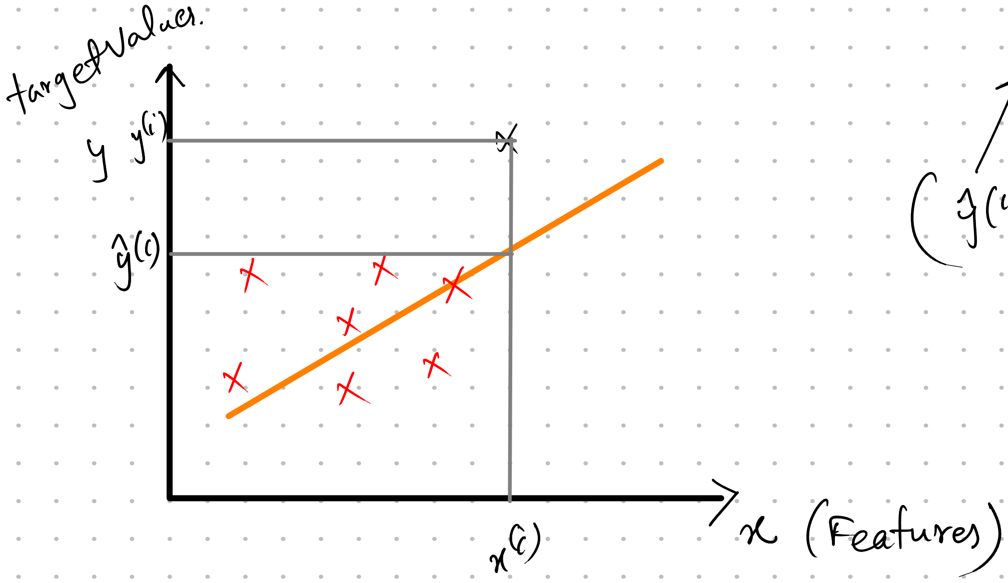

$$\big(\underbrace{\hat{y}^{(i)}}_{\text{Estimated Value}} - \underbrace{y^{(i)}}_{\text{Target Value.}}\big)^2$$

Error

Feature (Input) x

Output y

<u>Model</u> $\quad f_{w,b}(x^{(i)}) = wx^{(i)} + b$

Cost Function

$$J(w,b) = \frac{1}{2m} \sum_{i=1}^{m} \left(\hat{y}^{(i)} - y^{(i)}\right)^2$$

$w, b \rightarrow$ Parameters

$$= \frac{1}{2m} \sum_{i=1}^{m} \left\{ f_{(w,b)}(x^{(i)}) - y^{(i)} \right\}^2$$

$$\boxed{J(w,b) = \frac{1}{2m} \sum_{i=1}^{m} \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\}^2}$$

Cost Function (Squared)

Goal $\rightarrow$ Minimize Cost

Gradient Descent Algorithm

$$w = w - \alpha \frac{\partial}{\partial w} J(w,b) \qquad \alpha = \text{Learning Rate}$$

$$J(w,b) = \frac{1}{2m} \sum_{i=1}^{m} \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\}^2$$

$$\frac{\partial}{\partial w} J(w,b) = \frac{1}{2m} \sum_{i=1}^{m} 2 \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\} x^{(i)}$$

$$= \frac{1}{m} \sum_{i=1}^{m} \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\} x^{(i)}$$

$$f_{w,b}(x^{(i)}) = w x^{(i)} - b$$

$$\frac{\partial}{\partial w} f_{w,b}(x^{(i)}) = x^{(i)}$$

$$\frac{\partial}{\partial b} J(w,b) = \frac{1}{2m} \sum_{i=1}^{m} 2 \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\}$$

$$= \frac{1}{m} \sum_{i=1}^{m} \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\}$$

$$\frac{\partial}{\partial b} f_{w,b}(x^{(i)}) = 0$$

$$\boxed{\begin{aligned} w &= w - \alpha \left[\frac{1}{m} \sum_{i=1}^{m} \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\} x^{(i)} \right] \\ b &= b - \alpha \left[\frac{1}{m} \sum_{i=1}^{m} \left\{ f_{w,b}(x^{(i)}) - y^{(i)} \right\} \right] \end{aligned}}$$