HW-1

(x_i, y_i) trainingset where $i = 1$ to m

$h(x,w) = \sum_{j=0}^{n} w_j x^j$ where $n = 5$.

$L(h(x), y) = (h(x) - y)^2$

Hgood = $\underset{w}{\text{argmin}} \sum_{i=1}^{m} L(h(x_i, w), y)/m$

→ First we will calculate $h(x,w) = \sum_{j=0}^{n} w_j x^j$, $n = 0$ to 5

For $\underline{n=0}$

$w_0 x^0$

$\underline{n=1}$

$w_0 x^0 + w_1 x^1$

$\underline{n=2}$

$w_0 x^0 + w_1 x^1 + w_2 x^2$

$\underline{n=3}$

$w_0 x^0 + w_1 x^1 + w_2 x^2 + w_3 x^3$

$\underline{n=4}$

$w_0 x^0 + w_1 x^1 + w_2 x^2 + w_3 x^3 + w_4 x^4$

$\underline{n=5}$

$w_0 x^0 + w_1 x^1 + w_2 x^2 + w_3 x^3 + w_4 x^4 + w_5 x^5$

→ Now, calculating the gradient descent wrt (w) $\frac{dL}{dw_j}$.

For $n=0$, $\frac{d}{dw_0} (w_0 - y)^2$

$= 2(w_0 - y) \cdot (1)$

For $n=1$, $\frac{d}{dw_1} ((w_0 + w_1 x) - y)^2$

$= 2((w_0 + w_1 x) - y) \cdot (x)$

$= \frac{d}{dw_1} 2((w_0 + w_1 x + w_2 x^2) - y)^2$

For $n=2$, $\frac{d}{dw_2} ((w_0 + w_1 x + w_2 x^2) - y) \cdot (x^2)$

$= 2((w_0 + w_1 x + w_2 x^2 + w_3 x^3) - y)^2$

For $n=3$, $\frac{d}{dw_3} ((w_0 + w_1 x + w_2 x^2 + w_3 x^3) - y) \cdot (x^3)$

$= 2((w_0 + w_1 x + w_2 x^2 + w_3 x^3 + w_4 x^4) - y)^2$

For $n=4$, $\frac{d}{dw_4} ((w_0 + w_1 x + w_2 x^2 + w_3 x^4 + w_4 x^4) - y) \cdot (x^4)$

$= d/dw_4 \; 2((w_0 + w_1 x + w_2 x^2 + w_3 x^4 + w_4 x^4)$

For $n=5$,

$$\frac{d}{dw_5}\left((w_0 + w_1 x + w_2 x^2 + w_3 x^3 + w_4 x^4 + w_5 x^5) - y\right)^2$$

$$= 2\left((w_0 + w_1 x + w_2 x^2 + w_3 x^3 + w_4 x^4 + w_5 x^5) - y\right) \cdot (x^5)$$