Assignment-5:- (18K41A04D0)

let consider a Sample dataset have One i/p (x_i^a) & One o/p (y_i^a), and no.of Samples 4. Develop a Simple linear regression model using MBGD.

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

DO manual calculations for two iterations with batch size 2

x	y	
0.2	3.4	} batch1
0.4	3.6	
0.6	4.2	} batch 2
0.8	4.6	

step1) [x,y], m=1, c=-1, η=0.1, epochs=2, bs=2

2) $n_b = \frac{n_s}{bs} = \frac{4}{2} = 2$

3) iter = 1

4) batch = 1

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

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

$= \frac{-1}{2}[0.84+1.76]$

$\frac{\partial E}{\partial m} = -1.34$

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

$$= -4.3$$

6) $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-1.34)$

$$\Delta m = 0.134$$

$$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-4.3)$$

$$\Delta c = 0.43$$

7) $m = m + \Delta m = 1 + 0.134 = 1.134$

$c = c + \Delta c = -1 + 0.43 = -0.57$

8) batch = batch + 1 = 1 + 1 = 2

9) if (batch > nb)

2 > 2 false

goto step 5

5) $\frac{\partial E}{\partial m} = \frac{-1}{2}\left[(4.2 - (1.134)(0.6) + 0.57)0.6 + (4.6 - (1.134)(0.8) + 0.57)0.8\right]$

$$= \frac{-1}{2}\left[2.4537 + 3.4102\right]$$

$$\frac{\partial E}{\partial m} = -2.9319$$

$$\frac{\partial E}{\partial c} = \frac{-1}{2}\left[(4.2 - (1.134)(0.6) + 0.57) + (4.6 - (1.134)(0.8) + 0.57)\right]$$

$$= \frac{-1}{2}\left[4.0896 + 4.2628\right] = -4.1762$$

6) $\Delta m = -(0.1)(-2.932) = 0.2932$

$\Delta c = -(0.1)(-4.1762) = 0.41762$

7) $m = m + \Delta m = 1.134 + 0.2932 = 1.4272$

$c = c + \Delta c = -0.57 + 0.41762 = -0.1523$

8) batch = batch + 1 = 2 + 1 = 3

9) if (batch > ns)

3 > 2 true

goto next step.

10) iter = iter + 1 = 1 + 1 = 2

11) if (iter > epochs)
2 > 2 false
goto step 4

4) Batch = 1

5) $\frac{\partial E}{\partial m} = \frac{-1}{2}[(3.4 - (1.4272)(0.2) + 0.1523)(0.2) + (3.8 - (1.4272)(0.4) + 0.1523)0.4]$

$= \frac{-1}{2}[0.653 + 1.352] = -1.0029.$

$\frac{\partial E}{\partial c} = \frac{-1}{2}[(3.4 - (1.4272)(0.2) + 0.1523) + (3.8 - (1.4272)(0.4) + 0.1523)]$

$= \frac{-1}{2}[3.266 + 3.381] = -3.323$

6) $\Delta m = (-0.1)(-1.0029) = 0.1002.$

$\Delta c = (-0.1)(-3.323) = 0.332$

7) $m = m + \Delta m = 1.4272 + 0.1002 = 1.5274$

$c = c + \Delta c = -0.1523 + 0.332 = 0.1797$

8) batch = batch + 1 = 1 + 1 = 2.

9) if (batch > nb)
2 > 2 false
goto step 5

5) $\frac{\partial E}{\partial m} = \frac{-1}{2}[(4.2 - (1.5274)(0.6) - 0.1797)(0.6) + (4.6 - (1.5274)(0.8) - 0.1797)(0.8)]$

$= \frac{-1}{2}[1.8623 + 2.558] = -2.2101$

$\frac{\partial E}{\partial c} = \frac{-1}{2}[(4.2 - (1.5274)(0.6) - 0.1797) + (4.6 - (1.5274)(0.8) - 0.1797)]$

$= \frac{-1}{2}[3.103 + 3.198] = 3.151$

6) $\Delta m = -(0.1)(-2.2101) = 0.221$

$\Delta c = -(0.1)(-3.151) = 0.315$

7) $m = m + \Delta m = 1.5274 + 0.221 = 1.7484$

$c = c + \Delta c = 0.1797 + 0.315 = 0.4947$

8) batch = batch + 1 = 2 + 1 = 3

9) If (batch > nb)

3 > 2 true

goto step 10.

10) iter = iter + 1 = 2 + 1 = 3

11) if (iter > epochs)

3 > 2 true.

goto next step.

12) print m, c

m = 1.748 , c = 0.494