

## Second iteration

Given information:

Linear equation:  $y = mx + b$

• Updated  $m = 1.7$

• Updated  $b = 2.1$

• Learning rate =  $\alpha = 0.1$

• Given points:  $(1, 3)$  &  $(3, 6)$

• Number of points = 2

Gradient formulas

$$\frac{\partial J}{\partial m} = -\frac{2}{n} \sum (y_i - \hat{y}_i) x_i$$

$$\frac{\partial J}{\partial b} = -\frac{2}{n} \sum (y_i - \hat{y}_i)$$

$$m_{\text{new}} = m_{\text{old}} - \alpha \left( \frac{\partial J}{\partial m} \right)$$

$$b_{\text{new}} = b_{\text{old}} - \alpha \left( \frac{\partial J}{\partial b} \right)$$

1) Predictions ( $\hat{y}_i$ )

$$\hat{y}_1 = 1.7(1) + 2.1$$

$$\hat{y}_1 = 3.8$$

$$\hat{y}_2 = 1.7(3) + 2.1$$

$$\hat{y}_2 = 7.2$$

$(1, 3) \quad (3, 6)$

$y = mx + b$

## 2. Gradients

$$\frac{\partial J}{\partial m} = -\frac{2}{n} \sum (y_i - \hat{y}_i) x_i \quad \text{where } n=2$$

$$y_1 = 3$$

$$y_2 = 6$$

$$\hat{y}_1 = 3.8$$

$$\hat{y}_2 = 7.2$$

$$x_1 = \frac{1}{3}$$

$$x_2 = \frac{2}{3}$$

$$= -\frac{2}{2} [(3 - 3.8)(1) + (6 - 7.2)(3)]$$

$$= -1 [(-0.8) + (-3.6)]$$

$$= -1 (-4.4)$$

$$= 4.4$$

$$\frac{\partial J}{\partial b} = -\frac{2}{n} \sum (y_i - \hat{y}_i)$$

$$= -\frac{2}{2} [(3 - 3.8) + (6 - 7.2)]$$

$$= -1 [(-0.8) + (-1.2)]$$

$$= -1 (-2)$$

$$= 2$$

3. Updating Parameters), where  $m_{\text{old}} = 1.7$

$$m_{\text{new}} = m_{\text{old}} - \alpha \frac{\partial J}{\partial m}$$

$$m_{\text{old}} = 2.1$$

$$\alpha = 0.1$$

$$\frac{\partial J}{\partial m} = 4.4$$

$$b_{\text{new}} = b_{\text{old}} - \alpha \frac{\partial J}{\partial b}$$

$$\frac{\partial J}{\partial b} = 2$$

$$\Rightarrow m_{\text{new}} = 1.7 - 0.1 (4.4)$$

$$= 1.26$$

$$b_{\text{new}} = 2.1 - 0.1 (2)$$

$$= 1.9$$

$$m_{\text{new}} = 1.26, b_{\text{new}} = 1.9$$