Review questions linear regression

Wendy Nieuwkamer

14-09-2016

1 Question 6

Apply gradient descent by hand onthe training set given in Table 1.

Gradient descent algorithm

repeat until convergence {

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

$$\theta_1 := \theta_1 - \alpha \frac{1}{m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)}\right) \cdot x^{(i)}$$

}

Hypothesis:

$$h_\theta(x^{(i)}) = \theta_0 + \theta_1 x^{(i)} \tag{1}$$

Table 1: Training examples

x	y
3	2
1	2
0	1
4	3

We have four training examples, so $m = 4$. Let's take $\alpha = 0.1$. And start values $\theta_0 = -1.0$ and $\theta_1 = 0.5$. First, do the calculations as seen in equations 2 to 9.

$$\theta_0 = \theta_0 - \alpha \frac{1}{4} \sum_{i=1}^{4} (h_\theta(x^{(i)}) - y^{(i)}) \tag{2}$$

$$= -1.0 - 0.1 \cdot \frac{1}{4} \cdot (-1.5 - 2.5 - 2 - 2) \tag{3}$$

$$= -1.0 - 0.1 \cdot 0.25 \cdot -8 \tag{4}$$

$$= -0.8 \tag{5}$$

$$\theta_1 = \theta_1 - \alpha \frac{1}{4} \sum_{i=1}^{4} (h_\theta(x^{(i)}) - y^{(i)}) x^{(i)} \tag{6}$$

$$= 0.5 - 0.1 \cdot \frac{1}{4} \cdot (-4.5 - 2.5 + 0 - 8) \tag{7}$$

$$= 0.5 - 0.1 \cdot 0.25 \cdot -15 \tag{8}$$

$$= 0.875 \tag{9}$$

Then, assign the new values to θ; $\theta_0 = -0.8$ and $\theta_1 = 0.875$. Repeat this process until it starts to converge or diverge. In the latter case choose α smaller. Otherwise, you have approached the optimal values for θ_0 and θ_1. The best way to decide wether you are close to the optimum is by looking at the gradient. If this approaches zero it means you are approaching the optimum.