Assignment - 5

18K41A0508

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

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, epoches = 2, bs = 2

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

Step 3 : itr = 1

Step 4 : Batch = 1

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

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

$= -1.34$

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

$= -4.3$

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

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

step 7: $m = m + \Delta m = 1 + 0.134 = 1.134$

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

step 8: Batch + 1 = 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: $m += \Delta m = 1.134 + 0.2932 = 1.4272$

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

step 8: Batch += 1

2 + 1 = 3

step 9: if (batch > no b)

goto step 10

3 > 2

else

goto step 5

step 10: itr + 1 = itr

1 + 1 = 2

step 11: if (itr > epoches)

goto step 12

2 > 2

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: $m += \Delta m$

$= 1.4272 + 0.1002 = 1.5274$

$c += \Delta c$

$= -0.1523 + 0.332 = 0.1797$

step 8: Batch + = 1

1 + 1 = 2

step 9: if (Batch > nb)

goto step 10

2 > 2

else

goto step-7

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

$= -2.21$

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

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

$= 0.221$

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

$= 0.315$

step 7: $m + \Delta m = 1.5274 + 0.221$

$c + \Delta c = 0.1797 + 0.315$

$= 0.494$

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)

goto step 12

3 > 2

else goto step 4

step 12: print m, c

m = 1.748, c = 0.494