Considerations/Extensions

Wednesday, September 1, 2021   6:24 PM

- Qualitative Predictors
  - Non-numerical $\Rightarrow$ Binary/Bernoulli or Multinomial

  - Dummy variable:

$$x_i \begin{cases} 1 & \text{condition is true} \\ 0 & \text{otherwise} \end{cases}$$

$$\therefore \quad y_i = \beta_0 + \beta_1 x_i + \varepsilon_i = \begin{cases} \beta_0 + \beta_1 + \varepsilon_i \\ \beta_0 + \varepsilon_i \end{cases}$$

OR

$$x_i = \begin{cases} 1 & \text{condition true} \\ -1 & \text{otherwise} \end{cases}$$

Multinomial
  $\hookrightarrow$ More than two levels (factor)

$$x_{i1} = \begin{cases} 1 & \text{Red} \\ 0 & \neg \text{Red} \end{cases} \qquad x_{i2} = \begin{cases} 1 & \text{Blue} \\ 0 & \neg \text{Blue} \end{cases}$$

$$\therefore \quad y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \varepsilon_i = \begin{cases} \beta_0 + \beta_1 + \varepsilon & \text{Red} \\ \beta_0 + \beta_2 + \varepsilon & \text{Blue} \\ \beta_0 + \varepsilon & \text{Green} \end{cases}$$

- Additive Assumption
  - Interaction between features:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

$$\Downarrow$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \boxed{\beta_3 X_1 X_2} + \varepsilon$$

- Linearity Assumption
  - Polynomial (Quadratic):

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

$$\Downarrow$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_1^2 + \varepsilon$$