2), 281-304.