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# Regularized Estimation of the Latent Space Item Response Theory Model

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In latent space item response theory (IRT) modelling, both subjects and items are positioned in R dimensional Euclidian latent space. This framework allows for detailed modelling of local dependences among items and subjects, which are assumed to be absent in conventional IRT models. Latent space IRT has demonstrated its value in diverse fields, including intelligence assessment (Kang & Jeon, 2025; Kim et al., 2014), developmental psychology (Go et al., 2022), mental health (Jeon & Schweinberger, 2024), social influence (Park et al., 2023), national school policy evaluation (Jin et al., 2022), and student monitoring (Jeon et al., 2021). However, its broader application is limited by the computational challenges posed by the Bayesian algorithms commonly used for model estimation.

Therefore, in this presentation, a novel estimation procedure is proposed based on regularized joint maximum likelihood estimation. This approach significantly reduces computational demands making it feasible to conduct more robust model evaluations using K-fold cross-validation. The advantages of this method are illustrated in a simulation study and a real data analysis.

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