The Likelihood Ratio Test Procedure

Used in logistic regression to test hypotheses concerning the regression coefficients.

Let L_1 be the maximum value of the likelihood of the data without the additional assumption. In other words, L_1 is the likelihood of the data with all the parameters unrestricted and maximum likelihood estimates substituted for these parameters.

Let L_0 be the maximum value of the likelihood when the parameters are restricted (and reduced in number) based on the assumption. Assume k parameters were lost (i.e., L_0 has k less parameters than L_1).

Form the ratio $\lambda = L_0/L_1$. This ratio is always between 0 and 1 and the less likely the assumption is, the smaller λ will be. This can be quantified at a given confidence level as follows:

1. Calculate $\chi^2 = -2 \ln \lambda$. The smaller λ is, the larger χ^2 will be.
2. We can tell when χ^2 is significantly large by comparing it to the upper $100 \times (1-\alpha)$ percentile point of a Chi Square distribution with k degrees of freedom. χ^2 has an approximate Chi-Square distribution with k degrees of freedom and the approximation is usually good, even for small sample sizes.
3. The likelihood ratio test computes χ^2 and rejects the assumption if χ^2 is larger than a Chi-Square percentile with k degrees of freedom, where the percentile corresponds to the confidence level chosen by the analyst.

Note: While Likelihood Ratio test procedures are very useful and widely applicable, the computations are difficult to perform by hand, especially for censored data, and appropriate software is necessary.