

A Consistent Analysis of Granular data via the use of Composite Link Functions

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The concept of Composite Link Functions (CLFs) was devised by Thompson and Baker[1] who presented an example for analysing grouped continuous (granular) data within the framework of Generalised Linear Models (GLM). The Likelihood Analysis of grouped (normal) data as counts of observations within intervals was already well established, however as the intervals are allowed to converge to infinitesimal sizes the Deviance analysis converges on an Analysis which differs from the alternative straightforward GLM Regression based analysis using ANOVA. Edwards[2] (Chapter 9) showed how the test statistics (eg Fisher's F) used in simple regression could be transformed to Deviance test statistics in a standard Likelihood approach. This transformation can be inverted, but in general this back-transformation involves an unknown "residual degrees of freedom"; the algebra associated with CLF suggests a means of assigning this a value. In combination with CLFs this provides a mode of analysis where the granular analysis converges to the standard regression ANOVA and it is argued that the analysis in this form is a useful means of allowing for small sample and granular aspects of a data set analysed through Deviance. The initial consequential changes in analysis are not invariant with respect to uninformative changes in the presentation of data, such as the amalgamation of empty cells, but the consideration of what really constitutes an observation suggests an appropriate way of handling the analysis so that uninformative alterations lead to invariant methods. The technique developed in this way lends itself to a relatively straightforward generalisation of procedural code for analysing granular data.

References

- [1] Thompson, R. and Baker, R.J. (1981). Composite link functions in generalized linear models. *Journal of the Royal Statistical Society, Series C* 30, 125-131
- [2] A.W.F. Edwards (1972) *Likelihood*, Cambridge University Press (reprinted 1987)