Assignment - 5

18K41A05E4

let us consider a sample dataset have one input (X_i^a) and one output (y_i^a) and number 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 calculation for 2 iterations with batch size 2

x	y	
0.2	3.4	} batch 1
0.4	3.8	
0.6	4.2	} batch 2
	4.6	
0.8		

step 1 :- [x, y], m = 1, c = -1, η = 0.1, epochs = 2, bs = 2

step 2 :- $nb = \frac{ns}{bs} = \frac{4}{2} = 2$

step 3 :- iter = 1

Step 4 :- Batch = 1

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

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

$$= -1.34$$

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

$$= -4.3$$

Step 6 :- $\Delta m = -(0.1)(-1.34) = 0.134$

$\Delta c = -(0.1)(-4.3) = 0.43$

Step 7 :- $m = m + \Delta m = 1 + 0.134 = 1.134$

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

Step 8 :- batch = batch + 1

$= 1 + 1 = 2$

Step 9 :- if (batch $>$ nb)
2 $>$ 2

goto step 10

else

goto step 5

Step 5 :- At

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

$$= -2.932$$

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

$$= -4.1762$$

Step 6 :- $\Delta m = -(0.1)(-2.932)$

$$= 0.2932$$

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

$$= 0.417762$$

Step 7 :- $m = m + \Delta m = 1.134 + 0.2932 = 1.4272$

$$c = c + \Delta c = -0.57 + 0.4176 = -0.1523$$

Step 8 :- batch = batch + 1

$$2 + 1 = 3$$

Step 9 :- if (batch > nb)
$\quad\quad\quad\quad$ 3 $\quad$ > 2

goto step 10

else

goto step 5.

Step 10 :- iter = iter + 1

= 1 + 1

= 2

Step 11 :- if (iter > epoches)
$\quad\quad\quad\quad$ 2 $\quad\quad$ 2

goto step 12.

else

goto step 4.

Step 4 :- Batch = 1

Step 5 :-

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

$$(3.8 - (1.4272)(0.4) + 0.1523)\ 0.4\Big]$$

$$= -1.0029$$

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

$$(3.8 - (1.4272)(0.4) + 0.1523\Big]$$

$$= -3.3241$$

Step 6 :- $\Delta m = (-0.1)(-1.0029)$

$= 0.1002$

$\Delta c = (-0.1)(-3.3211)$

$= 0.332$

Step 7 :- $m = m + \Delta m = 1.4272 + 0.1002 = 1.5274$

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

Step 8 :- batch = batch + 1

$= 1 + 1$

$= 2$

Step 9 :- If (batch > nb)

$2 > 2$

goto step 10

else

goto step 4

Step 5 :-

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

$= -2.21$

$\frac{\partial E}{\partial c} = -3.151$

Step 6 :- $\Delta m = -0.1 \times -2.21$

$= 0.221$

$\Delta c = -0.1 \times -3.151$

$= 0.315$

Step 7 :- $m = m + \Delta m = 1.5274 + 0.221 = 1.748$

$c = c + \Delta c = 0.1797 + 0.315 = 0.494$

Step 8 :- batch = batch + 1

$= 2 + 1 = 3$

Step 9 :- if (batch > nb) goto step 10
3 > 2

else goto step 5

Step 10 :- iter = iter + 1

$= 2 + 1$

$= 3$

Step 11 :- if (iter > epochs) goto step 12
3 > 2

else goto step 4

Step 12 :- print m, c

$m = 1.748$; $c = 0.494$