$f(x)$

$f(x) = mx + b$

Error: deviation from function

$f(x)$ should minimize error

goal is to optimize m and b to minimize E

Mean Squared Error

$$E = \frac{1}{n} \cdot \sum_{i=0}^{n} \left(y_i - f(i)\right)^2 = \frac{1}{n} \cdot \sum_{i=0}^{n} \left(y_i - (mx_i + b)\right)^2$$

$f(i)$ → predicted

y_i → actual value

gradient descent

$$\frac{\partial E}{\partial m} = \frac{1}{n} \cdot \sum_{i=0}^{n} 2 \cdot \left(y_i - (mx_i + b)\right) \cdot -x_i$$

$$= -\frac{2}{n} \cdot \sum_{i=0}^{n} x_i \left(y_i - (mx_i + b)\right)$$

$$\frac{\partial E}{\partial b} = -\frac{2}{n} \cdot \sum_{i=0}^{n} \left(y_i - (mx_i + b)\right)$$

slope of E with respect to m and b

$$m_{new} = m_{old} - L \cdot \frac{\partial E}{\partial m}$$

$$b_{new} = b_{old} - L \cdot \frac{\partial E}{\partial b}$$

we subtract $\frac{\partial E}{\partial m}$ b/c we want to minimize E (go opposite direction)

↳ L = the size of "step" we take

larger L → fast, but inaccurate