Gradient Descent in Practice I: Feature Scaling

LR with Multiple Variables

Feature Scaling

- We can speed up gradient descent by having each of our input values in roughly the same range.
- This is because θ will descend
  - quickly on small ranges and
  - slowly on large ranges,
- So it will oscillate inefficiently down to the optimum when the variables are very uneven.

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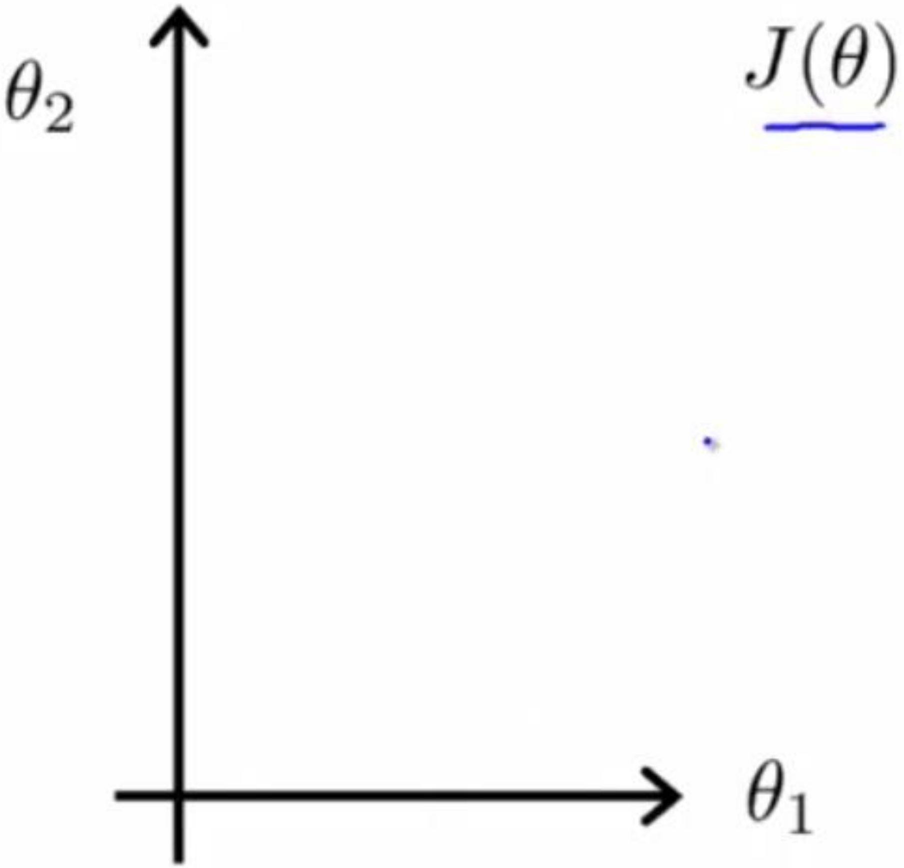

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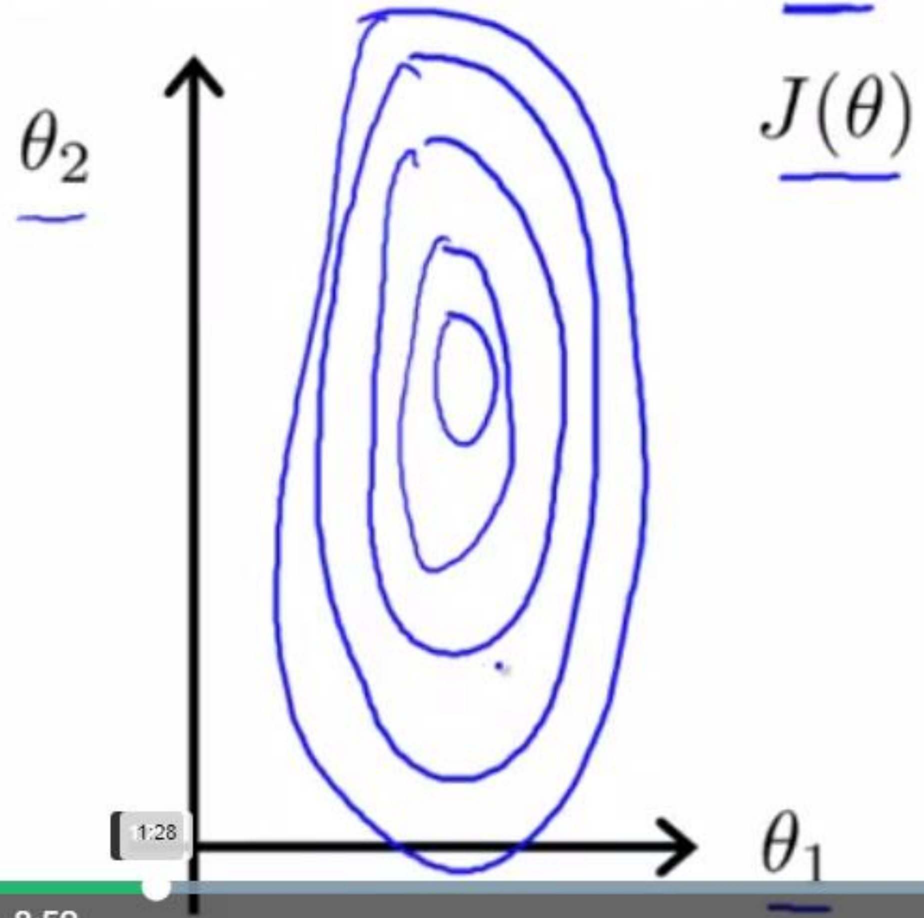

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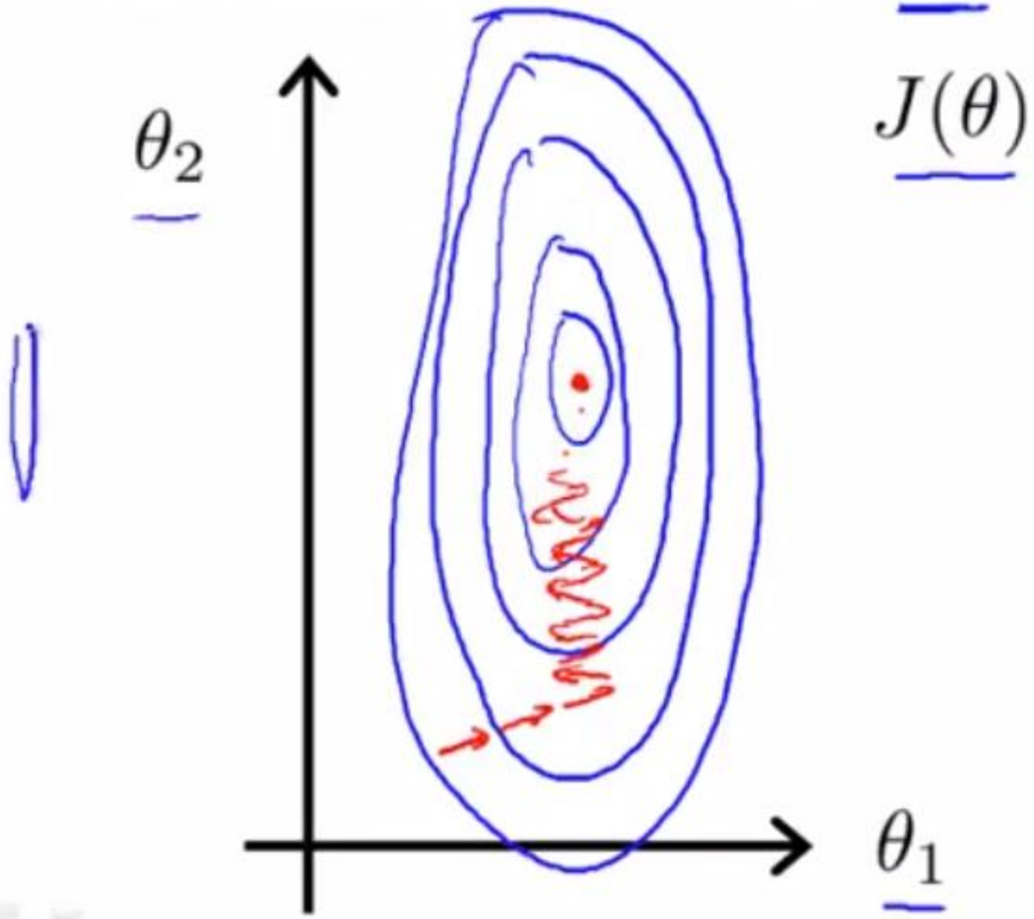

IT take a long time to find the optimal point with skinny contours.

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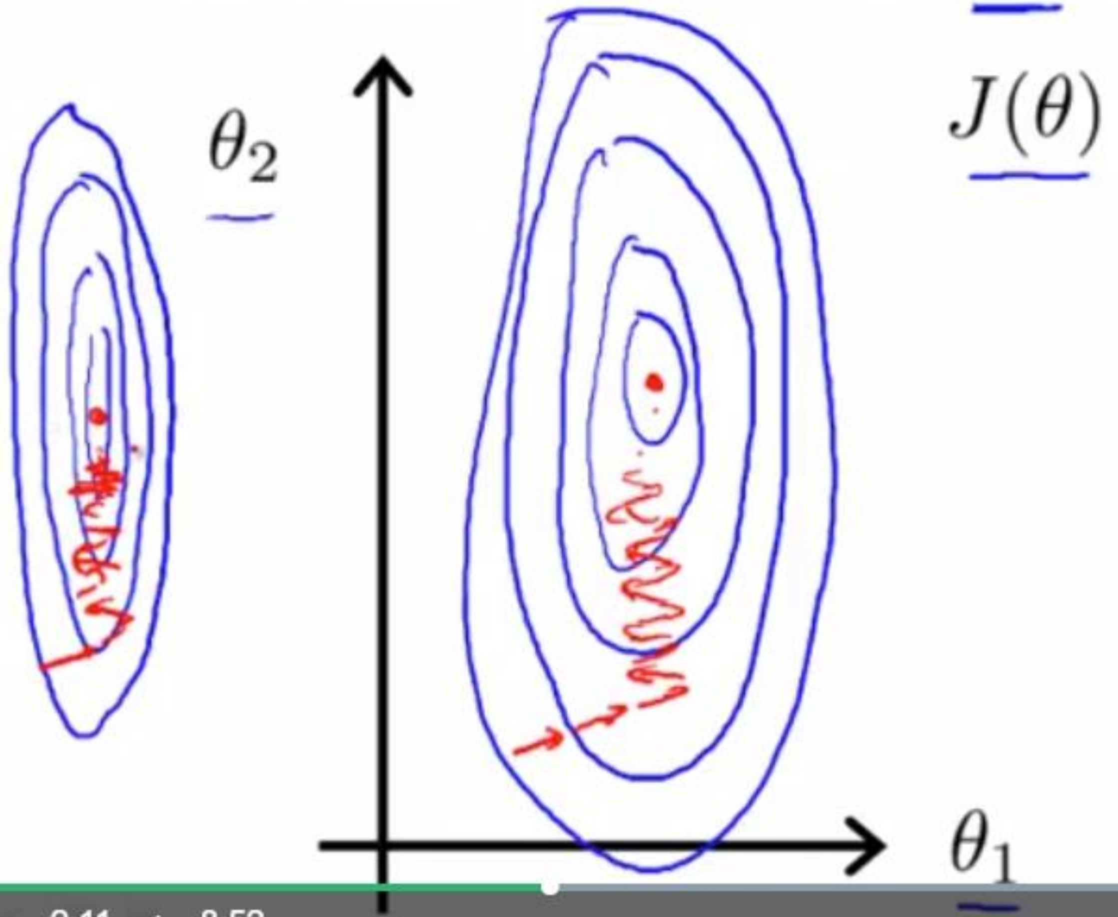

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$$\rightarrow x_1 = \frac{\text{size (feet}^2\text{)}}{2000}$$

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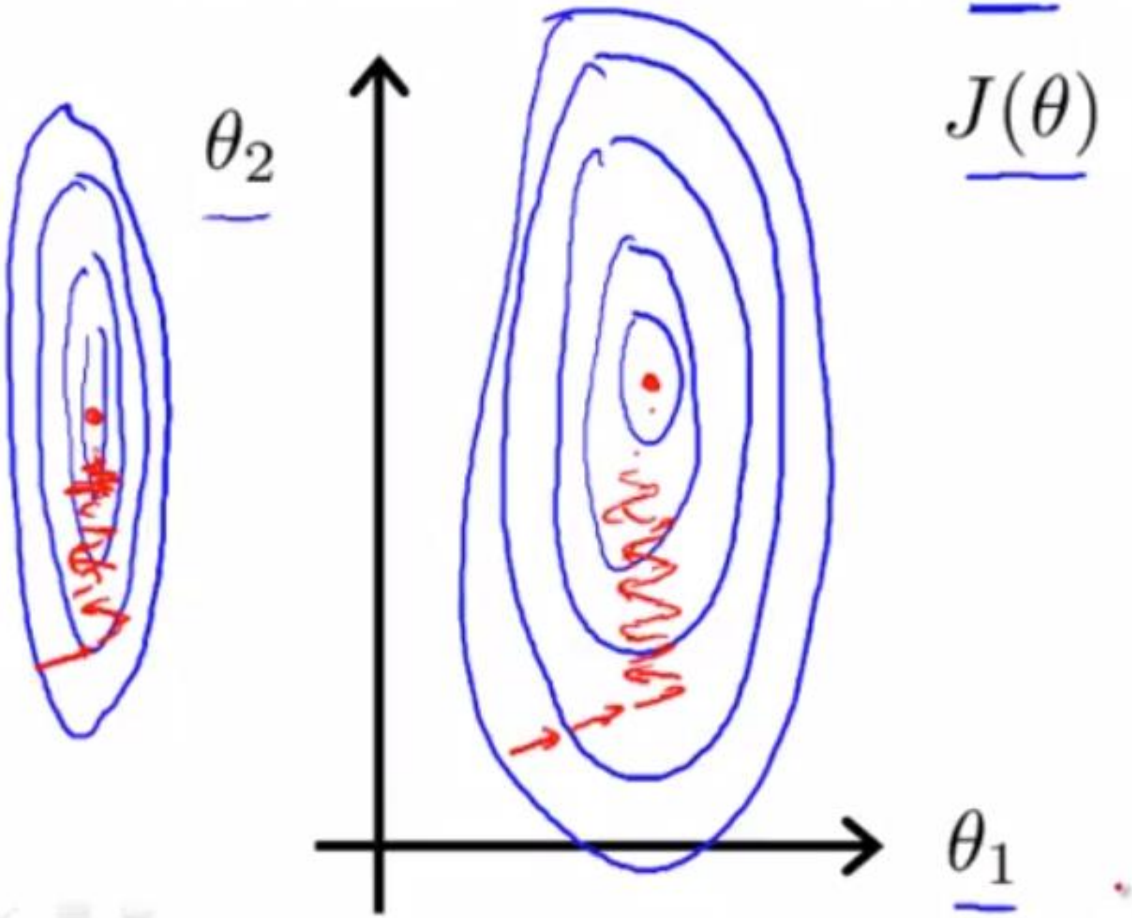

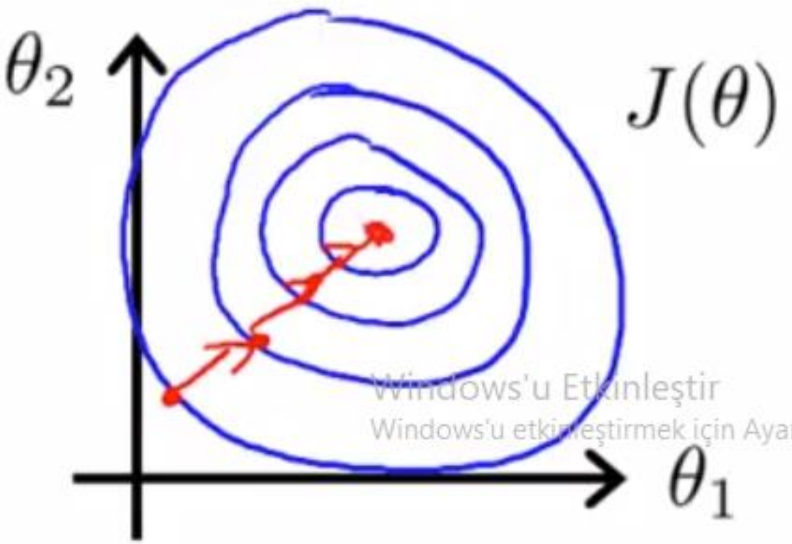

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$x_0 = 1$

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$-100 \le x_3$ 100 ✗

$-0.0001 \le x_4 \le 0.0001$ ✗

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-3 to 3 ✓

$-\frac{1}{3}$ to $\frac{1}{3}$ ✓

Mean normalization

Replace x_i with $x_i - \mu_i$ to make features have approximately zero mean (Do not apply to $x_0 = 1$).

E.g. $x_1 = \frac{size - 1000}{2000}$

$x_2 = \frac{\#bedrooms - 2}{5}$

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avg value of x_1 in training set

range (max - min)

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Exercise

- Suppose you are using a learning algorithm to estimate the price of houses in a city. You want one of your features x_i to capture the age of the house.
- In your training set, all of your houses have an age between 30 and 50 years, with an average age of 38 years.
- How do you normalize your data using mean normalization?