Lec 3

$$D = 2\left(\ell\left(\theta_{best} \mid y\right) - \ell\left(\hat{\theta} \mid y\right)\right)$$

$$= 2\left(\sum_{i=1}^{n} \ell\left(\theta_{best} \mid y_i\right) - \sum_{i=1}^{n} \ell\left(\hat{\theta} \mid y\right)\right)$$

$$= 2\sum_{i=1}^{n}\left(\ell\left(\theta_{best} \mid y_i\right) - \ell\left(\hat{\theta} \mid y_i\right)\right)$$

Poisson

$$\mathcal{L}(\lambda \mid y_i) = \frac{\lambda^{y_i} e^{-\lambda}}{y_i!}$$

$$\ell(\lambda \mid y_i) = y_i \log\lambda - \lambda - \log y_i!$$

$$E(y_i) = \lambda$$

$$Var(y_i) = \lambda$$

Best

$$E(y_i) = y_i = \lambda_{best}$$

model

$$E(y_i) = \hat{\lambda}$$

$$\ell(\lambda_{best} \mid y_i) - \ell(\hat{\lambda} \mid y_i)$$

$$= \left(y_i \log y_i - y_i - \log y_i!\right) - \left(y_i \log \hat{\lambda} - \hat{\lambda} - \log y_i!\right)$$

$$= y_i \log y_i/\hat{\lambda} - (y_i - \hat{\lambda})$$

$$D = 2 \sum_{i=1}^{n} \left(y_i \log \frac{y_i}{\hat{\lambda}} - (y_i - \hat{\lambda}) \right)$$

Normal

$$\ell(\mu, \sigma^2 \mid y_i) = -\frac{1}{2} \log 2\pi\sigma^2 - \frac{1}{2}\frac{(y_i - \mu)^2}{\sigma^2}$$

Best $\quad E(y_i) = y_i = \mu$

model $\quad E(y_i) = \hat{\mu}$

$$\ell(\theta_{best} \mid y_i) - \ell(\theta \mid y_i)$$

$$= -\frac{1}{2}\frac{(y_i - y_i)^2}{\sigma^2} + \frac{1}{2}\frac{(y_i - \mu)^2}{\sigma^2} = -\frac{1}{2}\frac{(y_i - \mu)^2}{\sigma^2}$$

$$D = \frac{(y_i - \mu)^2}{\sigma^2}$$