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MULTIDIMENSIONAL ITEM RESPONSE MODELS

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ABSTRACT

In this work we propose to study psychometric properties of item response models in theoretical terms and in the applicability to real data. In particular, we explore unidimensional dichotomous (Costa 2006) and polytomous item response models (Linden and Hambleton 1997); we apply unidimensional item response model to multiple groups (Linden and Hambleton 1997); we use the statistical procedures equating and linking (Kolen and Brennan 2004) to compare results obtained by the application of different instruments and we generalize unidimensional logistic item response models to multidimensional models.

In addition, we explore simulation procedures, Markov Chain Monte Carlo (MCMC), for the optimizing estimation procedures. We propose a bayesian estimation procedure through the use of MCMC, to estimate item parameters and latent factors of the two parameter logistic multidimensional compensatory item response model (Reckase 2009). In order to do this, we use the Metropolis-Hastings algorithm (Metropolis et al. 1953; Hastings 1970) with steps of Gibbs (Geman and Geman 1984). All steps of the algorithm and its mathematical fundament are presented and illustrated using a computer application developed in Matlab. The estimation of all parameters of the model is done simultaneously. To test the efficiency of the procedure, we use simulated data considering 2 and 3 latent factors. To select the number of dimensions that best fit the data, we utilize the Akaike's information criteria (Akaike 1981). The results show that good estimates are obtained by the proposed procedure in terms of correlation, mean absolute error and root mean square error, and that the procedure is efficient to estimate the model parameters. We also provide the confirmatory analysis of results obtained by the application of the two parameter logistic multidimensional item response model to real data, using the bayesian estimation procedure proposed. The application of this procedure to real data is an innovation and the results confirm its efficiency.

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