ZIP models

Recap: Zero-inflated Poisson (ZIP) model

$$P(Y_i = y) = \begin{cases} e^{-\lambda_i}(1-\alpha_i) + \alpha_i & y = 0 \\ \dfrac{e^{-\lambda_i}\lambda_i^y}{y!}(1-\alpha_i) & y > 0 \end{cases}$$

where

$$\log\left(\frac{\alpha_i}{1-\alpha_i}\right) = \gamma_0 + \gamma_1 FirstYear_i + \gamma_2 OffCampus_i + \gamma_3 Male_i$$

$$\log(\lambda_i) = \beta_0 + \beta_1 FirstYear_i + \beta_2 OffCampus_i + \beta_3 Male_i$$

Fitted model

$$P(Y_i = y) = \begin{cases} e^{-\lambda_i}(1-\alpha_i) + \alpha_i & y = 0 \\ \dfrac{e^{-\lambda_i}\lambda_i^y}{y!}(1-\alpha_i) & y > 0 \end{cases}$$

$$\log\left(\frac{\widehat{\alpha}_i}{1-\widehat{\alpha}_i}\right) = -0.40 + 0.89 FirstYear_i - 1.69 OffCampus_i - 0.07 Male_i$$

$$\log(\widehat{\lambda}_i) = 0.80 - 0.16 FirstYear_i + 0.37 OffCampus_i + 0.98 Male_i$$

Warm up: Class activity

https://sta712-f22.github.io/class_activities/ca_lecture_29.html

Class activity

$$P(Y_i = y) = \begin{cases} e^{-\lambda_i}(1-\alpha_i) + \alpha_i & y = 0 \\ \dfrac{e^{-\lambda_i}\lambda_i^y}{y!}(1-\alpha_i) & y > 0 \end{cases}$$

$$\log\left(\frac{\widehat{\alpha}_i}{1-\widehat{\alpha}_i}\right) = -0.40 + 0.89 FirstYear_i - 1.69 OffCampus_i - 0.07 Male_i$$

$$\log(\widehat{\lambda}_i) = 0.80 - 0.16 FirstYear_i + 0.37 OffCampus_i + 0.98 Male_i$$

> What is the estimated probability that a male first year student who lives on campus *never* drinks?

Class activity

$$P(Y_i = y) = \begin{cases} e^{-\lambda_i}(1-\alpha_i) + \alpha_i & y = 0 \\ \dfrac{e^{-\lambda_i}\lambda_i^y}{y!}(1-\alpha_i) & y > 0 \end{cases}$$

$$\log\left(\frac{\widehat{\alpha}_i}{1-\widehat{\alpha}_i}\right) = -0.40 + 0.89 FirstYear_i - 1.69 OffCampus_i - 0.07 Male_i$$

$$\log(\widehat{\lambda}_i) = 0.80 - 0.16 FirstYear_i + 0.37 OffCampus_i + 0.98 Male_i$$

> What is the estimated probability that a male first year student who lives on campus consumed 3 drinks last weekend?

Fitting ZIP models