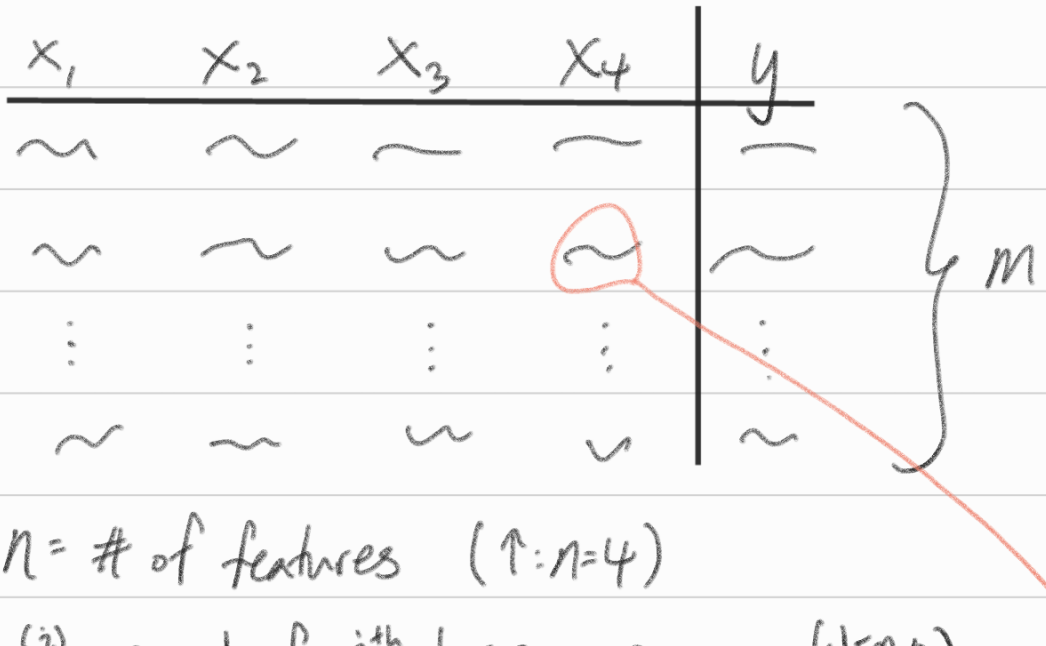
Multiple features (Variables)



n = # of features ($\uparrow$: $n=4$)

$x^{(i)}$ = input of i^{th} training ex. (인덱스)

$x_j^{(i)}$ = value of feature j in i^{th} training ex.

hypothesis: $h_\theta(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 + \theta_4 x_4 \cdots \theta_n x_n$

$$= [\theta_0\ \theta_1 \cdots \theta_n] \begin{bmatrix} x_0 \\ x_1 \\ \vdots \\ x_n \end{bmatrix} = \theta^T \cdot X$$

($x_0 = 1$)

Cost function: $J(\theta) = \frac{1}{2m} \sum_{i=1}^{m} (h_\theta(x^{(i)}) - y^{(i)})^2$

Gradient Descent ($n \geq 1$):

Repeat {

$$\theta_j := \theta_j - \alpha \underbrace{\frac{1}{m} \sum_{i=1}^{m} (h_\theta(x^{(i)}) - y^{(i)}) x_j^{(i)}}_{\frac{\partial}{\partial \theta_j} J(\theta)}$$

} Simultaneously Update θ_j for $j = 0, \cdots, n$

Feature Scaling 특징 스케일링 (전처리)

ex. x_1 = size (0-2000 $feet^2$)

x_2 = # of bedrooms (1-5)

⇓

$x_1 = \frac{size}{2000}$, $x_2 = \frac{\#}{5}$

스케일이 크게 다르면
경사하강이 오래 걸림

⇓

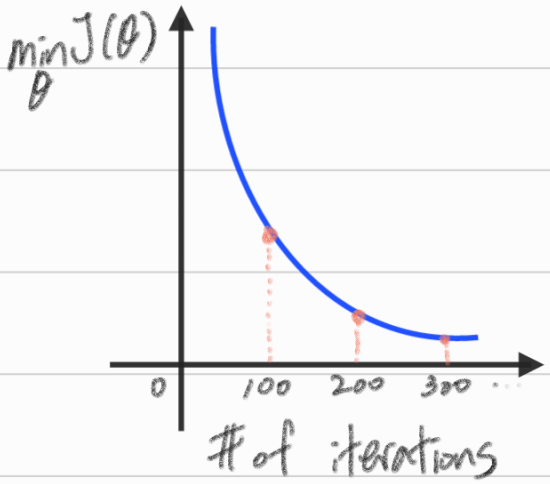
원이 가까운 등고선 : minimum 접근 빠름

일반적으로, $-1 \le x_i \le 1$ range로 scaling 함!

Mean normalization : Replace x_i with $x_i - \mu_i$ and divide it by s_i (max-min)

$$x_i := \frac{x_i - \mu_i}{s_i}$$

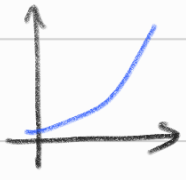
Making sure gradient descent is working correctly



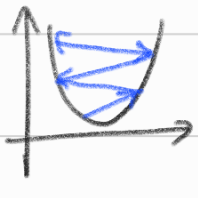
$J(\theta)$ should decrease after every iteration

⇒ 이를 확인하려면 (左)처럼 그려봐야 함

α가 큰 경우, learning rate



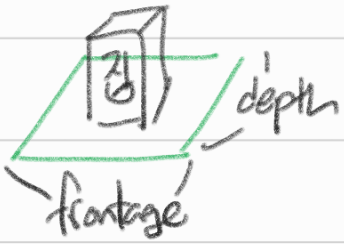
이런 꼴로 나올 수도



즉, if α is too small : slow convergence

if α is too large : $J(\theta)$ may not decrease;
may not converge

Features and Polynomial Regression



ex. Housing prices prediction

$h_\theta(x) = \theta_0 + \theta_1 \times \text{frontage} + \theta_2 \times \text{depth}$

x_1 x_2

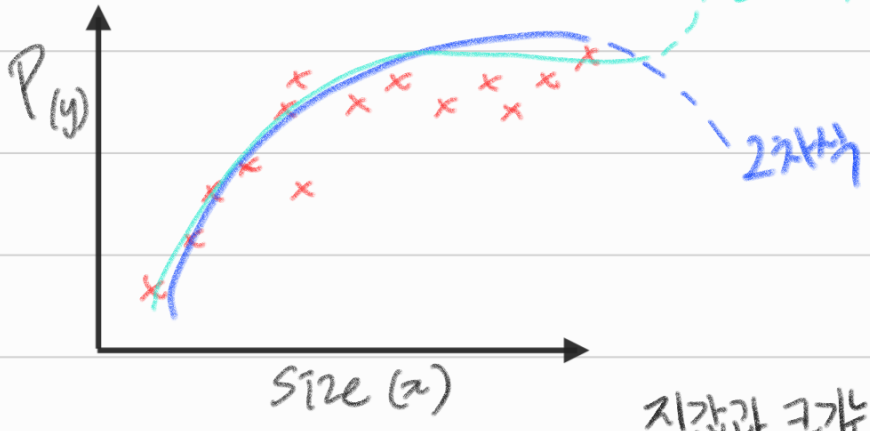
new feature "Area" 만들면,

$\text{Area} = x = x_1 \times x_2$

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

* 굳이 주어진 feature 쓰는 것보다는
때로는 새로운 feature로 더 나은 모델을 정의

Polynomial Regression 다항회귀



↳ $h_\theta(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x$

$x_1 = \text{size}$

$x_2 = \text{size}^2$

$x_3 = \text{size}^3$ (feature scaling 중요★)

집값과 크기는 비례, 2차식은 하락불가