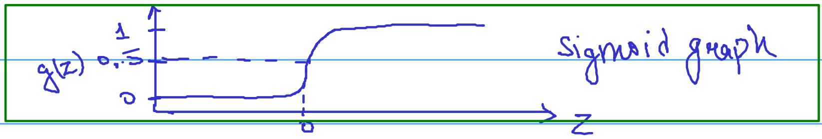
Logistic Regression Steps

Hypothesis Function - $h_\theta(x) = \theta^T x$ [Linear Regression Hypothesis]

In logistic regression, we modify the above equation a bit by adding sigmoid f^n to it

$$h_\theta(x) = g(\theta^T x), \quad \boxed{g(x) = \frac{1}{1+e^{-x}}} \rightarrow \text{sigmoid } f^n$$

$$\therefore h_\theta(x) = \frac{1}{1+e^{-\theta^T x}}$$



Logistic Regression Cost function

$$J(\theta) = -\left[y \log(h_\theta(x)) + (1-y)\log(1-h_\theta(x)) \right]$$

if $h_\theta(x) = \hat{y}$, $J(\theta) = -\left[y \log \hat{y} + (1-y)\log(1-\hat{y}) \right]$

$\log 0$ = undefined / $-\infty$

$\log 1 = 0$

$$J(\theta) = \left[\begin{array}{l} \text{if } y=0 \;\&\; \hat{y}=0, \; J(\theta) = -(1-y)\log(1-\hat{y}) = 0 \\ \text{if } y=0 \;\&\; \hat{y}=1, \; J(\theta) = -(1-y)\log(1-\hat{y}) = -[1] * -\infty = \infty \\ \qquad \hookrightarrow 0, \log 0 = -\infty \\ \text{if } y=1, \hat{y}=1, \; J(\theta) = -[y \boxed{\log(\hat{y})}] = 0 \quad \rightarrow \log 1 = 0 \\ \text{if } y=1, \hat{y}=0, \; J(\theta) = -[y\log(\hat{y})] \rightarrow \log(0) = -\infty \\ \qquad = -1 \times [+1 \times -\infty] \\ \qquad = -1 \times -\infty = \infty \end{array} \right.$$

cost f^n leads to ∞, when the predictor values is misclassifying

Logistic regression cost f^n is complex, to compute the right value of θ, we need to minimize $J(\theta)$

$$\frac{\delta J(\theta)}{\delta \theta} = \frac{1}{m}(h_\theta(x) - y)x \; ; \quad \{ \theta_j = \theta_j - \alpha (h_\theta(x) - y)x \}$$

Iterate until convergence

$\alpha \hookrightarrow$ learning rate