cases, is there any reason that conditional coverage should be desired?

In summary, for the first model, $\mathrm{pr}(Y \mid S)$ is the reference distribution for model checking and $\mathrm{pr}(S; \phi)$ is the reference distribution for inference about the parameter ϕ. For the second model, $\mathrm{pr}(A)$, where A represents the ancillary component of $S = Y$, is the reference distribution for model checking and $\mathrm{pr}(S \mid A; \pi)$ is the reference distribution for inference about the parameter π. For the third model, model checking is not possible, and $\mathrm{pr}(Y; \alpha)$ is the reference distribution for inference about any parameter of interest (i.e., any function of α).

Comment

Diana E. Duffy

1. INTRODUCTION

Professor Agresti is to be congratulated for a well-written and timely survey on exact conditional inference for contingency tables. At this point in time, 8 to 10 years after some of the key initial advances in computing strategies (Pagano and Halvorsen, 1981; Mehta and Patel, 1983; Pagano and Tritchler, 1983a, 1983b), it is instructive to take stock of both where the field is presently and where the field may be headed. For practitioners and applied statisticians, Agresti offers a practical introduction to currently available exact methods. For researchers in methodology and in statistical computing and algorithms. Agresti offers directions for possible future research.

Exact conditional inference for contingency tables involves assessing the exact (discrete) sampling distribution of test statistics and parameter estimates of interest after conditioning on the sufficient statistics for nuisance parameters. The sufficient statistics for nuisance parameters correspond directly to certain margins in the corresponding contingency table; as long as one operates within the arena of loglinear models, conditioning on these margins will eliminate the nuisance parameters. The exact sampling distribution of interest is then the distribution over all possible tables that could be observed with certain fixed margins (i.e., those margins fixed by the sampling design plus those margins fixed by the conditioning). I will refer to this set of tables as the conditional reference set. It is worth noting the following correspondence between conditional and unconditional problems: the conditional reference set for a problem with a set S_1 of margins fixed by the sampling design and a set S_2 of margins fixed by conditioning is identical to the sample space for a (different) problem in which margins in both S_1 and S_2 are fixed by the sampling design. For example, the conditional reference set for testing independence in a 2×2 table under product binomial sampling (one-fixed margin) is equivalent to the sample space for a 2×2 table with both margins fixed.

In this commentary, I would like to expand on two areas that offer challenges for future work. Throughout this discussion, I adopt Agresti's notation as described in his Section 1.2 in toto, and I refer to points in his paper by simply giving his name and the section number.

2. BAYES AND RELATED INFERENCES

The existing literature on Bayesian methods for analyzing contingency tables dates at least to Lindley (1964). One way to categorize the proposed methods is through the choice of prior. The simplest methods are those for 2×2 tables under product binomial sampling with beta priors; see Altham (1969, 1971) for examples. Generalizations to full multinomial sampling and to $I \times J$ tables for I or $J > 2$ lead to Dirichlet priors on the cell probabilities. These are discussed in Good (1967, 1975, 1976), Good and Crook (1974), Gunel and Dickey (1974), Crook and Good (1980), and Albert and Gupta (1982, 1983a, 1983b). Normal priors on logarithmic functions of the cell probabilities are discussed in Leonard (1975) and Nazaret (1987). Empirical Bayes analogs of the Dirichlet and normal approaches are described in Albert (1987) and Laird

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