

Improved Multivariate Extensions of McNemar's Test

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Abstract: McNemar's test is used on paired binary data to detect differences in the marginal probabilities (marginal homogeneity assumption). Klingenberg and Agresti (2006) considered extensions of McNemar's test to the global assumption of marginal homogeneity between paired vectors of binomial responses when paired multivariate binary data are collected. They suggested test statistics that are based on a generalized estimating equations (GEE) model (Liang and Zeger, 1986), bootstrap tests, and permutation tests. However, for sparse or imbalanced data, these approaches might either be intractable or computationally infeasible. To circumvent this, we propose test statistics that can be derived from a penalized GEE model. This ensures the finiteness of the regression parameters of the GEE model, and hence the existence of the proposed test statistics. We derive closed-form formulae for the proposed tests, investigate their theoretical properties, and assess their performance in finite samples via simulation. The proposed tests are applied to safety data for a drug, in which two doses are evaluated by comparing multiple responses by the same subjects to each one of them.

Key words: Correlated Binary Responses; Generalized Estimating Equations; Hypothesis Testing; McNemar Test; Paired Data

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