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One-Sided Test to Assess Correlation in Linear Logistic Models using Estimating Equations

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Summary

A score-type test is proposed for testing the hypothesis of independent binary random variables against positive correlation in linear logistic models with sparse data and cluster specific covariates. The test is developed for univariate and multivariate one-sided alternatives. The main advantage of using score test is that it requires estimation of the model only under the null hypothesis, that in this case corresponds to the binomial maximum likelihood fit. The score-type test is developed from a class of estimating equations with block-diagonal structure in which the coefficients of the linear logistic model are estimated simultaneously with the correlation. The simplicity of the score test is illustrated in two particular examples.

Key words: Correlated binary variables; Extra-binomial variation; Generalized estimating equations; Modeling overdispersion; One-sided test; Quantal response data; Quasi-likelihood.

1. Introduction

Overdispersion or extra-binomial variation is a common phenomenon that occurs in modeling grouped binary data and whose occurrence is indicated when the observed variation of the data exceeds the assumption of binomial variation. In particular, if a linear logistic model is used to fit the data, the mean deviance (see definition, for instance, in MCCULLAGH and NELDER, 1989, p.118) may be used to detect the possible occurrence of overdispersed data. Under the assumption of correct model and for large number of individual units, the deviance is well approximated by a χ^2-distribution with $(k-p)$ degrees of freedom, where p denotes the number of parameters and k is the number of proportions. Then, a mean deviance greater than one is an indication of extra-binomial variation. However, when the proportions are based on a small number of individual experimental