NNDL Assignment-5

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Let 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 (consider all 4 samples).

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

Step-3: if r=1

Step-4: Batch=1

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

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

$= -1.34$

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

$= -4.3$

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

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

Step-8: Batch+=1

2+1 = 3

Step-9: if (batch > nb)

3>2

goto step-10

else

goto step-5

step+10: itr = itr+1

1+1 = 2

Step-11: if (itr > epochs)

2>2

goto step-12

else

goto step-4

step-4: Batch=1

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

$= -1.0029$

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

$= -3.3241$

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

$= -2.21$

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

$= -3.151$

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

$= 0.221$

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

$= 0.315$

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

$= 1.748$

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

$= 0.494$

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 > epochs)

goto step-12

$3 > 2$

else

goto step-4

Step-12: print m, c

$m = 1.748, c = 0.494$