Maximum likelihood part 2

Log-likelihood tests

Log-Likelihood ratio test:

- Compare how well two models fit the data
- One of the null hypothesis has particular parameters; the other is the alternative hypothesis which has free-er parameter values. This is a similar situation to general linear models (chapter 18).

Log-Likelihood ratio =

$$\ln\left[\frac{likelihood[Maximum\_likelihood\_hypothesis]}{likelihood[Null\_hypothesis]}\right]$$

G = 2*Log-Likelihood ratio

Log-Likelihood ratio test:

- Compare how well two models fit the data

Log-Likelihood ratio = $$\ln\left[\frac{likelihood[Maximum\_likelihood\_hypothesis]}{likelihood[Null\_hypothesis]}\right]$$

- **Test statistic:**

$$\chi^2 = 2loglikelihood\_ratio$$

** If H_O is true, G follows* χ^2 distribution

Log-Likelihood ratio test:

- Compare how well two models fit the data

Log-Likelihood ratio = $\ln\left[\frac{likelihood[Maximum\_likelihood\_hypothesis]}{likelihood[Null\_hypothesis]}\right]$

- **Test statistic:**

$\chi^2 = 2loglikelihood\_ratio$

Example: 3 out of 8 individuals are male

H_0: 50% are male

H_A: not 50% are male

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$$L[p = 3/8 \mid 3males, 5females] = \binom{8}{3}(3/8)^3(1-3/8)^5 = 0.2816$$

Remember:

$$L[p = 3/8 \mid 3males, 5females] = P[3males, 5females \mid p = 3/8]$$

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Likelihood of Null Hypothesis:

$$L[p=0.5]=\binom{8}{3}(0.5)^3(1-0.5)^5=0.2188$$

Log-Likelihood ratio test:

- Compare how well two models fit the data

Log-Likelihood ratio =

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- **Test statistic:**

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Example: 3 out of 8 individuals are male

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$$\ln\left[\frac{L[p=3/8]}{L[p=0.5]}\right] = \ln\left[\frac{0.2816}{0.2188}\right] = 0.2526$$

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- Compare how well two models fit the data

Log-Likelihood ratio =

$$\ln\left[\frac{likelihood[Maximum\_likelihood\_hypothesis]}{likelihood[Null\_hypothesis]}\right]$$

- **Test statistic:**

$$\chi^2 = 2loglikelihood\_ratio$$

Example: 3 out of 8 individuals are male

H_0: 50% are male

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$$\ln\left[\frac{L[p=3/8]}{L[p=0.5]}\right] = \ln\left[\frac{0.2816}{0.2188}\right] = 0.2526$$

$$\chi^2 = 2(0.2526) = 0.5051$$

df = 1 ← fixed one variable in the null hypothesis (p)

$X^2_{0.05,1} = 3.84$ **, FTR H_0**