Bayesian covariance adaptive Lasso factor analysis models with ordinal data

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In this study, the previous work on the Bayesian covariance Lasso confirmatory factor analysis (CFA) model in Pan, Ip and Dubé (2017) is extended to take the ordered categorical (ordinal) data into account. The previous work focuses on relaxing the CFA assumption of diagonal residual covariance matrix in continuous data. Unlike the modification index approach, the approach simultaneously models all potentially nonzero elements in the matrix. In the current work, ordinal data are modeled as categories formed by cut-points for an underlying latent continuous variable. An adaptive covariance lasso prior, which avoids the same amount of shrinkage on all elements in the matrix, is assigned to the entire inverse residual covariance matrix of the underlying latent continuous variables. As a result, the matrix is modeled as a sparse positive definite matrix that contains only a few off-diagonal elements bounded away from zero. We developed a Bayesian inference method based on parameter expansion and Markov Chain Monte Carlo procedures, which was shown to achieve model parsimony and provide better fit to data, while keeping the factor structure intact. Our simulation studies showed that under the adaptive graphical lasso prior, the Bayesian estimates of unknown parameters of interest were reliable and had adequate power to detect non-zero residual covariance elements. Real data sets were analyzed to evaluate the validity and practical usefulness of the proposed procedure. In the presentation we will also discuss the generalization of the procedure to item response theory (IRT) for handling local dependency within item clusters.

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