

Generalized Linear Models and Extensions

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Abstract:

Generalized linear models were first introduced by Nelder and Wedderburn (JRSS, A, **135**:370-84, 1972) as an extension to the standard normal theory linear model. The assumption of normality is relaxed to the exponential family of distributions and the resulting unified theory includes the standard techniques of log-linear modeling for count data and the logistic model for proportions. Overdispersion can arise in various ways, typically through some failure of the basic model assumptions. We will consider mechanisms that can lead to overdispersion for categorical and count data.

Data analysis and model fitting will be illustrated with many examples using the R system.

Programme:

Generalized Linear Models:

- Definition: exponential family, link function, variance function
- Introduction with examples,
- Estimation: Iterative Weighted Least Squares
- Inference: deviance and analysis of deviance, standard errors and confidence intervals
- Goodness of fit, diagnostics.

Basic normal models:

- Regression, anova and ancova as GLM's.
- Transformations and link functions
- Model checking

Binomial regression models for proportions:

- Transformations and link functions
- Binary regression models
- Contingency tables

Log-linear models for count data:

- Poisson regression models
- Analysis of simple tables.
- Equivalence of binomial and Poisson log-linear models.
- Multinomial models

Overdispersion:

- Causes and consequences
- Two-stage models
- Quasi-likelihood