

# Bayesian Item Response Theory Models with Local Dependence

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## Abstract

Based on response on several items by each of subjects, Item Response Theory (IRT) models aim to make inference on latent factors, item discrimination, item difficulties, and so on. Local independence is a model assumption required to form the likelihood function in classical and neat IRT models. However, the assumption has been found to be violated in many real applications, such as testlet items, mixture models, and time limit tests. Therefore, local dependence (LD) modelings gain much attention in recent year. In the current study, we focus on the LD model in Chen, Li, Liu, and Ying (2018), where they incorporated the Ising model (1925) into IRT models to capture LD among items and proposed some frequentist estimation procedure. In order to further allow those LD parameters to borrow information from each others, we propose some Bayesian inference for the LD model. The main challenge of statistical inference is the intractable posterior distributions. We solve the issue using the pseudo likelihood methods. Simulation studies are conducted to demonstrate the validation of the proposed estimation procedure under various conditions.

Keyword: Bayesian estimation; Ising models; Item Response Theory models; local dependence; pseudo likelihood.