

# A Cross-Validity Comparison of Likelihood Methods for Distributions with Intractable Normalizing Constants

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## Abstract

In statistical applications, researchers often encounter problems of making inference for a model with intractable likelihood function due to a normalizing constant. This problem is especially well-known in marketing when modeling choices from a menu, where a choice of more than one item is possible. We show the bias from relying on Besag's (1972, 1974) pseudo-likelihood and test a method for evaluation of the approximate marginal likelihood. We contrast this approach with the exchange algorithm (Murray et al., 2006), which is designed to avoid evaluation of the ratio of normalizing constants. A comparison of likelihood methods is illustrated based on simulated menu choice data with interactions. The estimation is performed in the framework of the menu-choice model, proposed for the analysis of menu-based data by Kosyakova et al. (2018), in a hierarchical setting. The aim of this paper is to provide some guidance for researchers and practitioners in the choice of the estimation method.

**Keywords:** *intractable-likelihoods; MCMC; hierarchical-Bayes*

**Track:** Methods, Modelling & Marketing Analytics