Poisson Regression

STA 2101/442 Fall 2014

Regression: Outcomes are Counts

- Poisson process model roughly applies
- Examples: Relationship of explanatory variables to
  - Number of children
  - Number of typos in a short document
  - Number of workplace accidents in a short time period
  - Number of marriages
- For large λ, CLT says a normality assumption is okay, but not constant variance

Linear Model for log λ

- $\log \lambda = \beta_0 + \beta_1 x_1 + \ldots + \beta_{p-1} x_{p-1}$
- Implicitly for i = 1, …n
- Everybody in the sample has a different $\lambda = \lambda_i$
- Take exponential function of both sides
- Substitute into Poisson likelihood
- Maximum likelihood as usual
- Likelihood ratio tests, etc.

$$\log \lambda = \beta_0 + \beta_1 x_1 + \ldots + \beta_{p-1} x_{p-1}$$

- Increase x_k with everything else held constant, and
  - Log λ increases by β_k
  - λ is multiplied by $e^{\beta k}$

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