ASSIGNMENT-5

—18K41A0530

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 reggresion 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 reggresion model using MBGD optimizer (Consider all 4 samples)

Batch1

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

Step-3: itr$=1$

Step-4: Batch$=1$

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

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

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

$$= -1.34$$

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

$$= -4.3$$

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: $\dfrac{\partial E}{\partial m} = -\dfrac{1}{2}\left[(4.2 - (1.134)(0.6) + 0.57)0.6 + (4.6 - (1.134)(0.8) + 0.57)0.8\right]$

$$= -2.932$$

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

$$= -4.1762.$$

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

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

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

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

step-8: Batch $+ = 1$

$$2 + 1 = 3$$

step-9: if (batch > nb)
          goto step-10
      3 > 2
        else
          goto step-5

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

step-11: if (itr > epochs)
              goto step-12
          2 > 2
            else
              goto step-4

step-4:
      Batch = 1

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

$= -1.0029$

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

$= -3.3241$

step-6: $\Delta m = (-0.1)(-1.0029)$
          $= 0.1002$

$\Delta c = (-0.1)(-3.3241)$
          $= 0.332$

step-7: $mt = \Delta m$
          $= 1.4272 + 0.1002 = 1.5274$

$ct = \Delta c$
          $= -0.1523 + 0.332 = 0.1797$

step-8: Batch += 1
          1 + 1 = 2

Step-4: if (Batch >nb)
       goto step-10
       2 > 2
       else goto step-7

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

= −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: $m+\Delta m = 1.5274+0.221$
       = 1.748

$c+\Delta c = 0.1797+0.315$
       = 0.494

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

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

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

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

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