Gradient Descent for Multiple Linear Regression:

Parameters $\vec{w}$

Model $f_{\vec{w},b}(\vec{x}) = \vec{w} \cdot \vec{x} + b$

Cost function $J(\vec{w}, b)$

Gradient descent Algorithm

$$w_1 = w_1 - \alpha \frac{\partial}{\partial w_1} J(\vec{w}, b)$$

$$= w_1 - \alpha \frac{1}{m} \sum_{i=1}^{m} \left\{ f_{\vec{w},b}(\vec{x}^{(i)}) - y^{(i)} \right\} x_1^{(i)}$$

$$b = b - \alpha \frac{\partial}{\partial b} J(\vec{w}, b)$$

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

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

$$\frac{\partial}{\partial w_1} J(\vec{w}, b) = \frac{1}{2m} \sum_{i=1}^{m} 2 \left\{ f_{\vec{w},b}(\vec{x}^{(i)}) - y^{(i)} \right\}$$

$$= \frac{1}{m} \sum_{i=1}^{m} \left\{ f_{\vec{w},b}(\vec{x}^{(i)}) - y^{(i)} \right\} x_1^{(i)}$$