Gradient Descent

Parameter Learning

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

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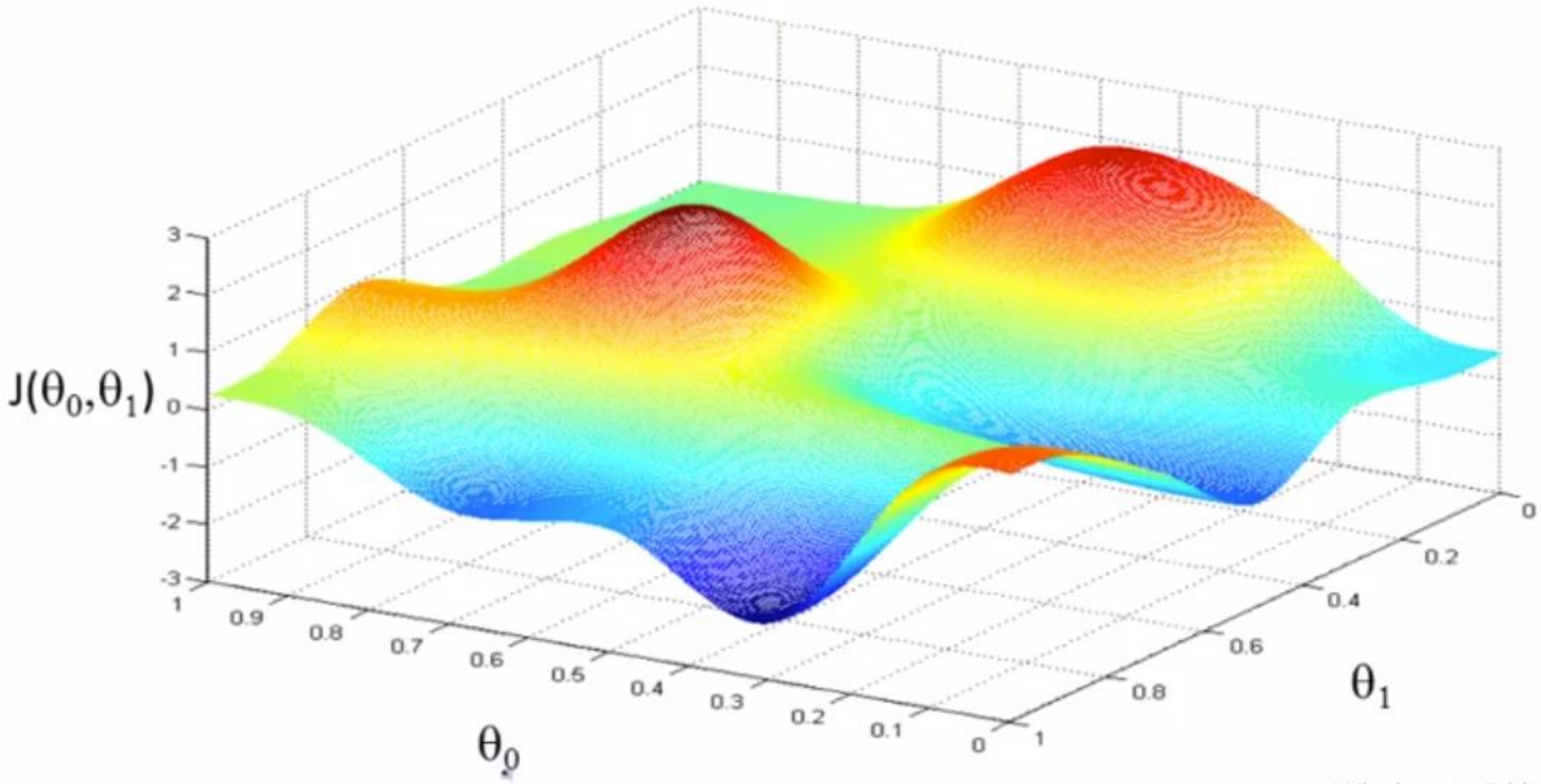
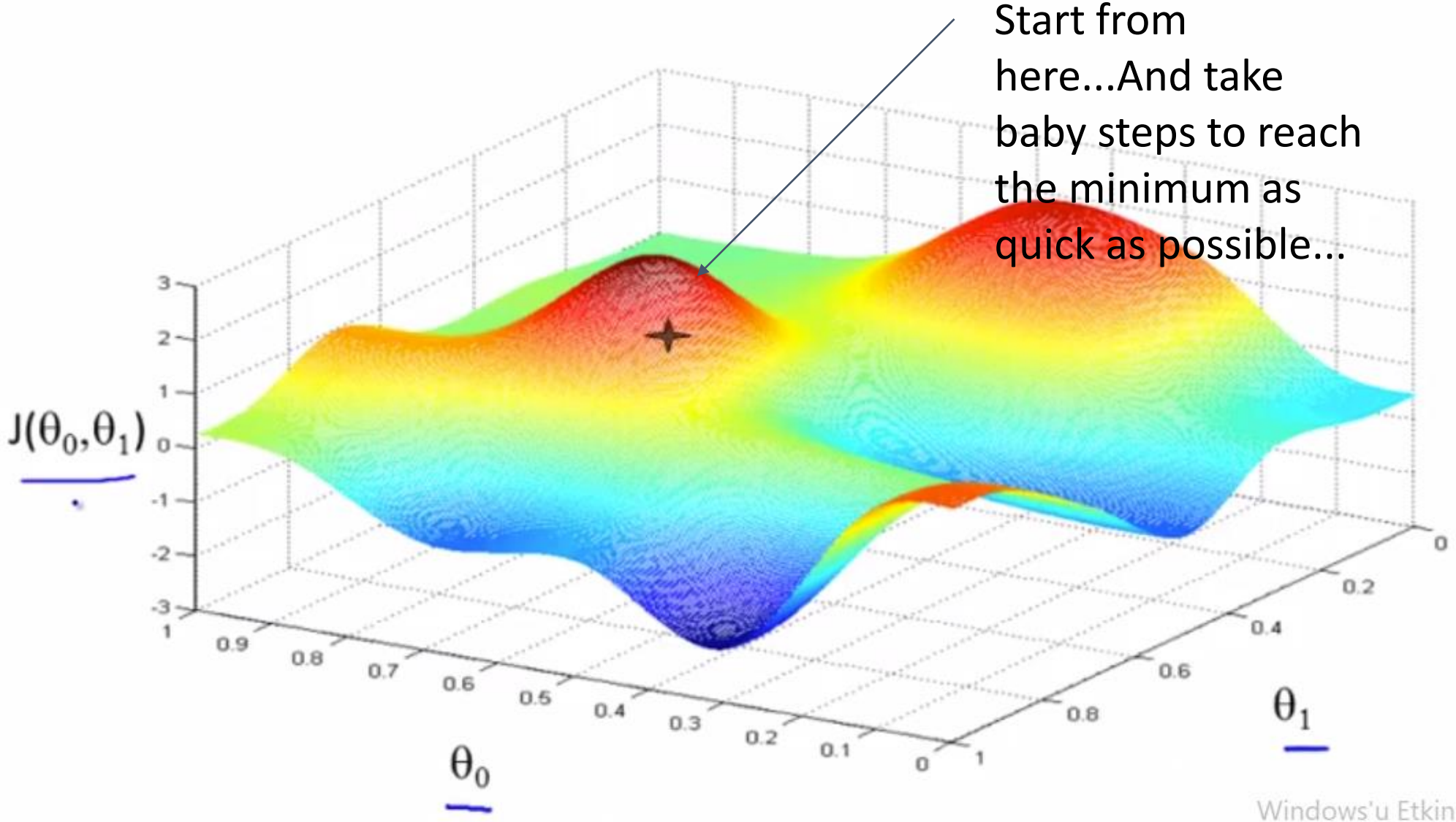
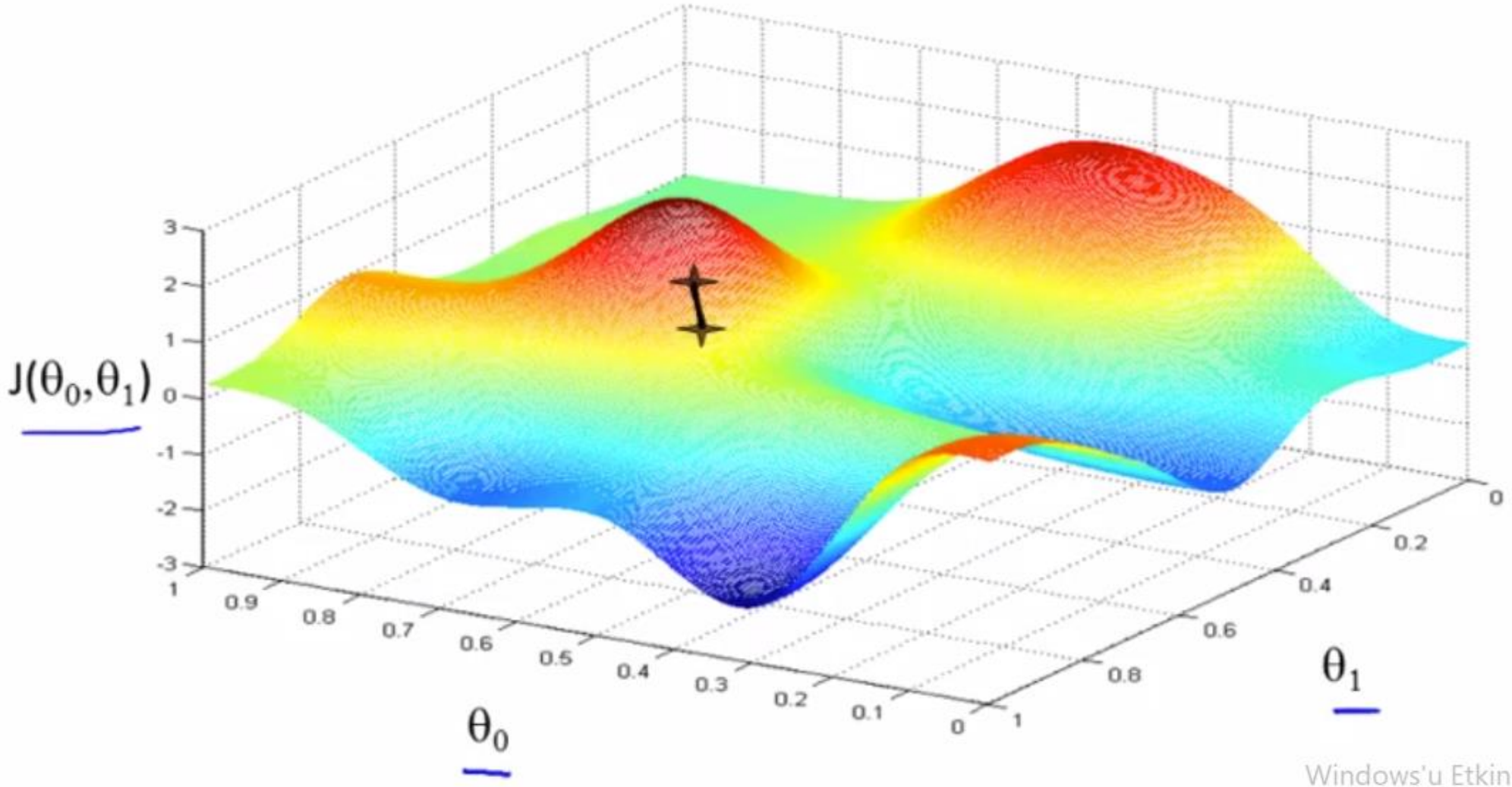
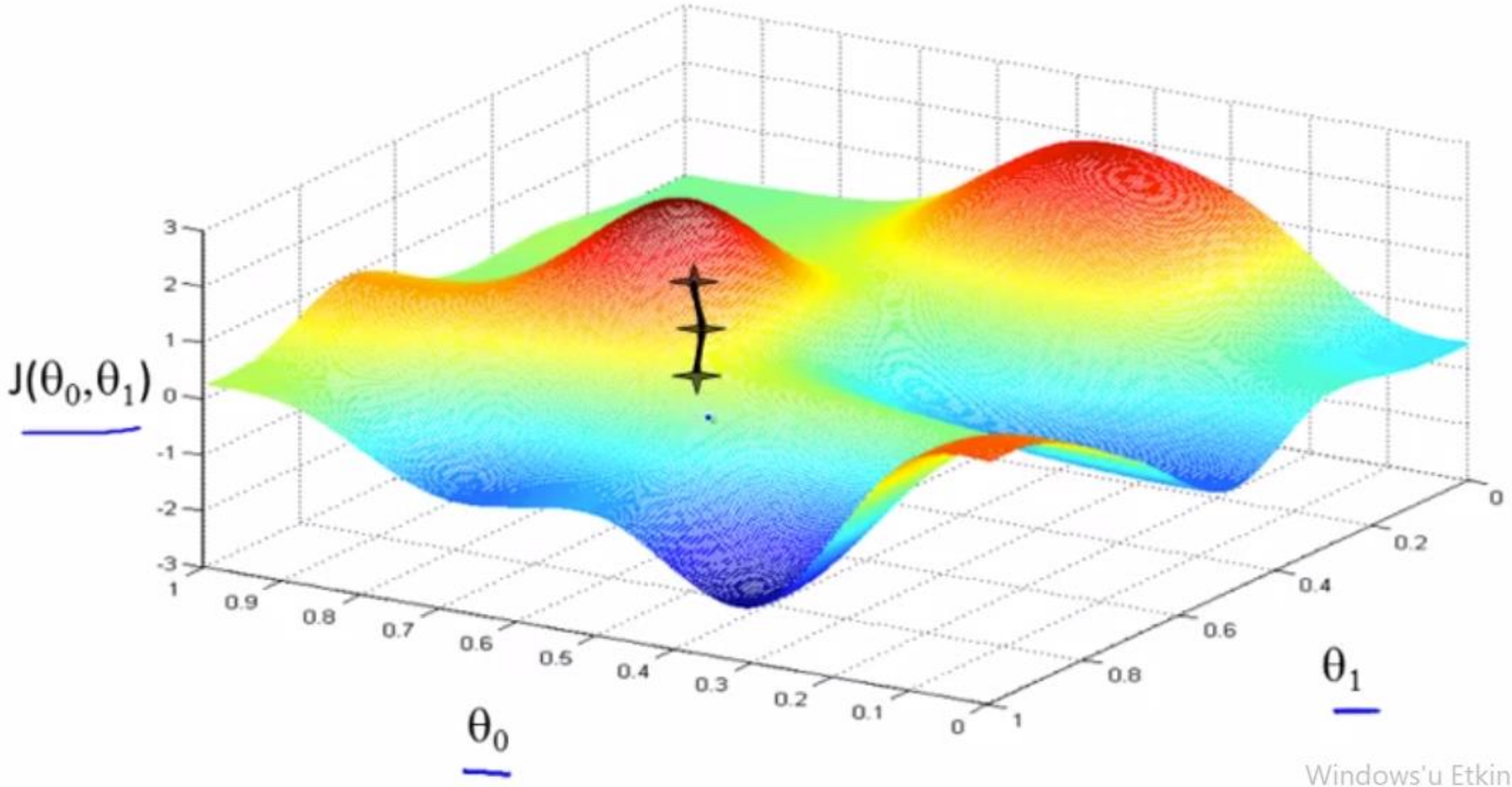
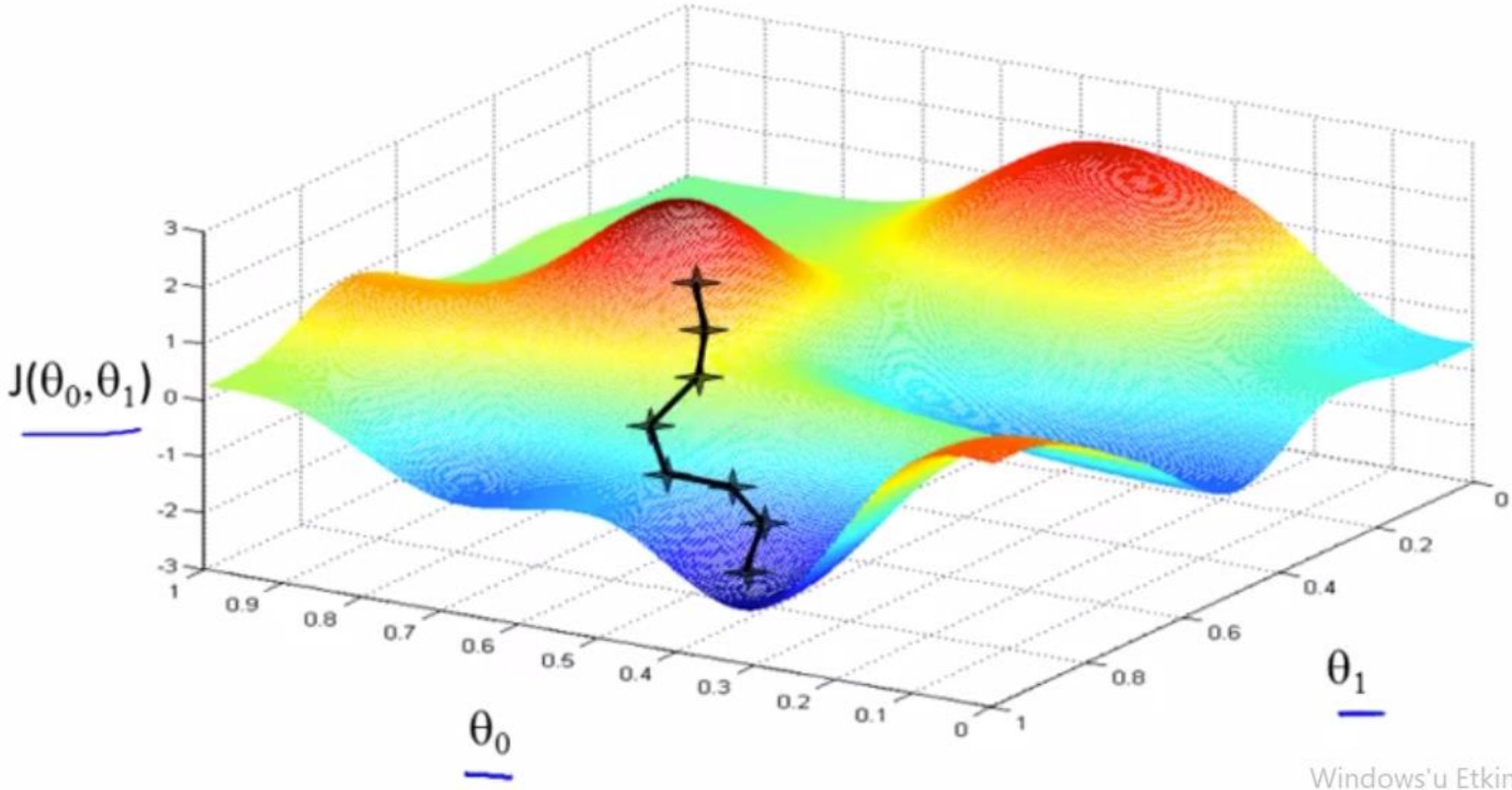




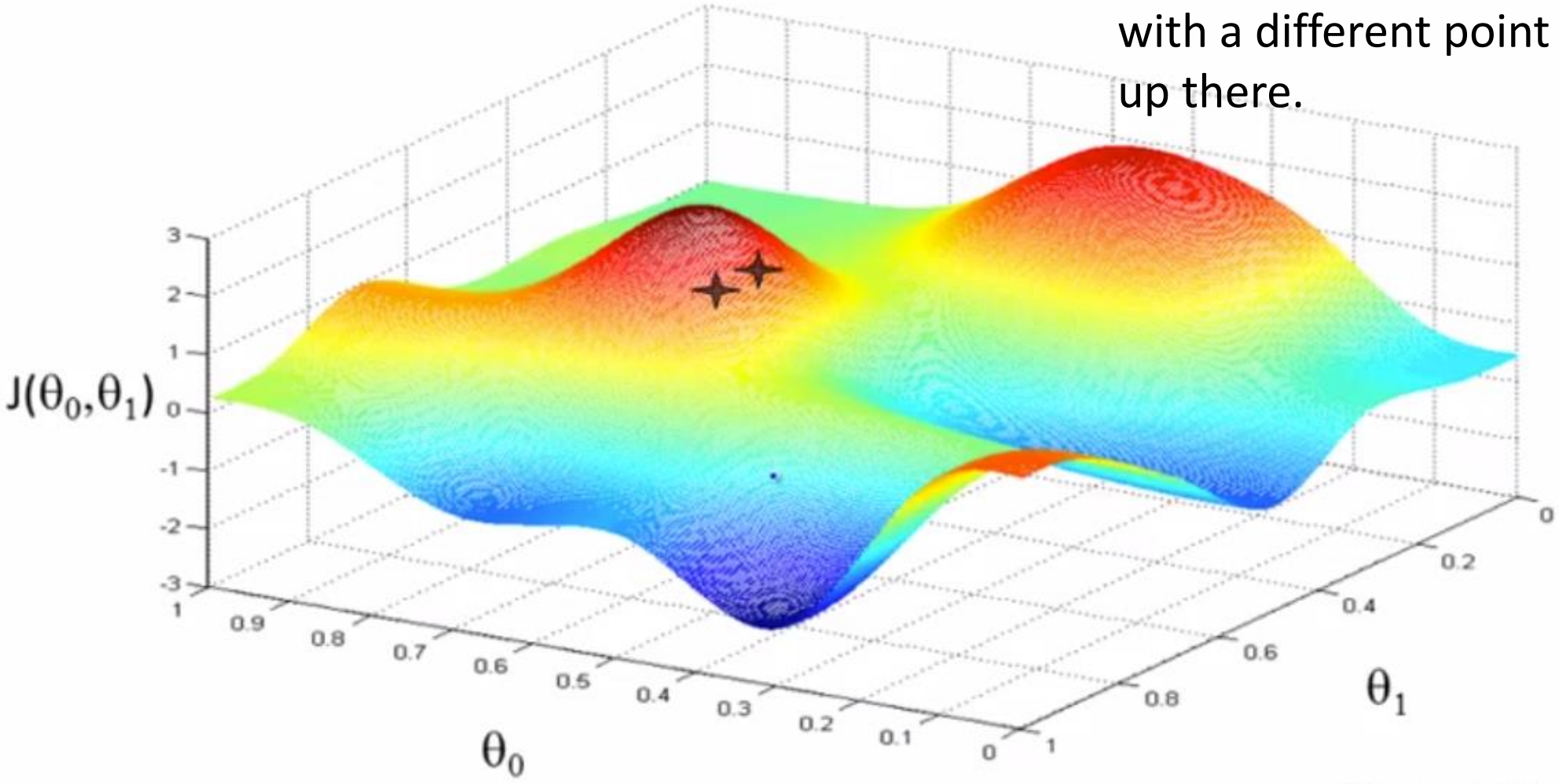
- Imagine this is like the landscape of some grassy park, with two hills like so,
- Imagine that you are physically standing on this little red hill in your park.
- In gradient descent, what we're going to do is we're going to spin 360 degrees around, just look all around us, and ask, if I were to take a little baby step in some direction, and I want to go downhill as quickly as possible, what direction do I take that little baby step in?
- If I wanna go down, so I wanna physically walk down this hill as rapidly as possible.

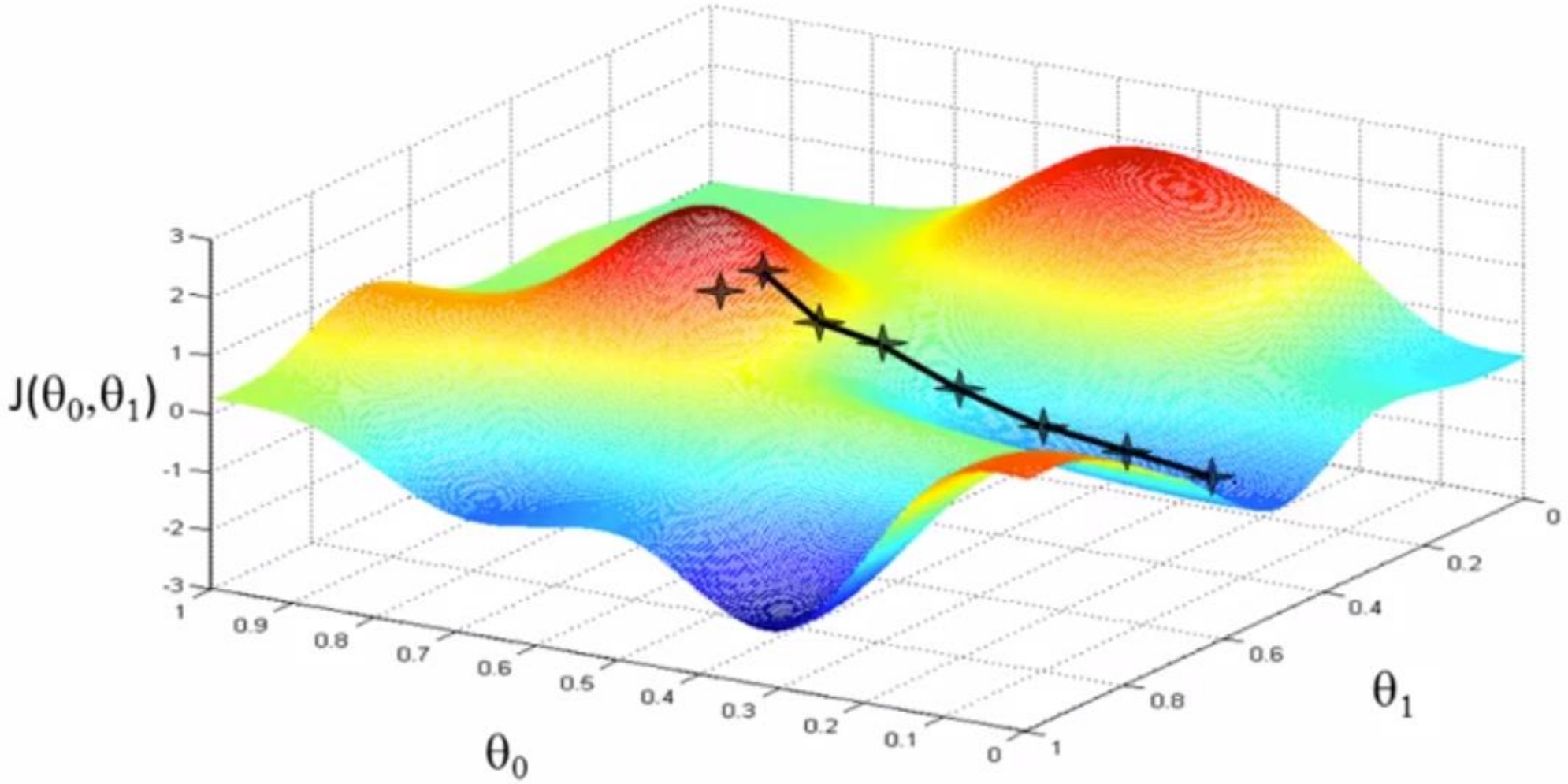


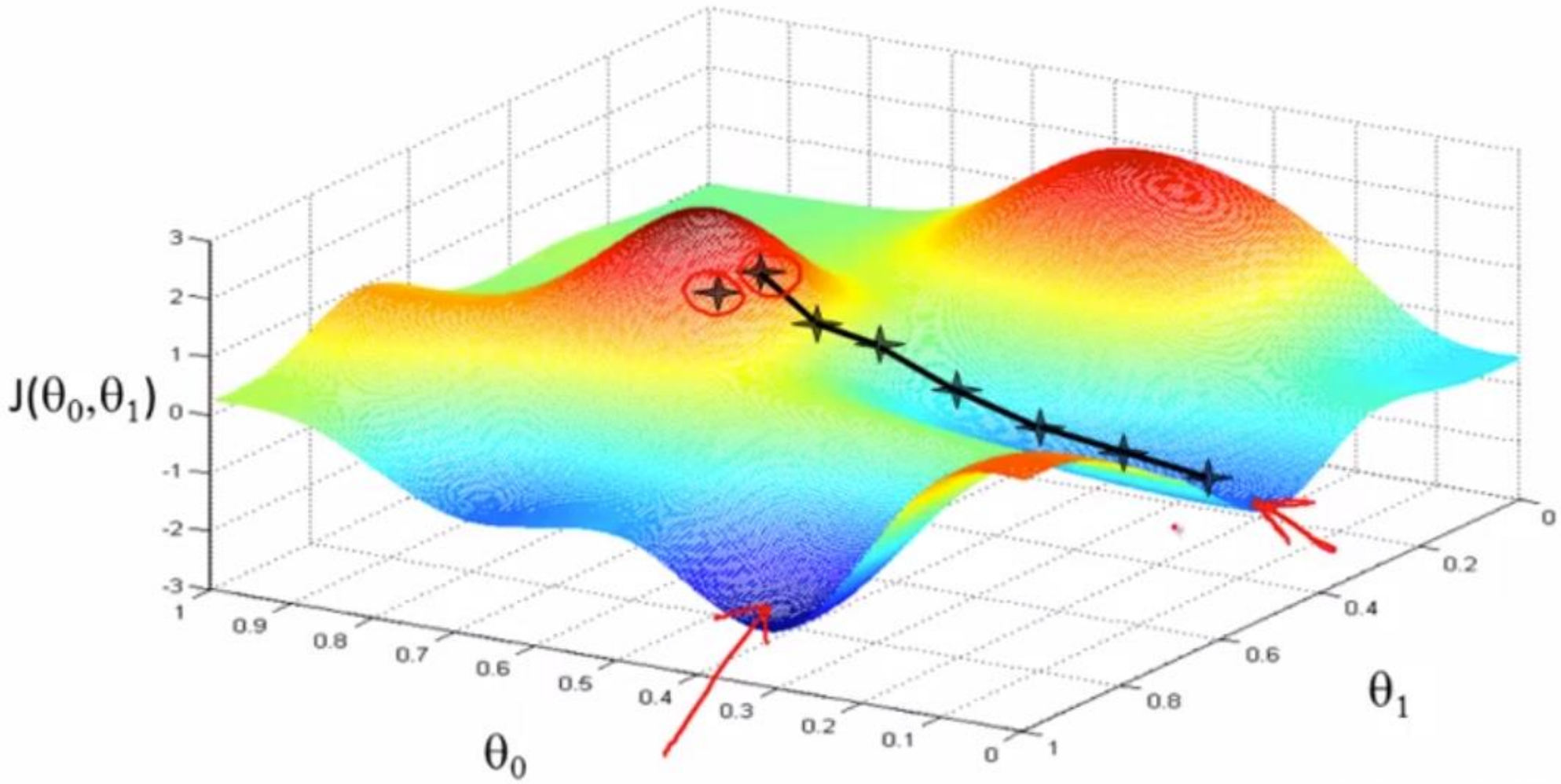




Now assume we start with a different point up there.







Gradient descent algorithm

A := B
A :=A+1
Assignment

A = B
A = A+1 !!!!!
Truth assertion

repeat until convergence {

$$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta_0, \theta_1) \quad (\text{for } j = 0 \text{ and } j = 1)$$

}

Learning rate

Derivative

Simultaneously update θ_0 and θ_1

Correct: Simultaneous update

$$\text{temp0} := \theta_0 - \alpha \frac{\partial}{\partial \theta_0} J(\theta_0, \theta_1)$$
$$\text{temp1} := \theta_1 - \alpha \frac{\partial}{\partial \theta_1} J(\theta_0, \theta_1)$$
$$\theta_0 := \text{temp0}$$
$$\theta_1 := \text{temp1}$$

Gradient descent algorithm

Assignment
$a := b$
$a := a+1$

Truth assertion
$a = b$
$a = a+1$ ✗

θ_0, θ_1

repeat until convergence {

$$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta_0, \theta_1) \quad (\text{for } j = 0 \text{ and } j = 1)$$

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learning rate

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Incorrect:

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$$\theta_1 := \text{temp1}$$

Suppose $\theta_0 = 1, \theta_1 = 2$, and we simultaneously update θ_0 and θ_1 using the rule:$\theta_j := \theta_j + \sqrt{\theta_0 \theta_1}$ (for j = 0 and j=1) What are the resulting values of θ_0 and θ_1?