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XLessons

This Course: Machine Learning

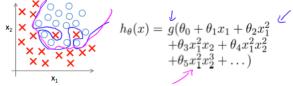
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## Regularized Logistic Regression

We can regularize logistic regression in a similar way that we regularize linear regression. As a result, we can avoid overfitting. The following image shows how the regularized function, displayed by the pink line, is less likely to overfit than the non-regularized function represented by the blue line:

## Regularized logistic regression.



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

$$+ \underbrace{\frac{1}{2m}\sum_{j=1}^{n}\Theta_{j}^{(i)}}_{j=1} \Theta_{i}, \Theta_{i}, \dots, \Theta_{n}$$

## Cost Function

Recall that our cost function for logistic regression was:

$$J( heta) = -rac{1}{m}\sum_{i=1}^m [y^{(i)} \; \log(h_{ heta}(x^{(i)})) + (1-y^{(i)}) \; \log(1-h_{ heta}(x^{(i)}))]$$

We can regularize this equation by adding a term to the end:

$$J( heta) = -rac{1}{m}\sum_{i=1}^m [y^{(i)} \; \log(h_ heta(x^{(i)})) + (1-y^{(i)}) \; \log(1-h_ heta(x^{(i)}))] + rac{\lambda}{2m}\sum_{j=1}^n heta_j^2$$

The second sum,  $\sum_{j=1}^n \theta_j^2$  means to explicitly exclude the bias term,  $\theta_0$ . i.e. the  $\theta$  vector is indexed from 0 to n (holding n+1 values,  $\theta_0$  through  $\theta_n$ ), and this sum explicitly skips  $\theta_0$ , by running from 1 to n, skipping 0. Thus, when computing the equation, we should continuously update the two following equations:

## **Gradient descent**

Repeat -

$$\theta_0 := \theta_0 - \alpha \frac{1}{m} \sum_{i=1}^m (h_\theta(x^{(i)}) - y^{(i)}) x_0^{(i)}$$

$$\theta_j := \theta_j - \alpha \underbrace{\left[ \frac{1}{m} \sum_{i=1}^m (h_\theta(x^{(i)}) - y^{(i)}) x_j^{(i)} + \frac{\lambda}{m} \Theta_j \right]}_{\left(j = \mathbf{X}, 1, 2, 3, \dots, n\right)}$$

$$\frac{\lambda}{\lambda \Theta_j} \underbrace{\mathbf{J}(\Theta)}_{\left(\mathbf{Y}, \mathbf{Y}, \mathbf$$

Mark as completed



