$\star$ $E(w(k+1)) < E(w(k))$

$\Rightarrow$ But the assumption holds only in the neighborhood of w.

$$\left.\begin{aligned} E(w) &= \frac{1}{2m} \sum_{i=1}^{m} (w x_i - t_i)^2 \\ \frac{\partial E}{\partial w} &= \frac{1}{m} \sum_{i=1}^{m} (w x_i - t_i)(x_i) \end{aligned}\right\} O(1)$$

treating x vector as constant

$$w^{(k+1)} = w^{(k)} - \eta \left(\frac{\partial E}{\partial w} \bigg|_{w = w^{(k)}} \right)$$

$$f(x) = x^2 + 2x + 5$$

$$\frac{1}{2m}(x^2 + 2x + 5)$$

$$E(w^{(2)}_{E}) - E(w^{(3)}) < E(w^{(1)}) - E(w^{(2)})$$

(slope decreases)

(assuming near terminal step)

$$E(w^{(n)}) - E(w^{(n-1)}) < \epsilon$$

for some $\epsilon = 10^{-30}$