<Regularized Logistic Regression>

* Logistic Regression model

$$f_{\vec{w},b}(\vec{x}) = \frac{1}{1+e^{-z}}$$

* cost function

$$\boxed{J(\vec{w},b)} = -\frac{1}{m}\sum_{i=1}^{m}\left[y^{(i)}\log\left(f_{\vec{w},b}(\vec{x}^{(i)})\right) + (1-y^{(i)})\log\left(1-f_{\vec{w},b}(\vec{x}^{(i)})\right)\right] + \frac{\lambda}{2m}\sum_{j=1}^{n} w_j^2$$

objective : $\min_{\vec{w},b} J(\vec{w},b)$

* gradient descent

repeat {

$$w_j := w_j - \alpha\frac{\partial}{\partial w_j}\boxed{J(\vec{w},b)}$$

$$b := b - \alpha\frac{\partial}{\partial b}J(\vec{w},b)$$

} simultaneous update

derivative ⟹

$$\frac{1}{m}\sum_{i=1}^{m}\left[\left(f_{\vec{w},b}(\vec{x}^{(i)}) - y^{(i)}\right)x_j^{(i)}\right] + \frac{\lambda}{m}w_j$$

$$\frac{1}{m}\sum_{i=1}^{m}\left(f_{\vec{w},b}(\vec{x}^{(i)}) - y^{(i)}\right)$$

* $f_{\vec{w},b}(\vec{x}^{(i)}) = \frac{1}{1+e^{-z}}$ (not linear regression model !)