Linear Regression with one variable

Lecture 2.3

Cost Function Intuition #1

Hypothesis:

$$h_\theta(x) = \theta_0 + \theta_1 \cdot x$$

Parameters:

θ_0, θ_1

Cost Function:

$$J(\theta_0, \theta_1) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)}\right)^2$$

Goal: minimize $J(\theta_0, \theta_1)$ over θ_0, θ_1

$h_\theta(x) = \theta_1 \cdot x$

$\theta_0 = 0$

θ_1

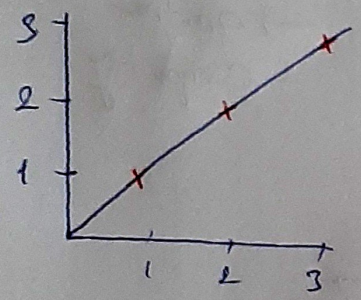
$$J(\theta_1) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)}\right)^2$$

$h_\theta(x^{(i)}) \rightarrow \theta_1 x^{(i)}$

minimize $J(\theta_1)$ over θ_1

$h_\theta(x)$

(for fixed θ_1, this is a function of x)



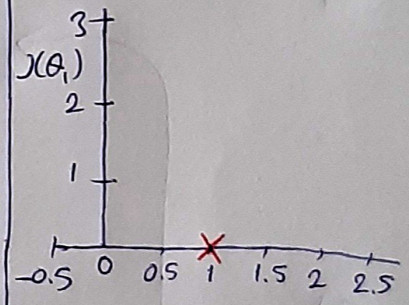
$$J(\theta_1) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)}\right)^2$$

$$= \frac{1}{2m} \sum_{i=1}^{m} \left(\theta_1 x^{(i)} - y^{(i)}\right)^2$$

$$= \frac{1}{2m} (0^2 + 0^2 + 0^2) = 0^2$$

$J(\theta_1)$

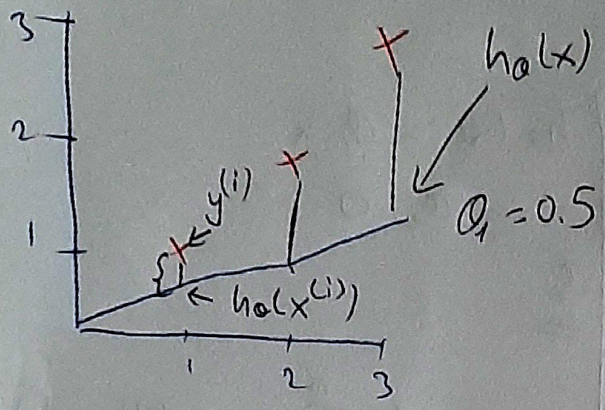
(function of the parameter θ_1)



$J(1) = 0$

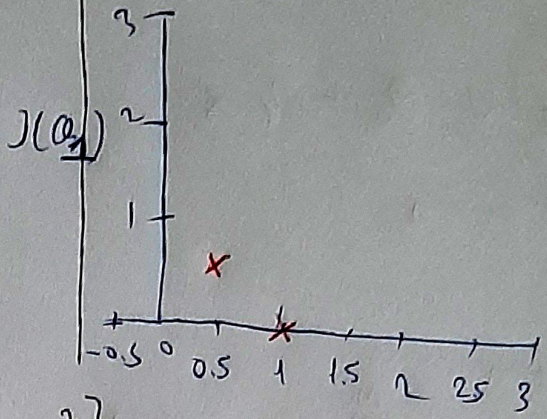
$h_\theta(x)$

(for fixed θ_1, this is a function of x)



$J(\theta_1)$

(function of the parameter θ_1)



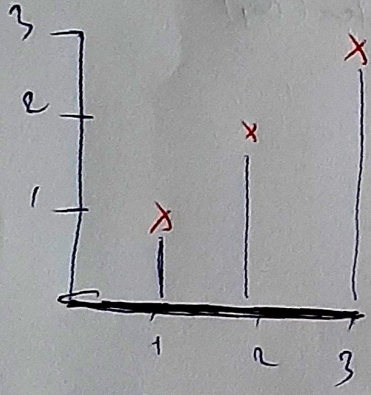
$$J(0.5) = \frac{1}{2m}\left[(0.5-1)^2 + (1-2)^2 + (1.5-3)^2\right]$$

$= \hookrightarrow m = 3$ training set

$$= \frac{1}{2\times 3}\cdot(3.5) = \frac{3.5}{6} \simeq 0.58$$

$\theta_1 = 0^2$

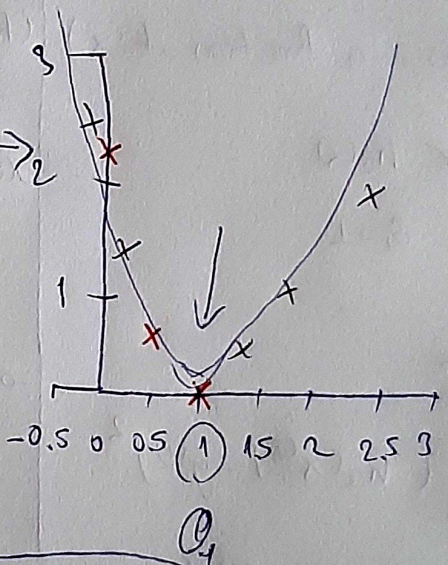
$J(0) = ?$



$\theta_1 = 0$

$$J(0) = \frac{1}{2m}\cdot(1^2+2^2+3^2)$$

$$J(0) = \frac{1}{6}\cdot 14 \simeq 2.3$$



→ and the computing

minimize θ_1 $J(\theta_1)$