

Exercise 3:

In slide 18 of Chapter 3, we didn't derive the gradient of the cost function for the logistic regression during the lecture.

Please start from the cost function and derive the **partial derivative of $J(\theta)$ w.r.t θ_j** step by step using your calculus knowledge. Submit a document describing your step-by-step computations.

Gradient Descent

$$J(\theta) = \frac{1}{m} \sum_{i=1}^m \left[-y^{(i)} \log(h_{\theta}(x^{(i)})) - (1 - y^{(i)}) \log(1 - h_{\theta}(x^{(i)})) \right]$$

Want $\min_{\theta} J(\theta)$:

Repeat{

$$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta)$$

}

(simultaneously update all θ_j)

Notice the fact that for
 $g(z) = \frac{1}{1+e^{-z}}$
 $g'(z) = g(z)(1 - g(z))$

Repeat {

$$\theta_j := \theta_j - \alpha \frac{1}{m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)}) x_j^{(i)}$$

}

(simultaneously update all θ_j)

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