

# 1 Gradient Descent

$$dC(\omega) = \lim_{\varepsilon \rightarrow 0} \frac{C(\omega + \varepsilon) - C(\omega)}{\varepsilon} \quad (1)$$

(2)

## 1.1 “Computing The Derivative of Twice“

$$C(w) = \frac{\sum_{i=1}^n (x_i \cdot w - y_i)^2}{n} \quad (3)$$

$$C'(w) = \left( \frac{\sum_{i=1}^n (x_i \cdot w - y_i)^2}{n} \right)' = \quad (4)$$

$$= \left( \frac{1}{n} \cdot \sum_{i=1}^n (x_i \cdot w - y_i)^2 \right)' = \quad (5)$$

$$= \frac{1}{n} \cdot \left( \sum_{i=1}^n (x_i \cdot w - y_i)^2 \right)' = \quad (6)$$

$$= \frac{1}{n} \cdot \sum_{i=1}^n ((x_i \cdot w - y_i)^2)' = \quad (7)$$

$$= \frac{1}{n} \cdot \sum_{i=1}^n (2 \cdot (x_i \cdot w - y_i)(x_i \cdot w - y_i)') = \quad (8)$$

$$= \frac{1}{n} \cdot \sum_{i=1}^n (2 \cdot (x_i \cdot w - y_i) \cdot x_i) \quad (9)$$

$$C(w) = \frac{\sum_{i=1}^n (x_i \cdot w - y_i)^2}{n} \quad (10)$$

$$C'(w) = \frac{1}{n} \cdot \sum_{i=1}^n (2 \cdot (x_i \cdot w - y_i) \cdot x_i) = \quad (11)$$

(12)