

**DEPARTMENT OF MANAGEMENT SCIENCE AND STATISTICS
RESEARCH SEMINAR SERIES**

**Friday, Feb. 24
2 – 3 p.m. (CST)**

San Pedro1 (downtown) Yotta Room – 430



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“Markov Item Network for Cognitively Diagnostic Classification Models”

Abstract

The talk discusses an exploratory graphical modeling approach for evaluating local item dependence in cognitively diagnostic models (CDMs). CDMs are restricted latent class models that describe an individual's status on a set of discrete latent attributes (e.g., mastery of cognitive skills, pathological symptoms). One of the assumptions of CDMs is local item independence—response variables on the items must be conditionally independent once an individual's latent status is taken into account. While the local independence assumption provides an important foundation for cognitive diagnosis and validity of measurement, it appears a strong assumption and is not warranted in applied settings. In this talk, I present an exploratory graphical modeling approach to evaluating local item dependence within the CDMs. The model integrates a pairwise Markov random field to the generalized CDM so that items' interdependence can be modeled via an undirected spatial network. An inferential framework is proposed based on the regularized pseudo-likelihood and is implemented by an EM algorithm applying the soft-thresholding and gradient-based Newton iteration. Numerical experimentation from Monte Carlo simulation suggests that the estimation adequately recovers the generating parameters and yields reliable standard error estimates. Comparison with a regular CDM showed that the network-integrated model achieves substantially lower bias in the parameter estimation and more accurate classification as items exhibit local dependency. Application to real assessments is provided using two secondary data: the data from a personality questionnaire and an international educational assessment.

Bio

Hyeon-Ah Kang is an assistant professor in the Quantitative Methods program in the Department of Educational Psychology. She also serves as an associate director of the Center for Applied Psychometric Research at the College of Education. She studies theoretical and applied statistics in educational and psychological measurement.