Gradient Descent - Group 8

X	Y
1	3
3	6

Initial m = -1 learning rate: 0.1

Initial b = 1

Step 1: $\hat{y} = mx + b$ $\quad \hat{y}_1 = -1.1 + 1 = 0$

$\hat{y}_2 = -1.3 + 1 = -2$

Step 2: $cost = y - \hat{y}$ $\quad cost_1 = 3 - 0 = 3$

$cost_2 = 6 - (-2) = 8$

Step 3: $M_{new} = M_{old} - (learning\ rate \cdot \frac{\partial mse}{\partial E})$

$$\frac{\partial mse}{\partial e} = \frac{(y-\hat{y})^2 + (y-\hat{y})^2}{2}$$

3.1 $$\frac{\partial mse}{\partial m} = \frac{(3-(mx+b))^2 + (6-(mx+b))^2}{2}$$

$$= (3-m-b)^2 + (6-3m-b)^2$$

Chain rule

let $u' = 3 - m - b = -1$	let $u' = 6 - 3m - b = -3$
let $v' = u^2 = 2u$	let $v' = u^2 = 2u$
$2u \cdot -1 = -2u$	$2u \cdot -3 = -6u$
Now $-2(3-m-b)$	Now $-6(6-3m-b)$

$$= -2(3-m-b) - 6(6-3m-b)$$

$$-6 + 2m + 2b - 36 + 18m + 6b$$

$$-6 - 36 + 2m + 18m + 2b + 6b$$

$$-42 + 20m + 8b \,/\, 2$$

$$\frac{-42 + 20(-1) + 8}{2} = \frac{-54}{2} = -27$$

$\frac{\partial mse}{\partial m} = -27$

$m\_new = -1 - 0.1 \cdot -27 = 1.7$

step 4: $b\_new = b\_old - (\text{learning rate} \cdot \frac{dmse}{db})$

$$\frac{dmse}{db} = \frac{\sum (3-(mx+b))^2 + (6-(mx+b))^2}{2}$$

$$= (3-m-b)^2 + (6-3m-b)^2$$

Chain rule

$u = 3-m-b = -1$; $v = u^2 = 2u$; $2u \cdot -1 = -2u$

$u' = 6-3m-b = -1$; $v' = u^2 = 2u$; $2u \cdot -1 = -2u$

$$-2(3-m-b) - 2(6-3m-b)$$

$$-6+2m+2b - 12+6m+2b$$

$$-6-12+2m+6m+2b+2b$$

$$-18+8m+4b$$

$$-18-8\cdot(-1)+4$$

$$\frac{dmse}{db} = \frac{-22}{2} = -11 //$$

$b\_new = 1 - (0.1 \cdot -11) = 2.1$

First Iteration
$m\_new = 1.7$
$b\_new = 2.1$

by Miracle Nanen

$m\_new = 3-(mx+b)^2 + 6-(mx+b)^2$

$\doteq -42 + 20m + 8b$

$= -42 + 34 + 16.8 = 8.8 = \frac{8.8}{2} = 4.4$

$m\_new = 1.7 - 0.1 \cdot 4.4 = 1.26$

$m\_new = 1.26 //$

$b\_new = -18 + 8m + 4b$

$= -18 + 8(1.7) + 4(2.1)$

$= -18 + 13.6 + 8.4$

$= \frac{4}{2} = 2$

$\frac{\partial mse}{\partial b}$

$b\_new = 2.1 - 0.1.2$

$= 1.9$

2nd Iteration

$m\_new = 1.26$

$b\_new = 1.9$

by Wagner Mushayija

Iteration 3

Using Iteration 2 parameters

$M_{new} = 1.26$

$B_{new} = 1.9$

$$\frac{\partial MSE}{\partial m} = \frac{42 + 20m + 8b}{2}$$

$$= \frac{-42 + 20(1.26) + 8(1.9)}{2}$$

$$= \frac{-42 + 25.2 + 15.2}{2} = \frac{-1.6}{2}$$

$$= -0.8$$

$$M_{new} = 1.26 - 0.1 \times -0.8 = 1.26 + 0.08$$

$$= 1.34$$

$$\frac{\partial MSE}{\partial b} = \frac{-18 + 8 + 4b}{2}$$

$$= \frac{-18 + 8(1.26) + 4(1.9)}{2}$$

$$= \frac{-18 + 10.08 + 7.6}{2}$$

$$= \frac{-18 + 17.68}{2} = \frac{-0.32}{2}$$

$$= -0.16$$

$$B_{new} = 1.9 - 0.1 \times -0.16$$

$$= 1.9 + 0.016$$

$$= 1.916$$

By Glory Paul

Date: / /

Iteration 4 By Duchime Paulette.

$$\frac{dmse}{dm} = -42 + 20m + 8b$$

$$-42 + 20(1.34) + 8(1.9)$$

$$-42 + 26.8 + 15.2$$

$$= \frac{0}{2}$$

$$= 0$$

$$m\_new = 1.34 - (0.1 \times 0)$$

$$= 1.34 - 0$$

$$= 1.34$$

$$b\_new = -18 + 8m + 4b$$

$$\frac{dmse}{db} = -18 + (8 \times 1.34) + 4(1.9)$$

$$= -18 + 10.7 + 7.6$$

$$= \frac{0.3}{2}$$

$$= 0.15$$

$$b\_new = 1.9 - (0.1 \times 0.15)$$

$$= 1.9 - 0.015$$

$$= 1.8$$