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Abstract

Latent class analysis (LCA) is a powerful statistical method for identifying unobserved subgroups within a population based on categorical data. However, selecting the optimal number of latent classes remains a challenge and there is no consensus on which fit index to use. Based on the properties of dichotomous variables, this paper introduces a new fit index that capitalizes on the recovery of the model implied covariance matrix from the response probabilities to measure its discrepancy with the sample covariance matrix S. Based on the pattern matrix
Based on the pattern X where each row represents one of the 2^I binary I-tuples, such as
X=[■(x_1,1&⋯&x_(1,I)@⋮&⋱&⋮@x_(2^I,I)&⋯&x_(2^I,I))],
where x_(i,j)∈{0,1} ∀i∈{1,2,⋯,2^I },j∈{1,2,⋯,I}, I is the number of item, the pattern probabilities are
P_i=Σ*(k=1)^K⁡Π*(j=1)^I⁡〖p(x_(i,j)^((k))) c_k 〗,
where K is the number of classes and c the class probability, we derived the implied covariance matrix
S(θ)=(XP)^’ X-MM^’,
where M_j=Σ*(i=1)^(2^I)⁡〖X(i,j) P_i 〗.
Using the square difference of the Fisher transform of both covariance matrices, we derived a pseudo χ^2statistic. A Monte Carlo simulation was carried out to compare the accuracy and bias of three versions of this fit index with nine usual fit indices (AIC, BIC, saBIC, χ^2, CAIC, AIC3, Lo-Mendell-Rubin, Vuong-Lo-Mendell-Rubin, and the bootstrap LRT). The simulation shows new among the three versions tested, two had very good properties: less bias and more accurate than other indices. The other one had very good accuracy but tended to narrowly miss the correct number of classes leading excessive over-extraction when it failed. Future developments are discussed, i.e., investigating the asymptotic properties of the underlying pseudo-χ^2 distribution, improving the current criteria and extending the index for ordinal scales.

Keywords

Latent class analysis, fit index

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