Intro to Machine Learning (CS436/CS580L)

Lecture 5 & 6: Linear Regression & Gradient Descent & Polynomial Regression

Xi Peng, Fall 2018

Thanks to Tom Mitchell, Andrew Ng, Ben Taskar, Carlos Guestrin, Eric Xing, Hal Daume III, David Sontag, Jerry Zhu, Tina Eliassi-Rad, and Chao Chen for some slides & teaching material.

This Class

- Linear Regression (One variable)
- Gradient Descend
- Linear Regression (Multiple variables)
- Polynomial Regression

Median

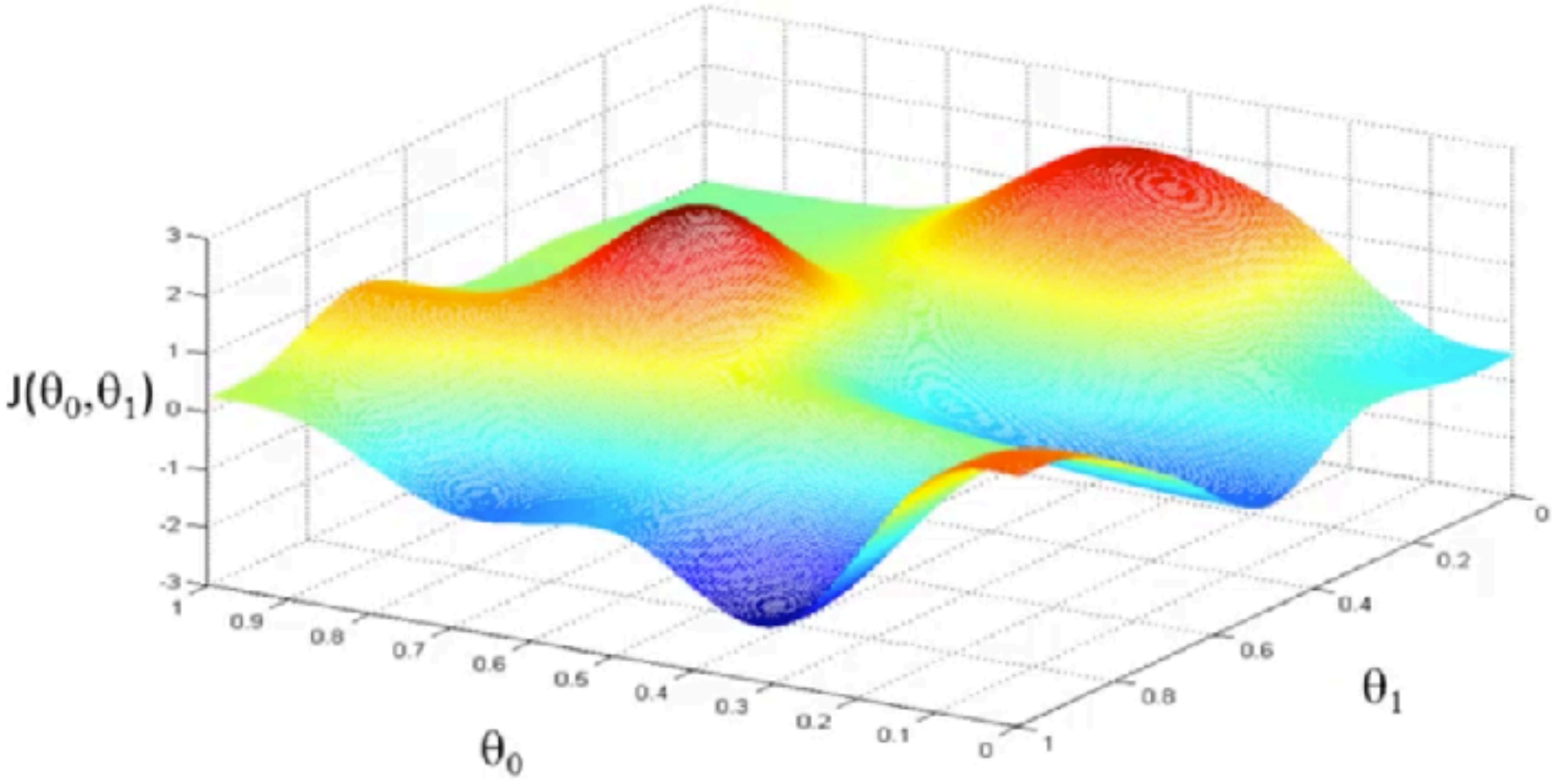
Have some function $J(\theta_0, \theta_1)$

Want $\min_{\theta_0, \theta_1} J(\theta_0, \theta_1)$

Outline:

- Start with some θ_0, θ_1
- Keep changing θ_0, θ_1 to reduce $J(\theta_0, \theta_1)$

  until we hopefully end up at a minimum


J(θ0,θ1)
3
2
1
0
-1
-2
-3
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
θ0
1
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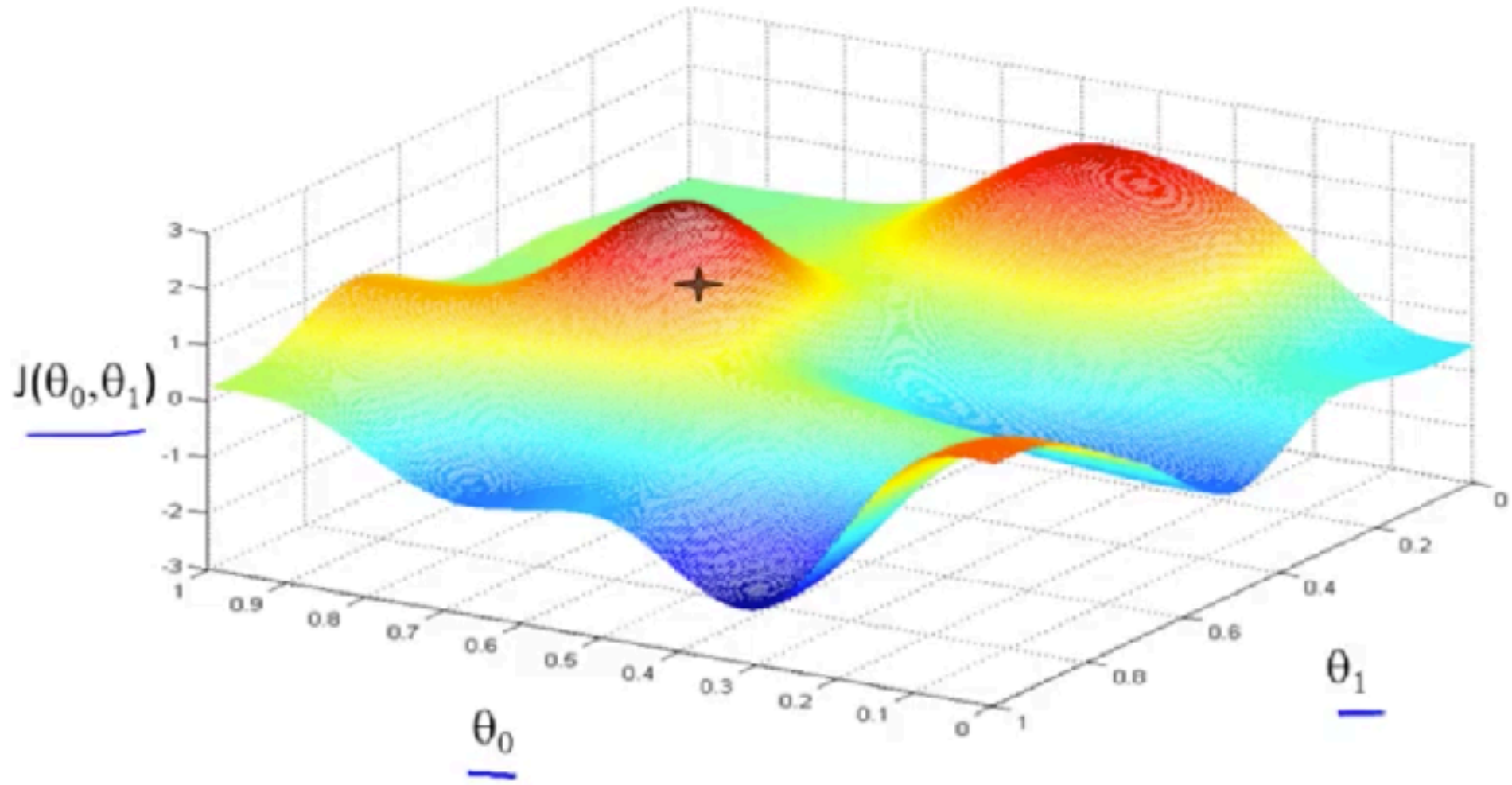
0
θ1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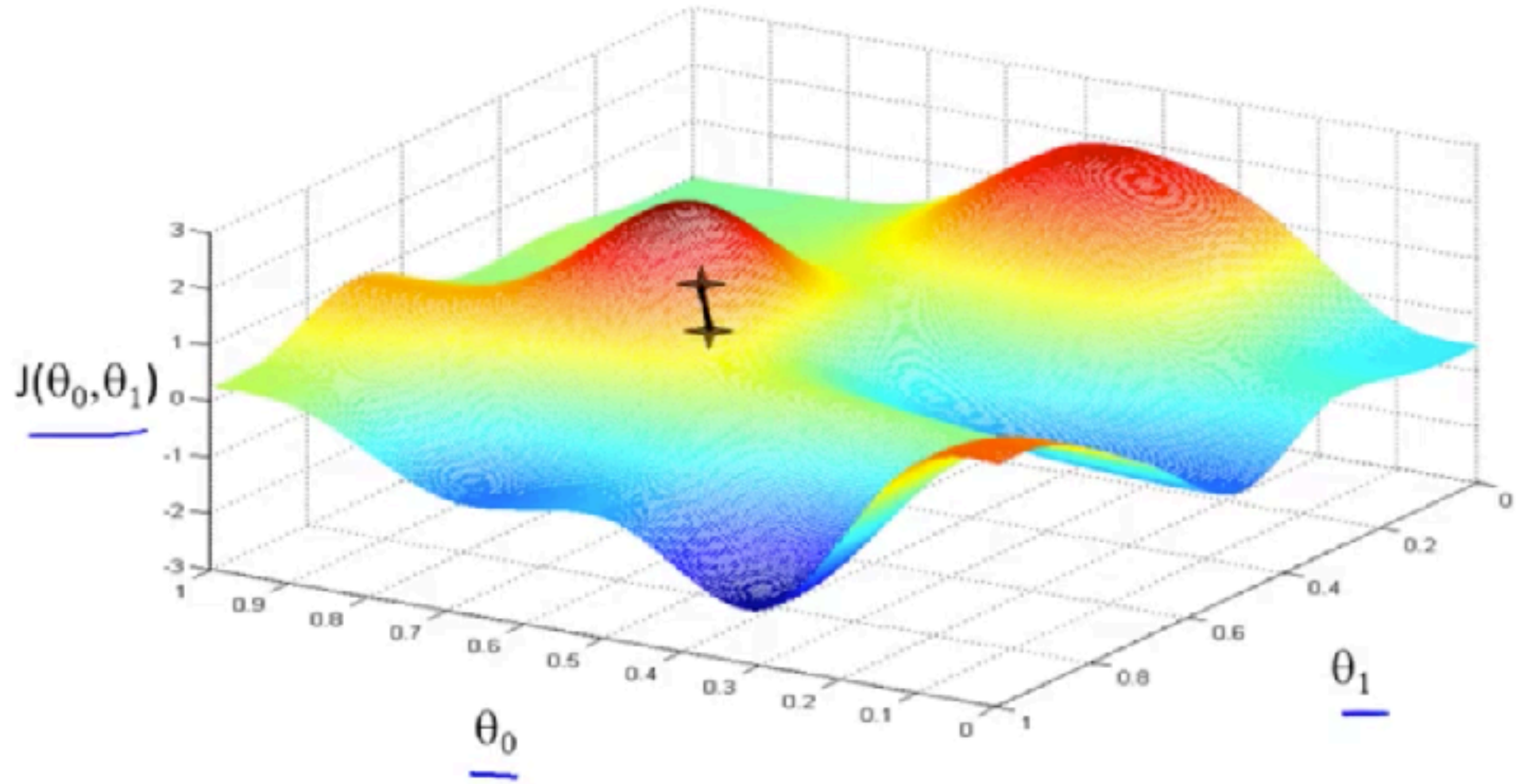
$J(\theta_0,\theta_1)$
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θ_0
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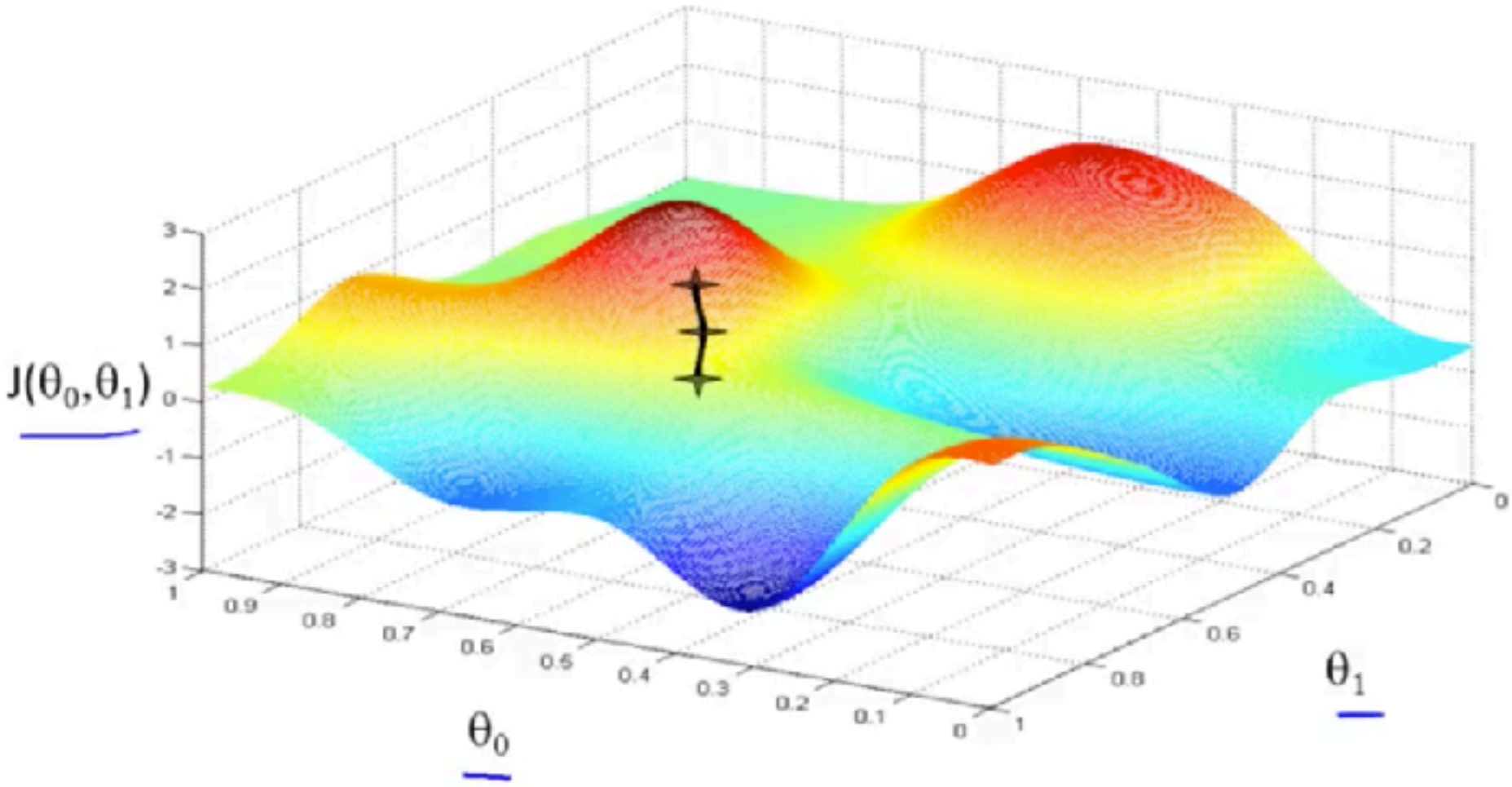
θ_1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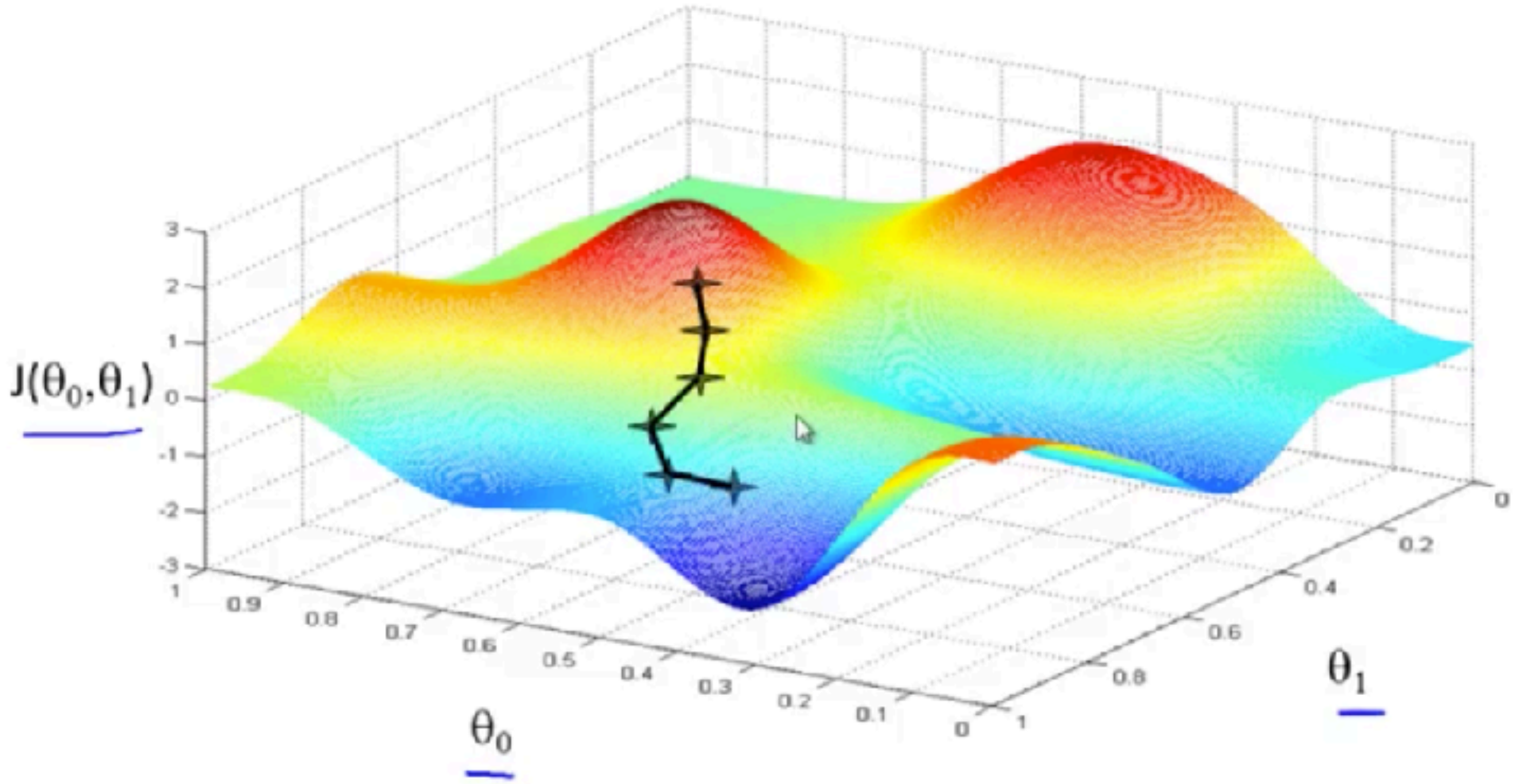
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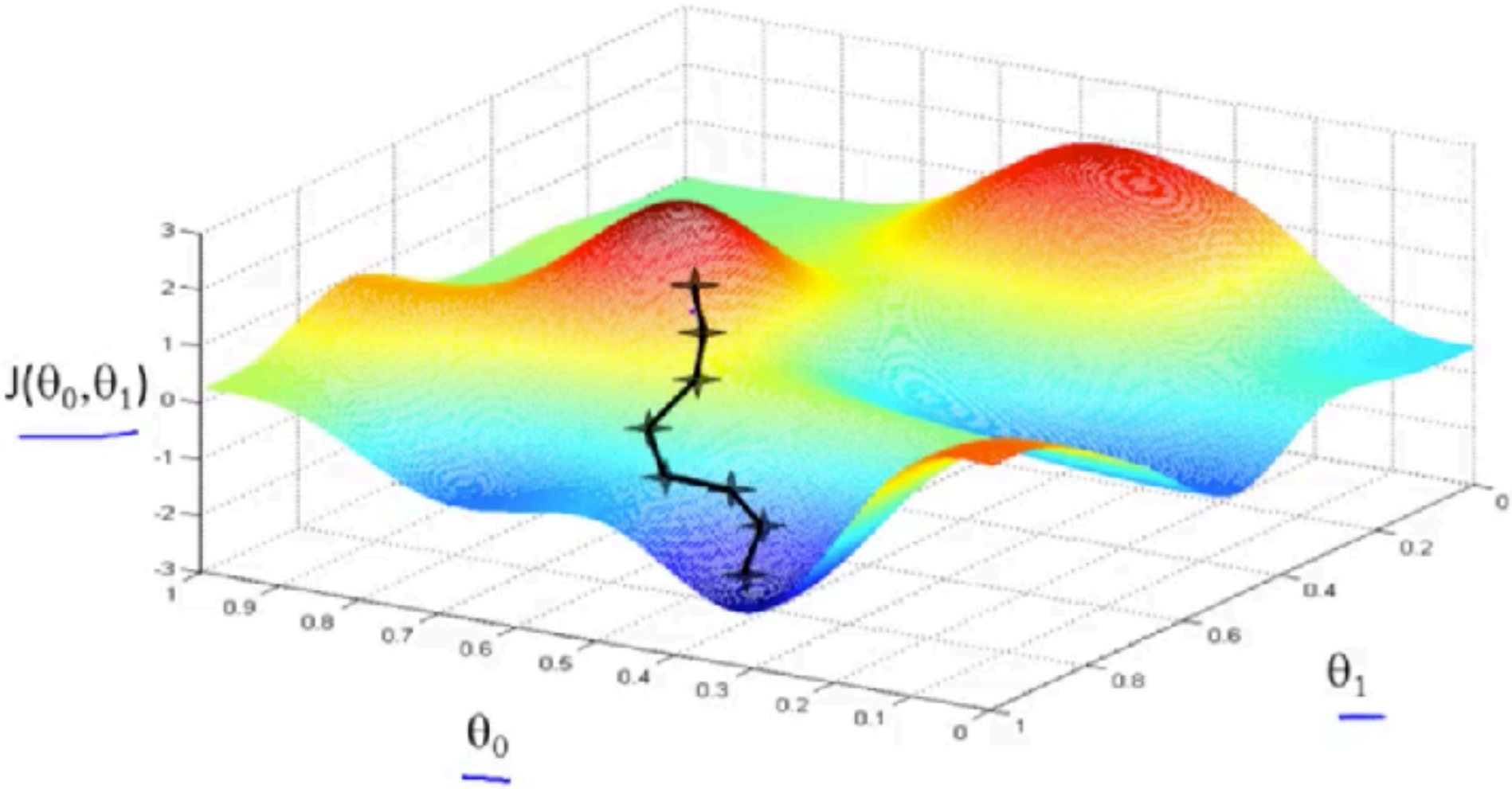
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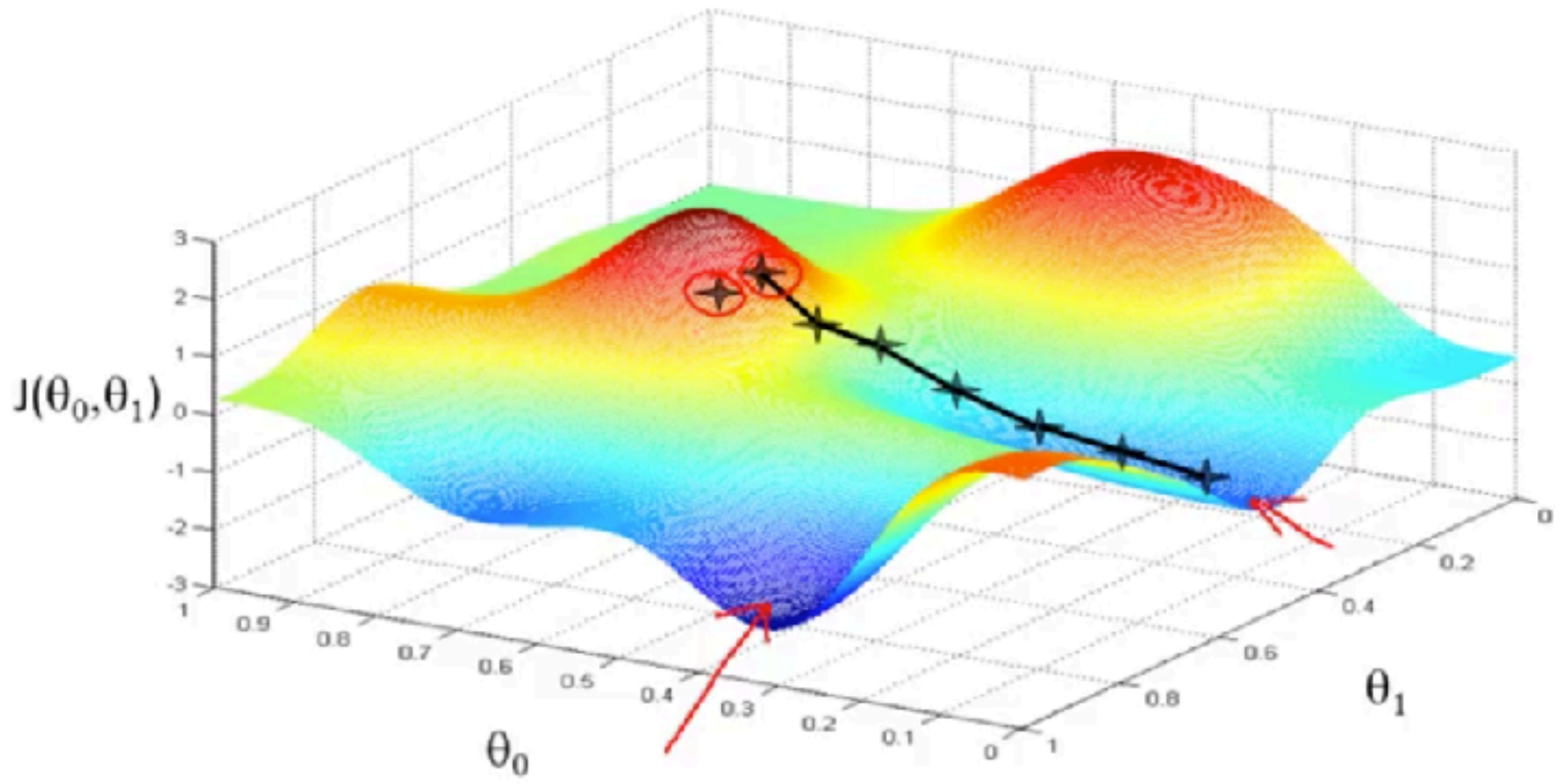
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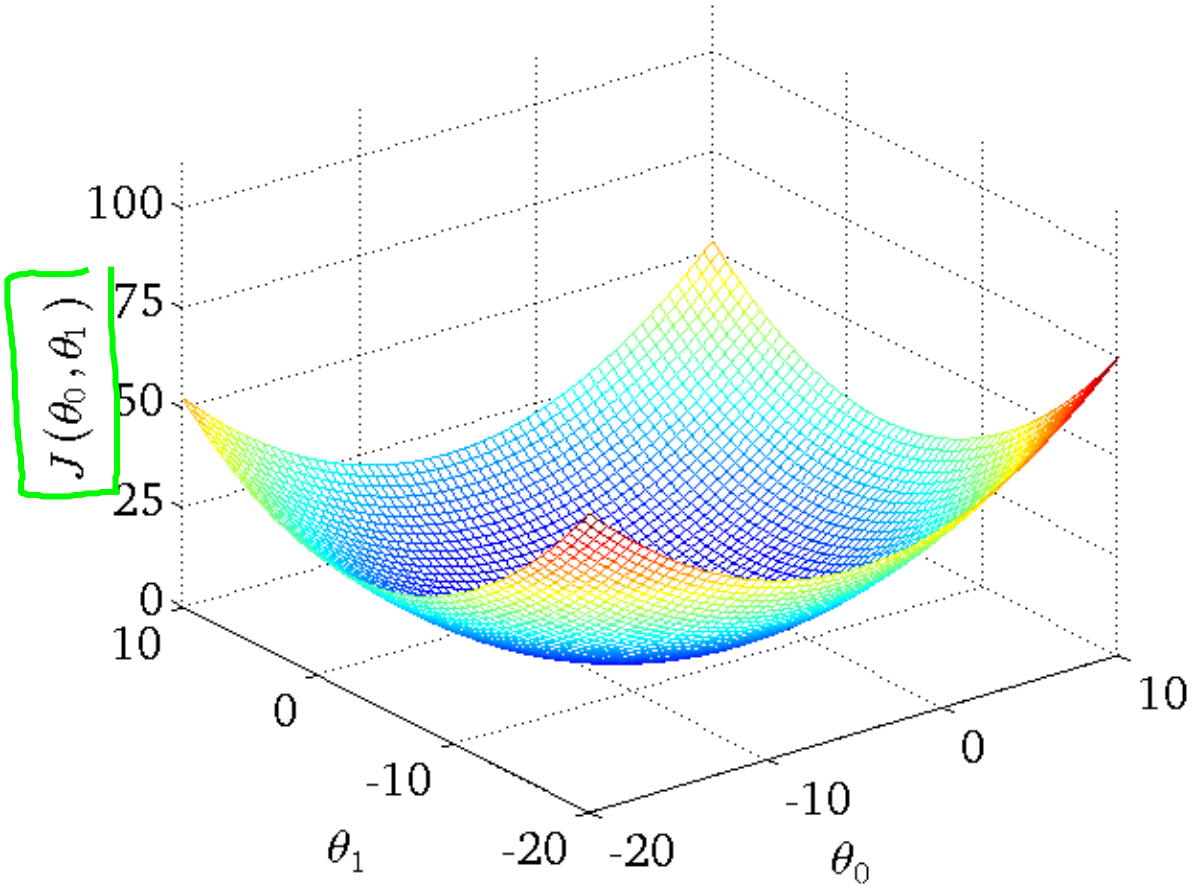
Gradient descent algorithm

repeat until convergence {

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

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

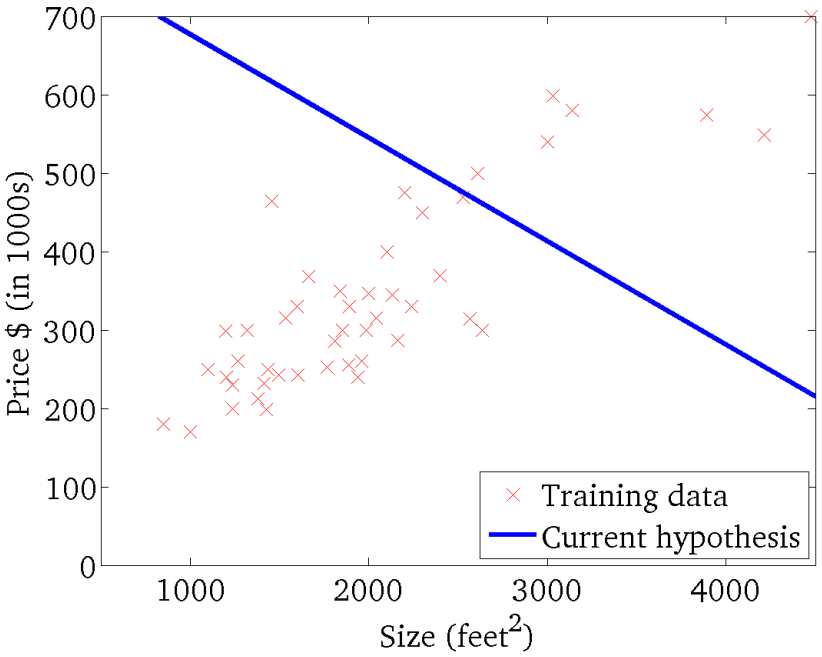
}



Andrew Ng

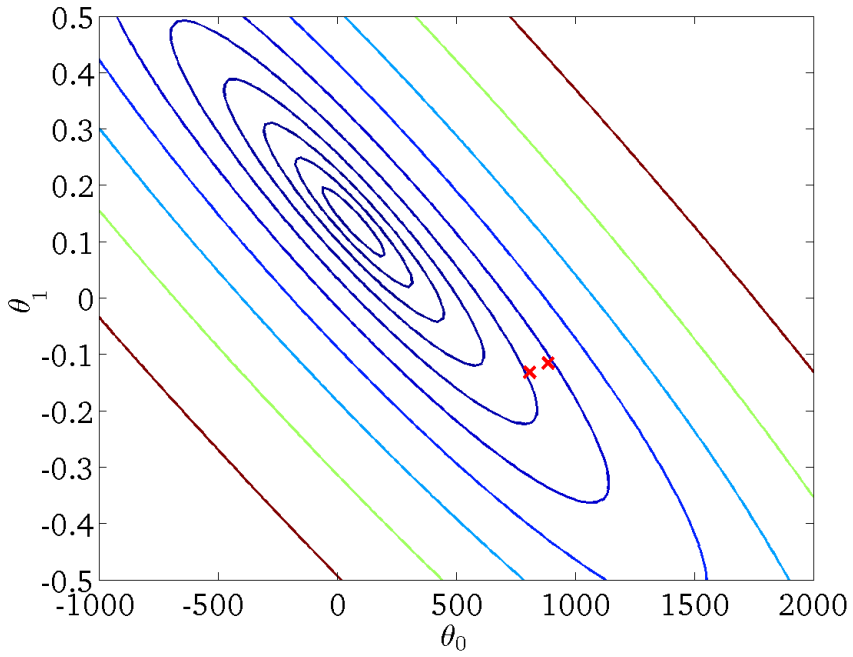
$h_\theta(x)$

(for fixed θ_0, θ_1, this is a function of x)



$J(\theta_0, \theta_1)$

(function of the parameters θ_0, θ_1)



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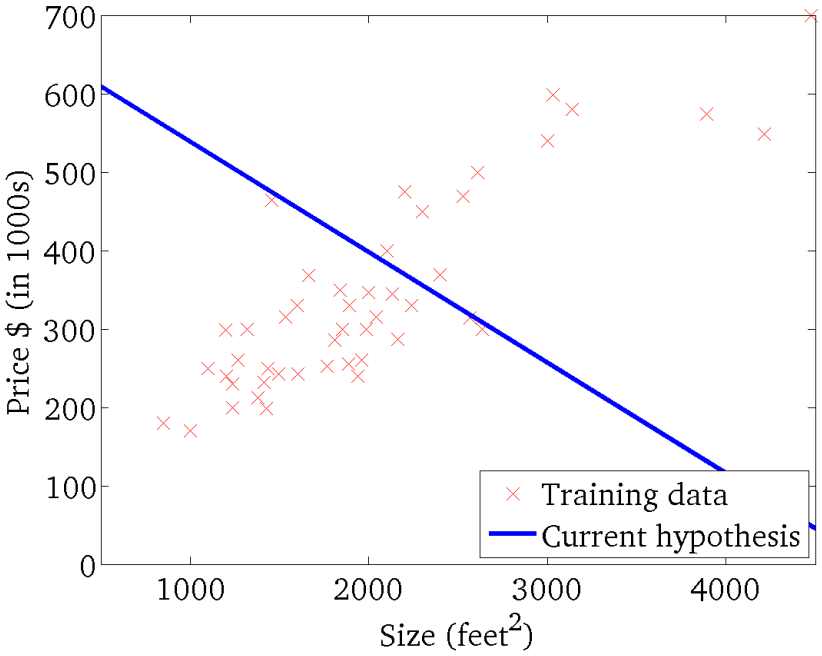

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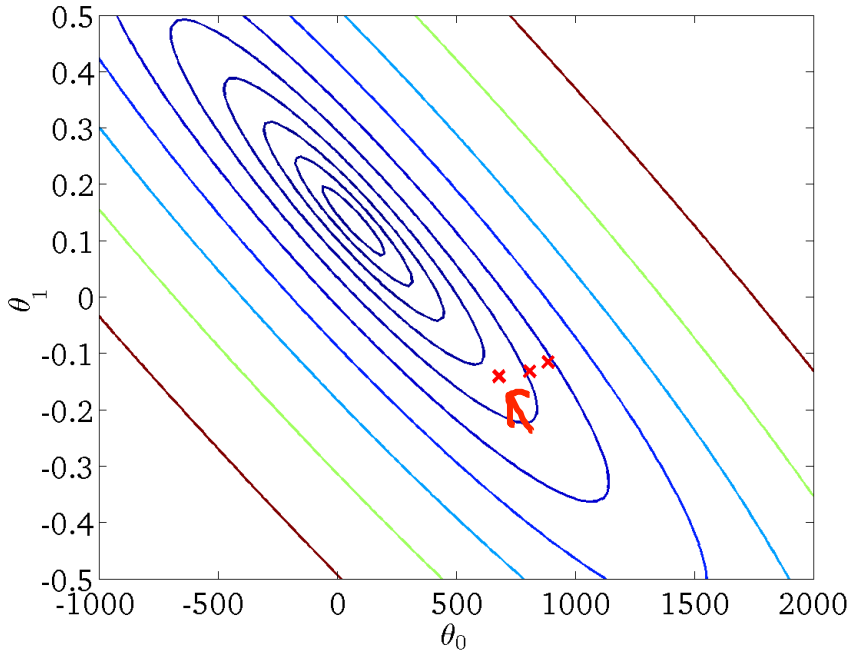

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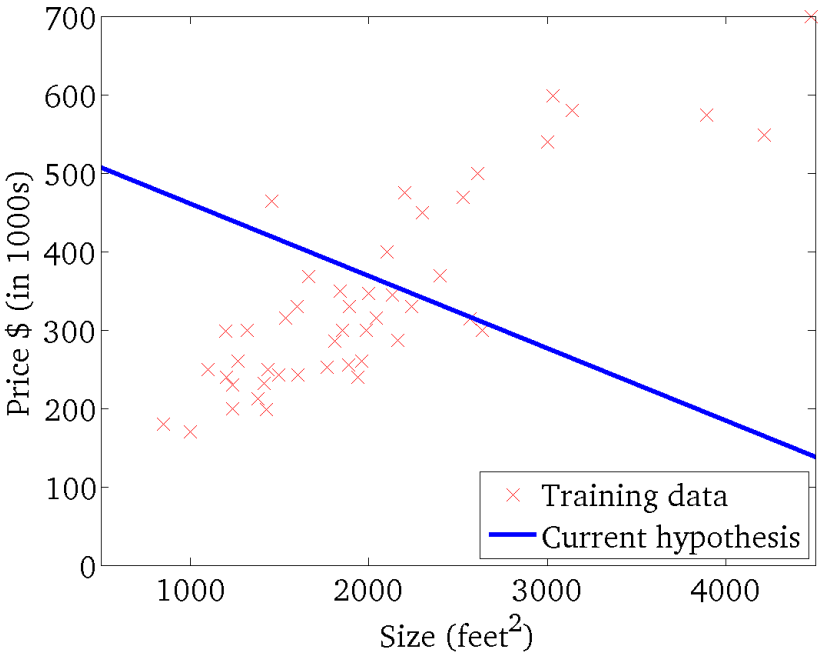

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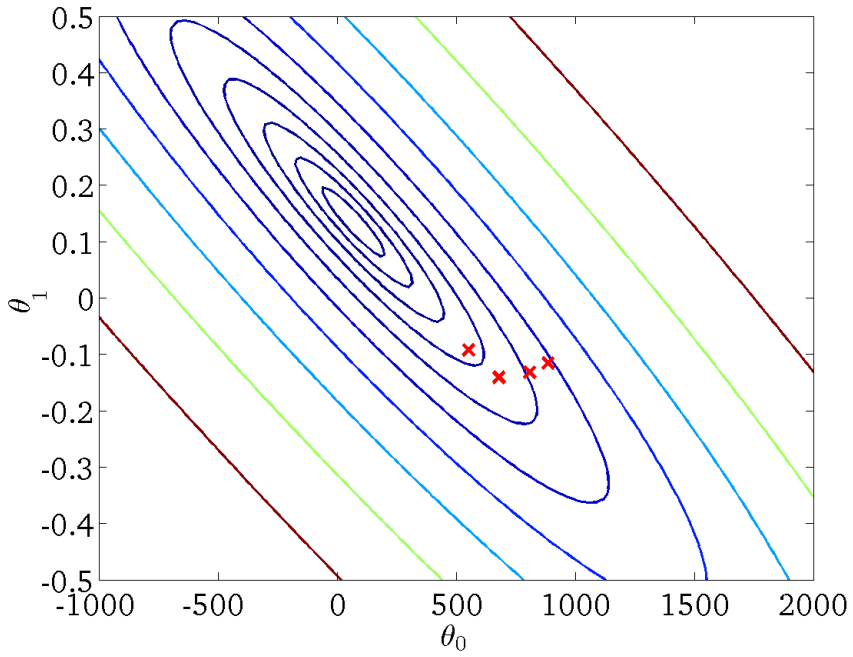

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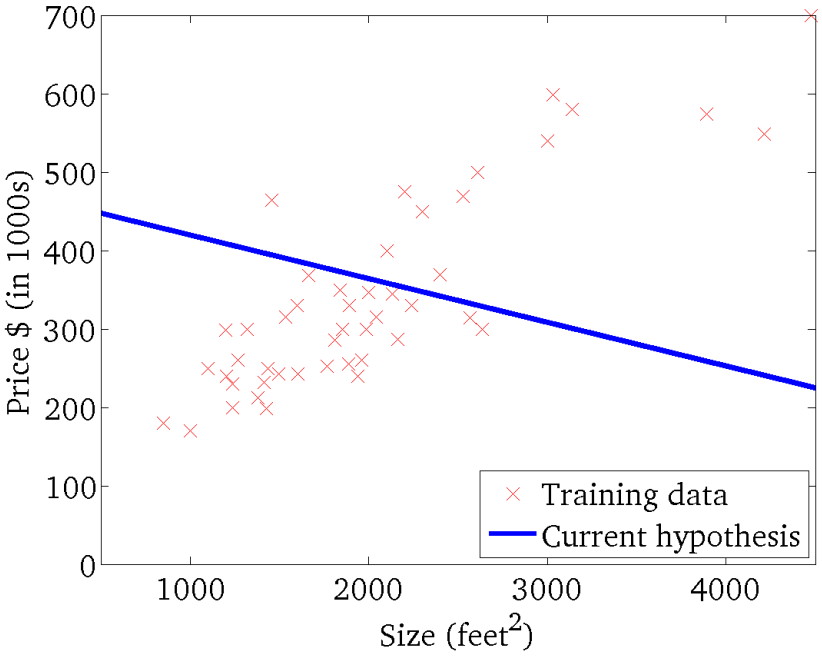

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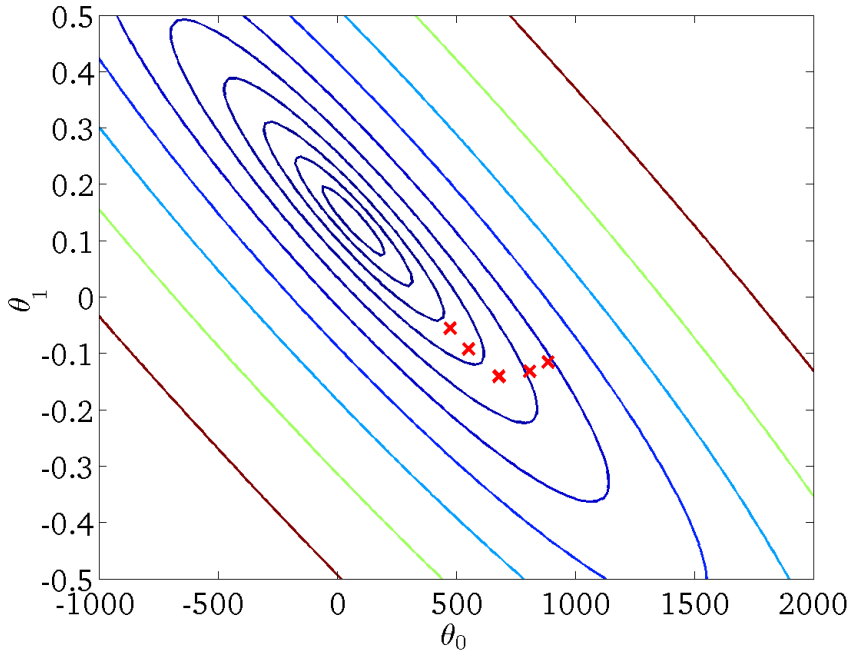

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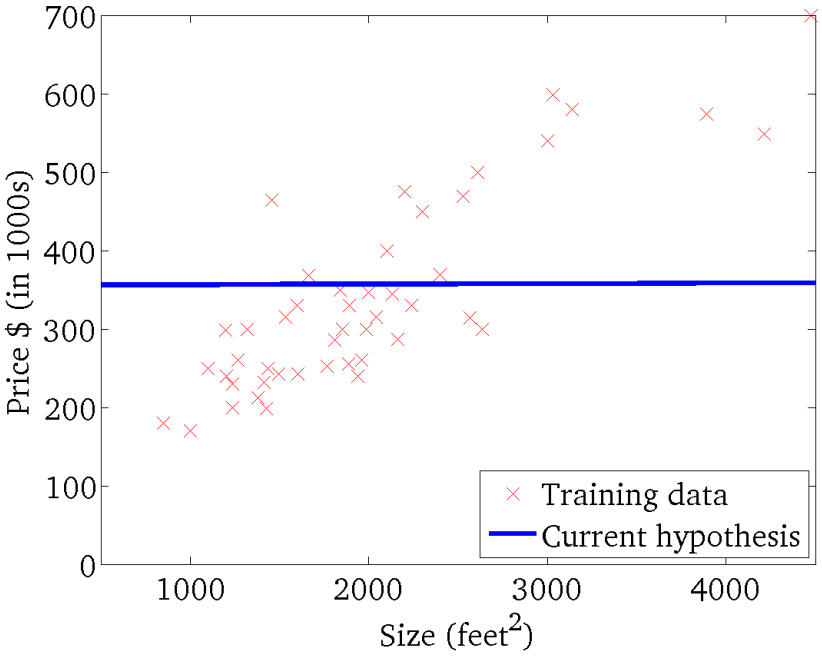

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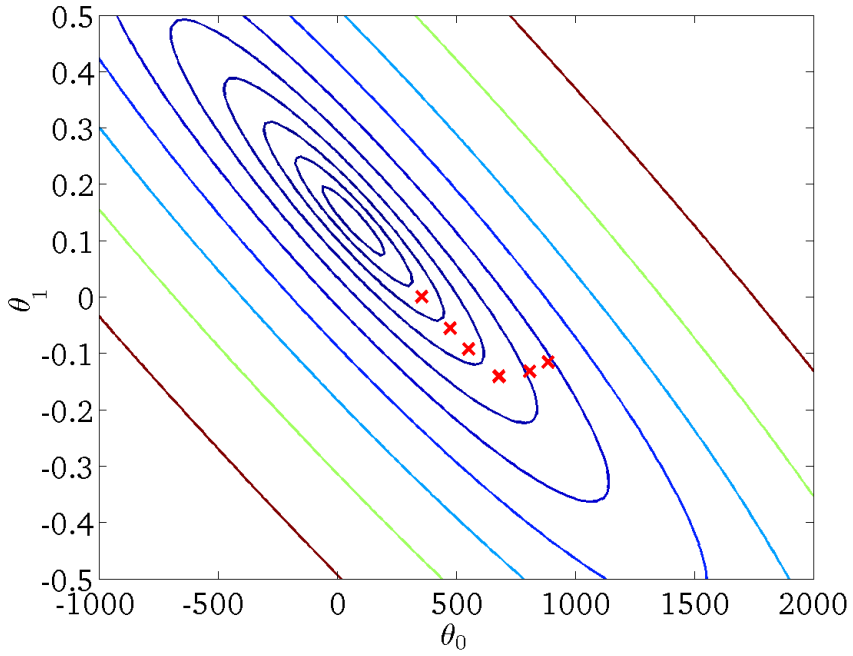

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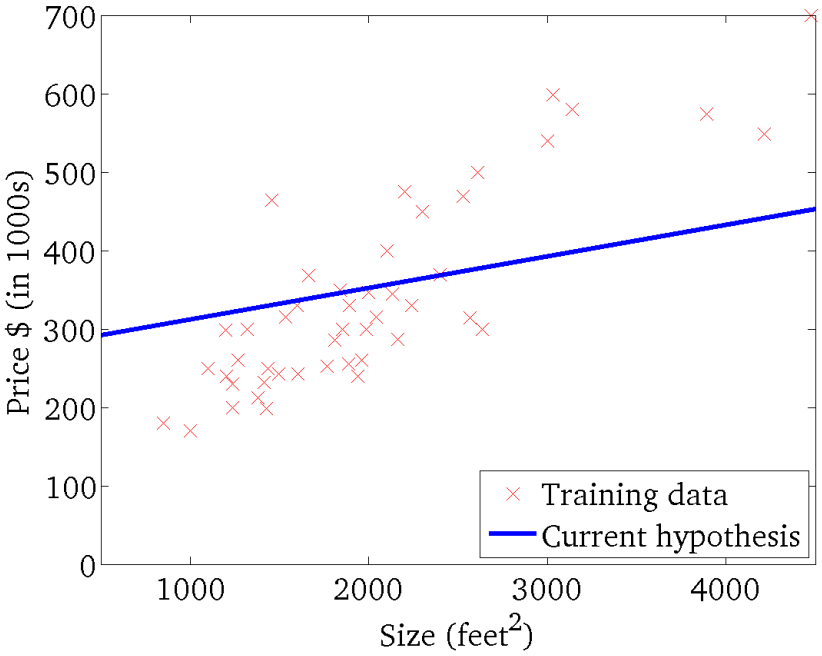

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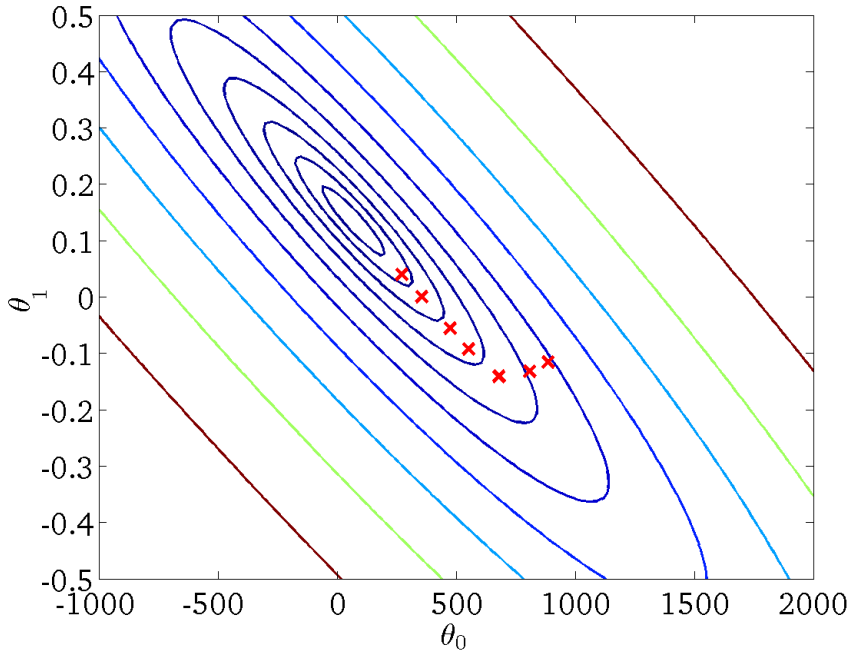

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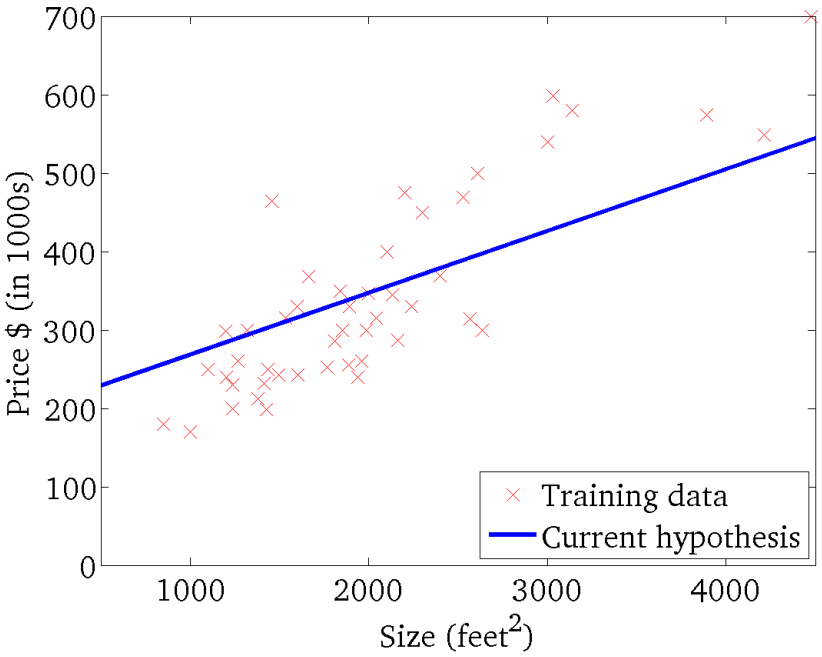

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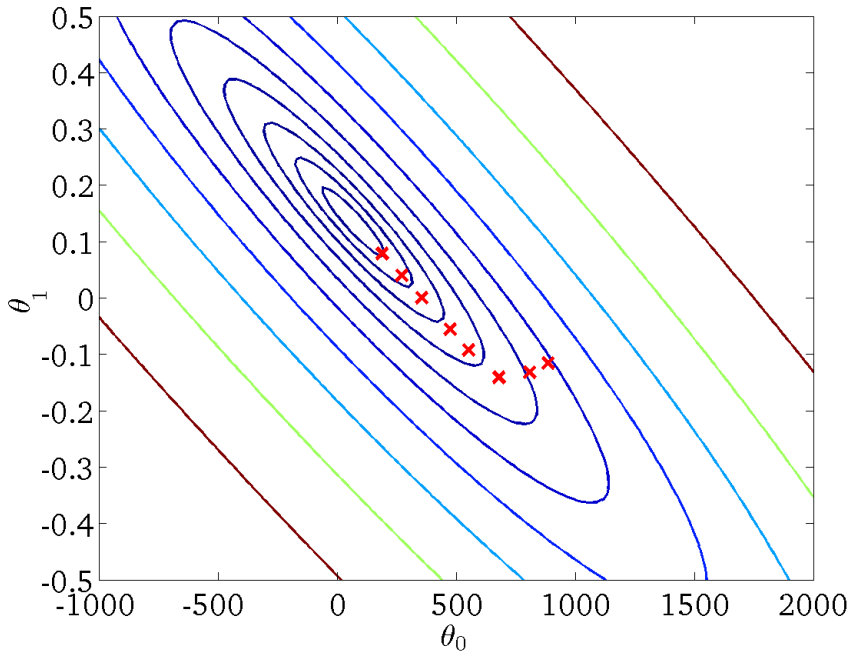

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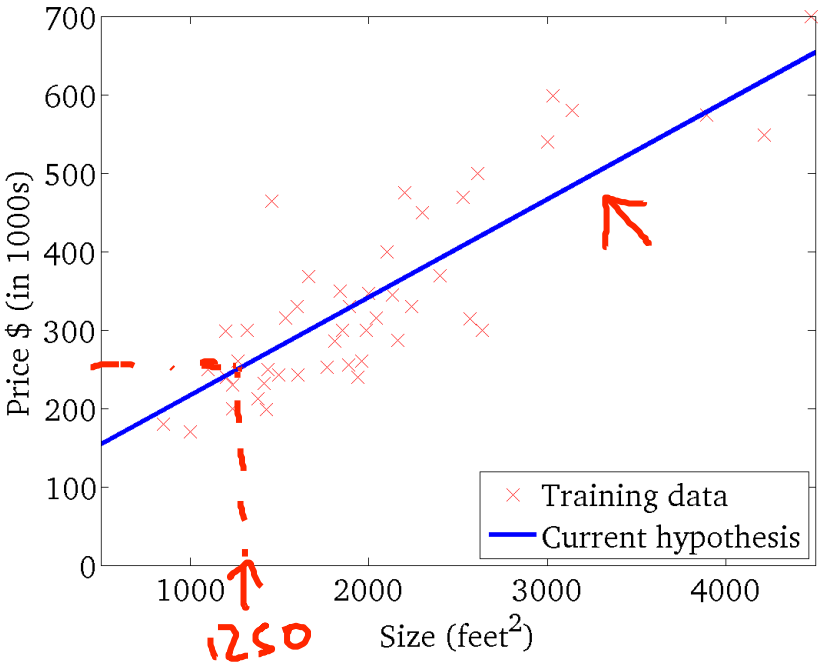

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