ASSIGNMENT-5

18K41A04B2

Develop the simple linear regression model for the following dataset using MBGD. where number of samples are 4.

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

Batch-1	
0.2	3.4
0.8	4.6

Batch-2	
0.4	3.8
0.6	4.2

bs = 2

Step 1:- $m=1$, $c=-1$ $\eta = 0.1$ epochs = 2

bs = 2 [batch size], ns = 4

Step 2:- Split training data on batch size,

$$n_b = \frac{ns}{bs}$$

$$\Rightarrow n_b = 4/2 = 2$$

Step 3:- iter = 1

Step 4:- batch = 1

Step 5:- $$\epsilon = \frac{1}{2bs} \sum_{i=1}^{bs} (y_i - mx_i - c)^2$$

$$\frac{\partial \epsilon}{\partial m} = \frac{-1}{bs} \sum_{i=1}^{bs} (y_i - mx_i - c)\, x_i$$

$$= \frac{-1}{2} \sum_{i=1}^{2} (y_i - mx_i - c) x_i$$

$$= \frac{-1}{2} \left[(y_1 - mx_1 - c) x_1 + (y_2 - mx_2 - c) x_2 \right]$$

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

$$\Rightarrow \frac{\partial \epsilon}{\partial m} = -1.3$$

$$\frac{\partial \epsilon}{\partial c} = -\frac{1}{2} \sum_{i=1}^{2} (y_i - mx_i - c)$$

$$= \frac{-1}{2} \left[(y_1 - mx_1 - c) + (y_2 - mx_2 - c) \right]$$

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

$$= -4.3.$$

Step6:- Calculating detta values

$$\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = -(0.1)(-1.3) = 0.13$$

$$\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = -(0.1)(-1.3) = 0.43$$

Step7:- Update m and c values

$$m = m + \Delta m = 1 + 0.13$$

$$= 1.13$$

$$c = c + \Delta c = -1 + 0.43$$

$$= -0.51$$

Step8:- Batch = Batch + 1

$$= 1 + 1 = 2$$

Step 4 :- If (batch > nb)

no

else

go to step 5

Step 5 :- $\frac{\partial \epsilon}{\partial m} = \frac{-1}{2} \sum_{bs=1}^{2} (y_i - mx_i - c) x_i$

$= \frac{-1}{2} (y_1 - mx_1 - c) x_1 + (y_2 - mx_2 - c) x_2$

$= \frac{-1}{2} [(4.2 - (1.13)(0.6) + 0.57](0.6) + (4.6 - (1.13)(0.8) + 0.57](0.8)]$

$= -2.934$

$\frac{\partial \epsilon}{\partial c} = \frac{-1}{2} \sum_{bs=1}^{2} (y_i - mx_i - c)$

$= \frac{-1}{2} [(y_1 - mx_1 - c) + (y_2 - mx_2 - c)]$

$= \frac{-1}{2} [(4.2 - (1.13 \times 0.6) + 0.057) + (4.6 - (1.13 \times 0.8) + 0.57)]$

$= -4.179$

Step 6 :- calculating delta values

$\Delta m = -n \cdot \frac{\partial \epsilon}{\partial m} = -(0.1)(-2.934)$

$= 1.4234$

$\Delta c = -n \cdot \frac{\partial \epsilon}{\partial c} = -(0.1)(-4.179)$

$= 0.4179$

Step 7 :- Updating m and c values.

$m = m + \Delta m = 1.13 + 0.2934 = 1.4234$

$c = c + \Delta c = -0.57 + 0.4179 = -0.1521$

Step 8:- batch = batch+1 = 2+1 = 3.

Step 9:- if (batch > nb) go to step 10.

Step 10:- iter = 1+1 = 2

Step 11:- if (iter > epochs).

No

else

go to step 5

Step 5:- batch = 1

Step 6:- $\frac{\partial \epsilon}{\partial m} = \frac{-1}{2}\left[(y_1 - mx_1 - c)x_1 + (y_2 - mx_2 - c)x_2\right]$

$= \frac{-1}{2}\left[(3.4 - (1.4234)(0.2) + 0.1521)(0.2) + (3.8 - (1.4234)(0.4) + 0.1521)(0.4)\right]$

$= -1.00329$

$\frac{\partial \epsilon}{\partial c} = \frac{-1}{2}\left[(y_1 - mx_1 - c) + (y_2 - mx_2 - c)\right]$

$= \frac{-1}{2}\left[(3.4 - (1.4234)(0.2) + 0.1521) + (3.8 - (1.4234)(0.4) + 0.1521)\right]$

$= -3.32508$

Step 7:- Calculating delta values

$\Delta m = -n \cdot \frac{\partial \epsilon}{\partial m} = -(0.1)(-1.00329)$

$= -0.100329$

$\Delta c = -n \cdot \frac{\partial \epsilon}{\partial c} = -(0.1)(-3.32508)$

$= +0.332508$

Step8:- Updating m and c values

$$m = m + \Delta m = 1.42344 + 0.100329$$

$$= 1.523729$$

$$c = c + \Delta c = -0.1521 + 0.332508$$

$$= 0.180408$$

Step 9 :- Batch = batch+1

$$= 2$$

Step10 :- if (batch > 2)

no

else

go to step 6

Step 6:- $\frac{\partial \epsilon}{\partial m} = \frac{-1}{2}[(4.2 - (1.523729 \times 0.6) - 0.180408)0.6 +$

$$(4.6 - (1.523729)(0.8) - 0.180408)(0.8)]$$

$$= -2.2118499$$

$$\frac{\partial \epsilon}{\partial c} = \frac{-1}{2}[(4.2 - (1.523729 \times 0.6) - 0.180408) +$$

$$(4.6 - (1.523729 \times 0.8) - 0.180408]$$

$$= -3.1529817$$

Step 7:- calculating delta values.

$$\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = -(0.1)(-2.2118499)$$

$$= 0.2118499$$

$$\Delta c = \eta \cdot \frac{\partial \epsilon}{\partial c} = -(0.1)(-3.1529817)$$

$$= 0.3152981$$

Step8:- Updating m and c values

$m = m + \Delta m = 1.523729 + 0.22118499$

$= 1.744491399$

$c = c + \Delta c = 0.180408 + 0.315297817$

$= 0.495705617$

Step9 :- batch 2+1 = 3

Step10:- if (batch > ns)

go to step11

Step11:- iter = 2+1 = 3

Step12 :- if (iter > epochs)

go to next step

Step13:- print (m,c)