

## Assignment - 5

18K41A0587

Q) 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 2 iterations with batchsize = 2

Sol:-

Batch 1

X	Y
0.2	3.4
0.4	3.8

Batch 2

X	Y
0.6	4.2
0.8	4.6

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

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

Step 3:  $itr=1$

Step 4: Batch = 1

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

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

$$= -1.34$$



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

$$= -4.3$$

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:  $\text{Batch} = \text{Batch} + 1 = 1 + 1 = 2$

Step 9: if (Batch > nb)

$$2 > 2$$

goto step 10

else

goto step 5

Step 5:  $\frac{\partial E}{\partial m} = -\frac{1}{2} [(4.2 - (1.134)(0.6) + 0.57)(0.6) +$

$$(4.6 - (1.134)(0.8) + 0.57)(0.8)] = -2.932$$

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

$$0.57)]$$

$$= -4.1762$$

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:  $\text{Batch} = \text{Batch} + 1 = 2 + 1 = 3$

step 9 : if (batch <sup>3 > 2</sup> nb)  
                   goto step 10  
           else  
                   goto step

step 10 : itr = itr + 1 = 1 + 1 = 2

step 11 : if (itr <sup>2 > 2</sup> epochs)  
                   goto step 12  
           else  
                   goto step 4

step 12 : Batch = 1

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

$$= -1.0029$$

~~$$\frac{\partial E}{\partial m} = -\frac{1}{2} [3.3241]$$~~

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

$$= -3.3241$$

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:  $\text{Batch} = \text{Batch} + 1 = 1 + 1 = 2$

step 9: if ( $\text{Batch} > nb$ )  
 $\xrightarrow{2 > 2}$  goto nextstep  
 else  
 goto step 5

step 5: 
$$\frac{\partial E}{\partial m} = -\frac{1}{2} \left[ (4.2 - (1.5274)(0.6) - 0.1797)0.6 + (4.6 - (1.5274)(0.8) - 0.1797)0.8 \right]$$
  
 $= -2.21$

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

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:  $\text{Batch} = \text{Batch} + 1 = 2 + 1 = 3$

step 9: if ( $\text{Batch} > nb$ )  
 goto step 10  
 else  
 goto step 5

step 10:  $\text{itr} = 1 = 2 + 1 = 3$

step 11: if ( $\text{itr} > \text{epochs}$ )  
 $\xrightarrow{3 > 2}$  goto step 12  
 else  
 goto step 4

step 12: print  $m, c$   
 $m = 1.748, c = 0.494$