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Chasing Normal Linear Unicorns – More Realistic Fit Indices for SEM

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Abstract

Structural Equation Modeling (SEM) remains a cornerstone of psychological research, providing a means of testing complex theoretical models. However, traditional model fit indices assume that data can be sufficiently summarized by a single covariance matrix and mean vector, an assumption rarely scrutinized despite psychological data frequently exhibiting nonlinear dependencies and subgroup heterogeneity. We compare standard SEM fit indices with alternative approaches that assess misspecification directly from raw data residuals. Specifically, we explore the Hilbert-Schmidt Independence Criterion (dHSIC) in both multiple bivariate and multivariate contexts, the Heteroscedasticity Fit Index (HFI), and multivariate normal energy tests as means of detecting missing dependencies in SEM models. These techniques allow for targeted misspecification checks that distinguish between general model assumption violations and the more crucial issue of unmodeled variable dependencies. While traditional fit indices fail to detect nonlinear misfit, approaches such as dHSIC focus on missing nonlinear dependencies while remaining insensitive to deviations from univariate normality – important, as SEM models primarily concern inter-variable relationships rather than marginal distributions. Recognizing the distinct roles of different fit checks is crucial for advancing SEM beyond its reliance on global covariance structures, enabling more robust and realistic model assessment in psychological research and theory development.

Keywords

SEM, model fit, misspecification

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