DIF Analysis with Unknown Groups and Anchor Items

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ABSTRACT: Measurement invariance across items is key to the validity of instruments like a survey questionnaire or an educational test.

Differential item functioning (DIF) analysis is typically conducted to assess measurement invariance at the item level. Traditional DIF analysis methods require knowing the comparison groups (reference and focal groups) and anchor items (a subset of DIF-free items) (see e.g Millsap, 2011). Such prior knowledge may not always be available, and psychometric methods have been proposed for DIF analysis when one piece of information is unknown.

The paper proposes a method for the case when both the anchor items and the groups are unknown. The proposed framework combines ideas of mixture IRT modeling for latent DIF analysis and regularised estimation for manifest DIF analysis with unknown anchor items. More specifically, the unknown groups are modelled by latent classes, and the DIF effects are characterised by item-specific DIF parameters. An L_1-regularised marginal maximum likelihood estimator is proposed, assuming that the number of DIF items is relatively small. This estimator penalises the DIF parameters by a Lasso regularisation term, so that the DIF items can be selected by the non-zero pattern of the estimated DIF parameters. Computing the L_1-regularised estimator involves solving a non-smooth optimisation problem. The proposed method simultaneously identifies the latent classes and the DIF items. A computationally efficient Expectation-Maximisation (EM) algorithm is developed to solve the non-smooth optimisation problem for the regularised estimator.

References

MILLSAP, R. E. 2011. *Statistical Approaches to Measurement Invariance*. Routledge, New York.