Assignment - 5

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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 calculations for two iterations with batch size 2.
- Write the python code to build simple linear regression model using MBGD optimizer.

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, η=0.1, epochs = 2, bs = 2

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

Step 3 : itr = 1

Step-4: Batch = 1

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

$= -1/2 [(3.4 - (1)(0.2) + 1)0.2] +$

$[3.8 - 0.4 + 1]0.4] = -1.34$

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

$= -4.3$

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:- Batch += 1

$1 + 1 = 2$

Step 9:- if (batch > nb)

goto step-10

2 > 2

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

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

Step7: Batch += 1
2+1=3

Step9:- if (batch > nb)
goto step-10
3 > 2
else
goto step5

Step10: itr = itr + 1
1+1=2

Step 11: if (itr > epoches)
goto step 12 2 > 2
else
goto step4.

Step 4:- Batch=1

Step5: $\frac{\partial E}{\partial m} = \frac{-1}{2}[(3.4 - (1.4272)(0.2) + 0.1523)^2 0.2 +$
$(3.8 - (1.4272)(0.4) + 0.1523)0.4]$
$= -1.0029$

$\frac{\partial E}{\partial c} = \frac{-1}{2}[(3.4) - (1.4272)(0.2) + 0.1523) +$
$(3.8 - (1.4272)(0.4) + 0.1523] = -3.3241$

Step6:- $\Delta m = (-0.1)(-1.0029) = 0.1002$
$\Delta c = (-0.1)(-3.3241) = 0.332$

Step7:- $m+ = \Delta m = 1.4272 + 0.1002 = 1.5274$
$c+ = \Delta c = -0.1523 + 0.332 = 0.1797$

Step8: Batch += 1
1+1=2

Step 9: if (Batch > nb)
goto step-10
2 > 2
else
goto step 7

Step 5: $\frac{\partial E}{\partial m} = \frac{-1}{2}[(4.2 - (1.5274)(0.6) - 0.1797)0.6 + (4.6 - (1.5274)(0.8) - 0.1797)0.8] = -2.2$

$\frac{\partial E}{\partial c} = -3.15$

Step 6: $\Delta m = -0.1 \times -2.2$
$= 0.221$

$\Delta c = -0.1 \times -3.15$
$= 0.315$

Step 7: $m + \Delta m = 1.5274 + 0.221 = 1.748$
$c + \Delta c = 0.1797 + 0.315 = 0.494$

Step 8:- Batch += 1
2+1=3

Step 9:- if (Batch > nb)
goto step-10
else goto step 5

Step 10:- itr = 1 2+1=3

Step 11: if (itr > epoches) 3 > 2
goto step 12
else
goto step 4

Step 12: print m, c
m = 1.748, c = 0.494