Logistic Regression With Regularization Parameters

Cost function

$$J(\theta_0,\theta_1) = -y\log(h_\theta(x)) - (1-y)\log(1-h_\theta(x))$$

$$h_\theta(x) = \frac{1}{1+e^{-(\theta_0+\theta_1 x_1)}}$$

$$J(\theta_0,\theta_1) = \begin{cases} -\log(h_\theta(x)) & \text{if } y=1 \\ -\log(1-h_\theta(x)) & \text{if } y=0 \end{cases}$$

Reduce Overfitting ⇓

$$J(\theta_0,\theta_1) = -y\log(h_\theta(x)) - (1-y)\log(1-h_\theta(x)) + \lambda_2 \text{ Regularization}$$

feature selection ⇙

$$J(\theta_0,\theta_1) = -y\log(h_\theta(x)) - (1-y)\log(1-h_\theta(x)) + \lambda_1 \text{ Regularization}$$

$$J(\theta_0,\theta_1) = -y\log(h_\theta(x)) - (1-y)\log(1-h_\theta(x)) + \lambda_2 \text{ Reg} + \lambda_1 \text{ Reg.}$$

- **λ_2 Regularization** ⇒ Reduce Overfitting

$$J(\theta_0,\theta_1) = -y\log(h_\theta(x)) - (1-y)\log(1-h_\theta(x)) + \lambda \sum_{i=1}^{n} (\text{slope})^2$$

λ_1 Regularization ⇒ Feature selection

λ ⇒ Hyperparameter

$$J(\theta_1, \theta_1) = -y \log(h_\theta(x)) - (1-y) \log(1-h_\theta(x)) + \lambda \sum_{i=1}^{n} |\text{slope}_i|$$

- ElasticNet

$$J(\theta_1, \theta_1) = -y \log(h_\theta(x)) - (1-y) \log(1-h_\theta(x)) + \lambda_1 \sum_{i=1}^{n} (\text{slope}_i)^2 + \lambda_2 \sum_{i=1}^{n} |\text{slope}_i|$$

C & λ Relationship

$$C = \frac{1}{\lambda} \Rightarrow \lambda = \frac{1}{C}$$