Assignment - 5

18K41A0551

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 (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, $\eta = 0.1$, epochs = 2, $b_s = 2$

Step - 2 : $n_b = \frac{n_s}{b_s} = 4/2 = 2$

Step - 3 : itr = 1

Step 4 : batch = 4

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

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

$[3.8 - 0.4 + 1]0.4]$

$= -1.34$

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

$= -4.3$

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 > n_b)

goto step-10

else

goto step 5

step 5 : $\frac{dE}{dm} = -\frac{1}{2}[(4.2 - (1.134)(0.6) + 0.57)0.6$

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

$= -2.932$

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

$$= -4.1762$$

step-6 : $\Delta m = -(0.1)(-2.932) = 0.2932$

$\Delta c = -(0.1)(-4.1762) = 0.41762$

step-7 : $m = m + \Delta m = 1.134 + 0.2932 = 1.4272$

$c = c + \Delta c = -0.57 + 0.41762 = -0.1523$

step-8 : Batch = 1

2 + 1 = 3

step-9 : if (batch > n_b)

goto step-10.

else

goto step-5

step 10 : itr = itr + 1

1 + 1 = 2

step 11 : if (itr > epochs)

goto step-12

else

goto step-4.

step 4 : Batch = 1

Step 5 : $\frac{dE}{dm} = \frac{-1}{2}[(3.4 - (1.4272)(0.2) + 0.1523)0.2 +$
$(3.8 - (1.4272)(0.4) + 0.1523)0.4]$

$= -1.0029$

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

$= -3.3241$

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

$= 0.1002$

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

$= 0.332$

Step 7 : $m = m + \Delta m$

$= 1.4272 + 0.1002 = 1.5274$

$c = c + \Delta c$

$= -0.1523 + 0.332 = 0.1797$

Step 8 : Batch += 1

$1+1 = 2$

Step 9 : if (Batch > n_b)

$2 > 2$

Go to Step-10

else

go to Step 7

step 5 : $\frac{dE}{dm} = -1/2 [(4.2 - (1.5274)(0.6) - 0.1797) 0.6$

$+ (4.6 - (1.5274)(0.8) - 0.1797) 0.8]$

$= -2.21$

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

$= 0.221$

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

$= 0.315$

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

$= 1.748$

$c + \Delta c = 0.1797 + 0.315$

$= 0.494$

step 8 : Batch $t = 1$

$2 + 1 = 3$

step 9 : if (Batch $> n_b$)

goto step-10

else

go to step 5

step 10 : itr $t = 1$

$2 + 1 = 3$

step 11 : if (itr > epochs)

$3 > 2$

go to step-12

else

go to step-4

step 12 : print m, c

$m = 1.748$, $c = 0.494$.