Research on Feature Selection in Logistic Regression

Machine Learning Algorithm

Logistic Regression.

- → Supervised Machine Learning Algorithm
- → classify the output either 0 or 1 or multi-class
- → uses Sigmoid as Activation function or Soft-max
- → useful for Fraud, Spam, Diagonsis, Customer purn
- → Loss function evaluate the true labeled value vs Predicted value.
- → Uses Cross-entropy (for-binary Classification)
- → uses Categorical Cross-Entropy (for Multi-Class classification)

Logistic Regression takes Linear Combination

$$z = \text{bias} + x_1 w_1 + x_2 w_2 + \cdots + x_n w_n$$

where bias is the additional weight

$x_n \Rightarrow$ inputs for each feature

$w_n \rightarrow$ weights for each feature

Sigmoid Activation function $\sigma(x)$:-

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

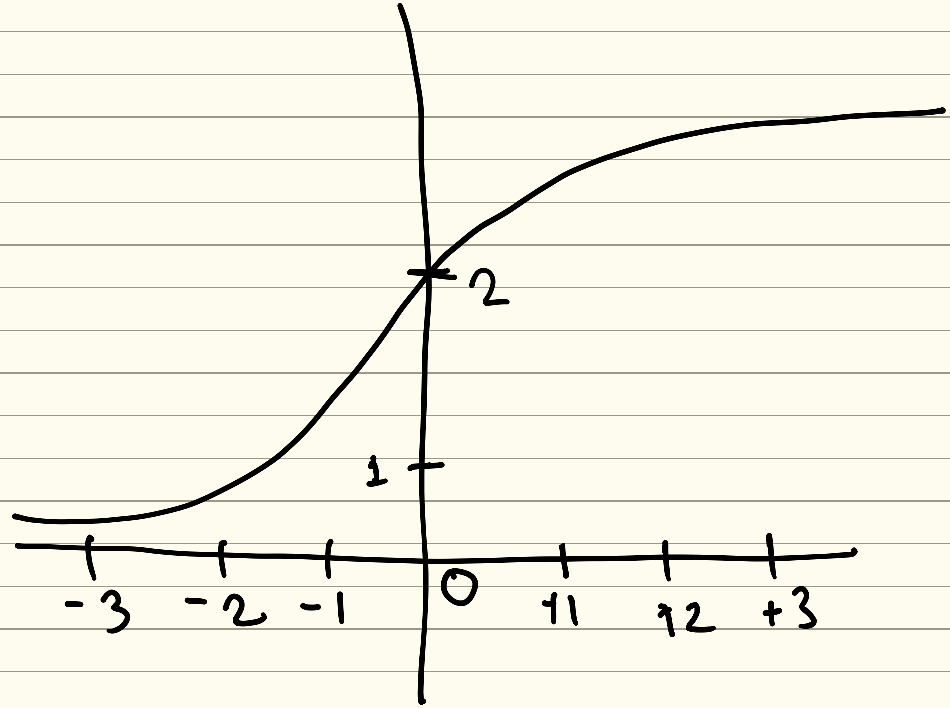


fig. logistic Curve.

Before Diving Into Logistic Regression

We must understand the probability Concept on

odds of success (θ)

$$\theta = \frac{p}{1-p}$$ where p is the probability

So,

$$\theta \Rightarrow \frac{p}{1-p}$$

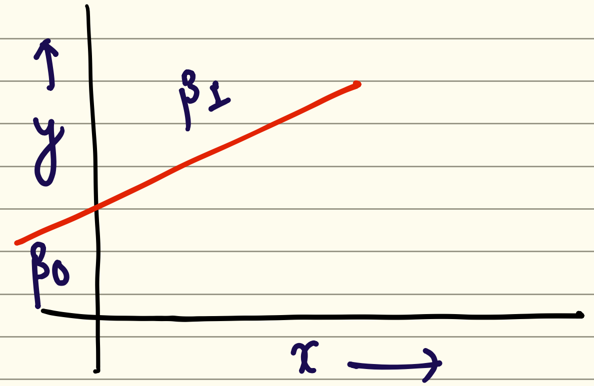
$$\Rightarrow \frac{\text{Probability of an event happening}}{\text{Probability of an event not happening}}$$

$$\boxed{\theta \Rightarrow \frac{p}{1-p}}$$

Here the value of Probability lies between Range of 0 to 1
But the θ or odds range from 0 to ∞.

Let's understand the straight line related to the logistic Regression

$$\boxed{y = \beta_0 + \beta_1 x}$$



Now to predict the odds of success, we take log on odds formula:

$$\log\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + \beta_1 x$$

- Exponentiating both sides, we have

$$e^{\ln\left(\frac{p(x)}{1-p(x)}\right)} = e^{\beta_0+\beta_1 x} \qquad \left[e^{\ln(x)} = x\right]$$

$$\frac{p(x)}{1-p(x)} \Rightarrow e^{\beta_0+\beta_1 x}$$

Let, $Y = e^{\beta_0+\beta_1 x}$

then $\frac{p(x)}{1-p(x)} \Rightarrow Y$

$$p(x) = Y - Y p(x)$$

$$p(x) + Y p(x) = Y$$

$$p(x) \Rightarrow \frac{Y}{Y+1}$$

$$p(x) \Rightarrow \frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}}$$

$\Rightarrow$ Dividing by $e^{\beta_0+\beta_1 x}$

$$\Rightarrow \frac{\dfrac{e^{\cancel{\beta_0+\beta_1 x}}}{e^{\cancel{\beta_0+\beta_1 x}}}}{\dfrac{1+e^{\beta_0+\beta_1 x}}{e^{\beta_0+\beta x}}}$$

$$\Rightarrow \frac{1}{\dfrac{1}{e^{\beta_0+\beta x}}+\dfrac{e^{\cancel{\beta_0+\beta x}}}{e^{\cancel{\beta_0+\beta x}}}}$$

$$\Rightarrow \frac{1}{\dfrac{1}{e^{\beta_0+\beta x}}+1} \Rightarrow \frac{1}{1+e^{-(\beta_0+\beta x)}}$$