

牛顿一次迭代求Logistic解析解

$$J(\theta) = \frac{1}{m} \sum_{i=1}^m \log(1 + e^{-y^{(i)} \theta^T x^{(i)}}) = -\frac{1}{m} \sum_{i=1}^m \log(h_{\theta}(y^{(i)} x^{(i)}))$$

• Solution:

$$\begin{aligned} \nabla J(\theta) &= -\frac{1}{m} \sum_{i=1}^m y^{(i)} x^{(i)} (1 - h_{\theta}(y^{(i)} x^{(i)})) \\ H &= \frac{\partial J}{\partial \theta \partial \theta^T} = \frac{\partial J}{\partial \theta} \left( \frac{1}{m} \sum_{i=1}^m y^{(i)} x^{(i)} h_{\theta}(y^{(i)} x^{(i)}) \right)^T \\ &= \frac{1}{m} \sum_{i=1}^m y^{(i)^2} h_{\theta}(y^{(i)} x^{(i)}) (1 - h_{\theta}(y^{(i)} x^{(i)})) x^{(i)} x^{(i)T} \\ &= \frac{1}{m} \sum_{i=1}^m h_{\theta}(y^{(i)} x^{(i)}) (1 - h_{\theta}(y^{(i)} x^{(i)})) x^{(i)} x^{(i)T} \end{aligned}$$

• Iteration:

$$x := x - \frac{\nabla J(\theta)}{H} = x + \frac{\sum_{i=1}^m y^{(i)} x^{(i)} (1 - h_{\theta}(y^{(i)} x^{(i)}))}{\sum_{i=1}^m h_{\theta}(y^{(i)} x^{(i)}) (1 - h_{\theta}(y^{(i)} x^{(i)})) x^{(i)} x^{(i)T}}$$