STA 406 Week 03 06.10.2020

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Definition of Odds

$\mathbb{P}(Y=1) = p$ $\quad \omega(Y=1) = \frac{p}{1-p}$

$\omega(Y=0) = \frac{1-p}{p}$

$\mathbb{P}(Y \le y) = F_Y(y)$ $\quad \omega(Y \le y) = \frac{F_Y(y)}{1-F_Y(y)}$

$\mathbb{P}(D=1 \mid E) = p_E$

$\mathbb{P}(D=1 \mid \bar{E}) = p_{\bar{E}}$

$$\frac{\frac{p_E}{1-p_E}}{\frac{p_{\bar{E}}}{1-p_{\bar{E}}}} = OR$$

$$\frac{\frac{p_E}{1-p_E}}{\frac{p_{\bar{E}}}{1-p_{\bar{E}}}} \quad \frac{9:1}{1} = 9$$

$$\frac{\omega}{1+\omega} = p$$

$\mathbb{P}(Y=1 \mid x) = \text{expit}(\theta \pm x^T\beta)$

↓ log ORs

POLR Model

$Y \in \{ y_1 < y_2 < \dots < y_K \}$

$$F_{Y|X}(y_k|x) = \text{expit}(\theta_k + x^T\beta)$$

$F_{Y|X}(y_k|x) = P(Y \le y_k|x)$

$\text{expit}(\theta_k + x^T\beta)$: log OR

θ_k , $k = 1, \dots, K-1$

- θ_k are the log odds of belonging to class y_k or below

- $P(Y = y_k) = P(Y \le y_k) - P(Y \le y_{k-1})$

- β are restricted to be same for each class boundary
  $\Rightarrow$ "proportional odds assumption"