

# 1 GRADIENT DESCENT

$$C'(w) = \lim_{e \rightarrow 0} \frac{C(w+e) - C(w)}{e}$$

## 1.1 Double

$$\begin{aligned} C(w) &= \frac{1}{n} \sum_{i=1}^n (x_i w - y_i)^2 \\ C'(w) &= \left( \frac{1}{n} \sum_{i=1}^n (x_i w - y_i)^2 \right)' \\ &= \frac{1}{n} \left( \sum_{i=1}^n (x_i w - y_i)^2 \right)' \\ &= \frac{1}{n} \left( (x_0 w - y_0)^2 + (x_1 w - y_1)^2 + \dots + (x_n w - y_n)^2 \right)' \\ &= \frac{1}{n} \sum_{i=1}^n \left( (x_i w - y_i)^2 \right)' \\ &= \frac{1}{n} \sum_{i=1}^n 2(x_i w - y_i)(x_i w - y_i)' \\ &= \frac{1}{n} \sum_{i=1}^n 2(x_i w - y_i)(x_i)' \\ &= \frac{1}{n} \sum_{i=1}^n 2(x_i w - y_i)x_i' \end{aligned}$$

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

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

## 1.2 One neuron model with 1 input

