Day 7 - deviance

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Newton-Raphson

Basically, all you need to know is $f(x_1) = f(x_0)+(x_1-x_0)f'(x_0)+\frac{1}{2!}(x_1-x_0)^2f''(x_0)+\frac{1}{3!}(x_1-x_0)^3f'''(x_0)+\ldots,$, which intuitively is similar to $f(x_1) \approx f(x_0) + (x_1 - x_0)f'(x_0) \approx f(x_0) + \Delta x \times \frac{\Delta y}{\Delta x}$. We use this to find roots.

Weighted Least Squares

Corrects for heteroskedasticity, but does not allow for covariation. We will go over this when we get to Bayesian. It is almost never the best solution.

Iterative Weighted Least Squares

We want to maximize the likelihood, and minimize the loss. Algorithm:

- Assign starting values to the weights, generally equal to one
- Estimate beta using weighted least squares with the current weights
- Update the weights using the new estimated mean vector
- Repeat Steps 2 and 3 until convergence

Profile Likelihood Confidence Intervals

Wald-type intervals with upper and lower bounds computed in the following way:

$[LB, UB] = \hat{\beta}_k \pm z_{1-\frac{\alpha}{2}} \times \sqrt{VC_{k,k}}$

We can (should) use the t-distribution for moderate sample sizes.

LRT: $2[\ell(\hat{\theta}, \hat{\psi}) - \ell(\theta_0)] \sim \chi^2(1)$