Approximate maximum likelihood estimation for p_2 network regression models with crossed random effects

Ruggero Bellio[*], Nicola Soriani[†]

Abstract

The class of p_2 models can be used for the study of binary relational data with covariates, typical of social network analysis. Such models have been somewhat underused in empirical applications, though they represent a useful tool, capable of being extended in various directions. A p_2 model is a regression model for multinomial responses, with correlated crossed random effects to represent actor heterogeneity and within-dyad dependence. In the literature there are proposals to estimate the parameters of p2 models either by joint maximization methods (such as MQL o PQL estimation) or following a Bayesian approach and employing MCMC methods. Here we propose a further possibility, based on the Laplace approximation approach coupled with importance sampling. This solution represents a good approximation to maximum likelihood estimation. Its implementation requires some care, but it can be performed efficiently, and we provide details on the software implementation using `R` and `ADMB`. Numerical examples and simulation studies illustrated the methodology.

Key words: Importance Sampling; Numerical Integration; Maximum Likelihood Estimation; Random Effects; Social Network Analysis.

---

[*]Dipartimento di Scienze Economiche e Statistiche, Università di Udine, via Treppo, 18, 33100 Udine, Italy, `ruggero.bellio@uniud.it`

[†]Dipartimento di Scienze Cardiologiche, Toraciche e Vascolari, Università di Padova, Via Loredan, 18, 35121 Padova, Italy, `nicola.soriani@unipd.it`