

— x — x —

Lecture 03 = Gradient Descent (1)

$$\text{Gradient} = \frac{\partial \text{loss}}{\partial w}$$

→ find "w"
that min
the loss

$$w = w - \alpha \frac{\partial \text{loss}}{\partial w}$$

Derivative

$$\text{loss} = (\hat{y} - y)^2 = (x * w - y)^2$$

$$w = w - \alpha \frac{\partial \text{loss}}{\partial w}$$

$$\frac{\partial \text{loss}}{\partial w} = ?$$

$$\text{loss} = (\hat{y} - y)^2 = (xw - y)^2$$

$$\frac{\partial}{\partial w} (\text{loss}) = \frac{\partial}{\partial w} ((xw - y)^2)$$

$$\frac{\partial \text{loss}}{\partial w} = 2(xw - y) \cdot \frac{\partial}{\partial w} (xw - y)$$

$$\frac{\partial \text{loss}}{\partial w} = 2(xw - y) \left[\frac{\partial xw}{\partial w} - \frac{\partial y}{\partial w} \right]$$

$$\frac{\partial \text{loss}}{\partial w} = 2(xw - y) [x - 0]$$

$$\frac{\partial \text{loss}}{\partial w} = 2x(xw - y)$$

$$\cancel{w} = \cancel{w} - \cancel{\alpha} \frac{\partial \text{loss}}{\partial w}$$

$$w = w - \alpha \frac{\partial}{\partial w} (\text{loss})$$

$$w = w - \alpha (2x(xw - y))$$

Exercise 3-1 (compute gradient)

(3)

$$\hat{y} = x^2 w_2 + x w_1 + b$$

$$\text{loss} = (\hat{y} - y)^2$$

$$\frac{d}{dw_1} (\text{loss}) = ?$$

$$\frac{d}{dw_1} (\text{loss}) = \frac{d}{dw_1} (\hat{y} - y)^2$$

$$= \frac{d}{dw_1} (x^2 w_2 + x w_1 + b - y)^2$$

$$= \left[\frac{d}{dw_1} (x^2 w_2) + \frac{d}{dw_1} (x w_1) + \frac{d}{dw_1} (b) \right.$$

$$\left. + \frac{d}{dw_1} (-y) \right] (2)(x^2 w_2 + x w_1$$

$$+ b - y)$$

$$= [0 + x + 0 + 0] (2(x \hat{y} - y))$$

$$= 2x (\hat{y} - y)$$

$$\frac{d}{dw_1} (\text{loss}) = 2x (\hat{y} - y)$$

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