Statistics > Methodology

Counting processes for correlated binary responses

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We propose a class of continuous-time Markov counting processes for analyzing correlated binary data and establish a correspondence between these models and sums of dependent Bernoulli random variables using a technique called "probabilistic embedding". Our approach generalizes many previous models for correlated outcomes, admits easily interpretable parameterizations, allows different cluster sizes, incorporates ascertainment bias in a natural way, and dramatically simplifies likelihood-based inference. We demonstrate several new models for dependent outcomes, derive explicit likelihood expressions, and provide algorithms for computing maximum likelihood estimates. We show how to incorporate cluster-specific covariates in a regression setting and apply our method to well-known problems from developmental toxicology and familial disease epidemiology.

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