Summary GLM

1. GLM-models
   - Pdf for responses
   - Link-functions
   - Linear component of explanatory variables.
2. Inference
3. Evaluation

Inference

Maximum likelihood estimate for $\theta = (\beta_1, \beta_2, \ldots \beta_p)$

- Multi-dimensional optimization problem.
- Analytic estimates only for Gaussian response.
- Else: Numerical solution:
  - Method of scoring.
  - Uses score statistic and information matrix.

$\Rightarrow \hat{\theta}$

Evaluation

- Look for collinearity and how factors are (e.g levels with few observations, if interaction, does all combination have data)
- Plot standardized residuals;

$$r_i = \frac{y_i - E_{\hat{\theta}}(Y_i)}{\sqrt{Var_{\hat{\theta}}(Y_i)}}$$

histograms, against explanatory variables. Trends? Outliers?

Evaluation statistics

- Score statistic: Inference about μ.
- Wald statistic: Hypothesis for parameters.
- Deviance:

$$D = 2[l(\hat{\theta}; y) - l(\hat{\theta}_{max}; y)]$$

  - Log-likelihood ratio test., for testing fit for models without nuisance parameters.
  - $D \sim \chi^2(\nu)$ when $n \to \infty$. But can be poor approximation for small n.
  - $D_1 - D_2 \sim \chi^2(\nu_1 - \nu_2)$ test to compare nested models.
  - Same role as residual variance in ANOVA.

- AIC:

$$-2l(\hat{\theta}; y) + 2p$$

  the smaller the better. Compare (non-nested) models.