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Variational Autoencoders for Models with Latent Classes

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Amortized variational inference (AVI) has recently been proposed in the field of Item response theory as a computationally efficient alternative to marginal maximum likelihood estimation (MML). The current study investigates if the computational advantages of AVI for large, high dimensional data carry over to discrete latent variable models. We adapt three techniques from the machine learning literature to the estimation of discrete latent variable models. In separate simulations, we compare the different approaches for latent class analysis, cognitive diagnostic models and mixture IRT models respectively. Results show that AVI is much faster than MML for mixture IRT models. AVI is also slightly faster than MML for LCA models with a large number of classes and items, and is less likely to end up in local minima. Overall we conclude that AVI provides accurate parameter estimates for all three models discussed, but that the computational advantages are most significant for models that have a mixture of discrete and continuous latent variables, such as mixture IRT.

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