Assignment - 07

- Let consider a sample dataset have one i/p (x_i^q) & one o/p (y_i^q) and number of samples 4. Develop a simple linear regression model using BGD.

Sample (i)	x_i^q	y_i^q
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

- Do manual calculations for 2 iterations, with first 2 samples.

Sol:-

sample(i)	x_i^q	y_i^q
1	0.2	3.4
2	0.4	3.8

step1:- $[x, y]$, $m=1$, $c=1$, $\eta=0.1$, epochs = 2, ns=2

step2:- iter = 1

step3:- $E = \frac{1}{2ns} \sum_{i=1}^{ns} (y_i - mx_i - c)^2$

$$\frac{\partial E}{\partial m} = \frac{-1}{ns} \sum_{i=1}^{ns} (y_i - mx_i - c)(x_i)$$

$$= \frac{-1}{2} \left[[3.4 - (1)(0.2) - 1](0.2) + [3.8 - (1)(0.4) - 1][0.4] \right]$$

$$= \frac{-1}{2} \left[(2.2)(0.2) + (2.4)(0.4) \right]$$

$$\frac{\partial E}{\partial m} = -0.7$$

$$\frac{\partial E}{\partial c} = \frac{-1}{ns}\sum_{i=1}^{ns}(y_i - mx_i - c)$$

$$= \frac{-1}{2}\left[(3.4 - (1)(0.2) - 1) + (3.8 - (1)(0.4) - 1)\right]$$

$$= \frac{-1}{2}\left[2.2 + 2.4\right]$$

$$\boxed{\frac{\partial E}{\partial c} = -2.3}$$

step 4:- $\Delta m = -\eta \frac{\partial E}{\partial m}$

$$= -(0.1)(-0.7)$$

$$\boxed{\Delta m = 0.07}$$

$$\Delta c = -\eta \frac{\partial E}{\partial c}$$

$$= -(0.1)(-2.3)$$

$$\boxed{\Delta c = 0.23}$$

step 5:- $m = m + \Delta m$

$$= 1 + 0.07$$

$$\boxed{m = 1.07}$$

$$c = c + \Delta c$$

$$= 1 + 0.23$$

$$\boxed{c = 1.23}$$

step 6:- $iter = iter + 1$

$$= 1 + 1 = 2$$

step 7:- if (iter > epochs)

$2 > 2$ ×

True: Next step

False: go to step 3.

step 3:- $\frac{\partial E}{\partial m} = -\frac{1}{2}\left[(3.4 - (1)(0.2) - 1)(0.2)\right.$

$$\frac{\partial E}{\partial m} = \frac{-1}{ns}\sum_{i=1}^{ns}(y_i - mx_i - c)(x_i)$$

$$= \frac{-1}{2}\left[\left[3.4 - (1.07)(0.2) - 1.23\right](0.2) + \left[3.8 - (1.07)(0.4) - 1.23\right](0.4)\right]$$

$$\frac{\partial E}{\partial m} = -0.624$$

$$\frac{\partial E}{\partial c} = \frac{-1}{ns}\sum_{i=1}^{n} (y_i - mx_i - c)$$

$$= \frac{-1}{2}\left[(3.4 - (1.07)(0.2) - 1.23) + (3.8 - (1.07)(0.4) - 1.23)\right]$$

$$\frac{\partial E}{\partial c} = -2.049$$

step4:- $\Delta m = -\eta \frac{\partial E}{\partial m}$ $\Delta c = -\eta \frac{\partial E}{\partial c}$

$= -(0.1)(-0.624)$ $= -0.1(-2.049)$

$\Delta m = 0.0624$ $\Delta c = 0.2049$

step5:- $m = m + \Delta m$ $c = c + \Delta c$

$= 1.07 + 0.0624$ $= 1.23 + 0.2049$

$m = 1.1324$ $c = 1.4349$

step6:- iter = iter + 1

= 2 + 1

= 3

step7:- if (iter > epochs)

3 > 2 ✓

True: Next step ✓

false: go to step 3.

step8:- printing m and c values.

m = 1.1324 , c = 1.04349.