

Logistic Regression

$$\ln\left(\frac{\hat{\pi}}{1-\hat{\pi}}\right) = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2$$

$$X_1 = \begin{cases} 1 & \text{if male} \\ 0 & \text{if female} \end{cases}$$

$$\hat{\pi} = P(Y=1|X_1) \quad \text{where } 1 = \text{"survived"}$$

$$\ln\left(\frac{\hat{\pi}}{1-\hat{\pi}}\right) = \begin{cases} 1.05 - 2.5 & \text{if male} \\ 1.05 & \text{if female} \end{cases}$$

$$\hat{\pi} = \begin{cases} \frac{e^{1.05-2.5}}{1+e^{1.05-2.5}} & \text{if male} \\ \frac{e^{1.05}}{1+e^{1.05}} & \text{if female} \end{cases}$$

$$\left(e^{-2.5}\right) \left(\begin{array}{l} \text{odds} \\ \text{ratio} \end{array} \begin{array}{l} \text{for } fe \\ \text{male} \end{array} \right) = \left(\begin{array}{l} \text{odds} \\ \text{ratio} \end{array} \begin{array}{l} \text{for} \\ \text{male} \end{array} \right)$$

$$\left(\frac{\pi}{1-\pi} \right)$$

$$\left(\begin{array}{l} \text{odds} \\ \text{ratio} \end{array} \begin{array}{l} \text{for } fe \\ \text{male} \end{array} \right) = \left(e^{2.5} \right) \left(\begin{array}{l} \text{odds} \\ \text{ratio} \end{array} \begin{array}{l} \text{for} \\ \text{male} \end{array} \right)$$

$$\begin{aligned}\hat{\pi} &= \hat{P}(Y=1|X) \\ &= \frac{P(X|Y=1)P(Y=1)}{P(X)}\end{aligned}$$

$$P(X | Y=1) = \text{normal pdf} \\ = \frac{1}{\sqrt{\pi \sigma_1^2}} e^{-\frac{(x-\mu_1)^2}{2\sigma_1^2}}$$

Where μ_1 is the mean X
for $Y=1$ and σ_1 is the SD of
 X for $Y=1$

Bayes Rule

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

$$P(Y=0) = \frac{P(X|Y=0)P(Y=0)}{P(X)}$$

Bayes Classifier

$$\hat{Y} = \begin{cases} 1 & \text{if } P(X|Y=1)P(Y=1) \\ & > P(X|Y=0)P(Y=0) \\ 0 & \text{if not} \end{cases}$$

LDA if $\sigma_1 = \sigma_0$

same SD for $Y=0$ and
 $Y=1$

QDA if $\sigma_1 \neq \sigma_0$