Assignment - 5

18KU1A0423

Let us consider a sample dataset have one input (x_i^a) and one o/p output (y_i^a) and number of samples 4. Develop a simple linear 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
0.8	4.6	

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

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

$= -1.34$

$\frac{\partial E}{\partial c} = \frac{-1}{2} \left[(3.4 - 0.2 + 1) + (3.3 - 0.4 + 1) \right]$

$= -4.3$

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 :

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

$$= -2.932$$

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

$$= -4.1762$$

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

$= 0.2932$

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

$= 0.41762$

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)

3 > 2

goto step 10

else

goto step 5

step 10: iter = iter + 1

= 1 + 1 = 2

step 11: if (iter > epochs)

2 > 2

goto step 12

else

goto step 4

step 4: Batch = 1

step 5:

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

$$= -1.0029$$

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

$$= -3.3241$$

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

$\Delta c = (-0.1)(-3.3241) = 0.332$

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 5

Step 5 :

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

$$= -2.21$$

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

$$= -3.151$$

Step 6 : $\Delta m = (-0.1)(-2.21) = 0.221$

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

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

else

goto step 5

Step 10 : ite = ite + 1

= 2 + 1

= 3

Step 11 : If (ite > epochs) goto step 12

3 > 2

else

goto step 4

Step 12 : Print m, c

m = 1.748 c = 0.494.