Assignment-5

18KH1A05H1

Develop the simple linear regression model for the following dataset using MABGD where no. of samples

Sample	x_i	y_i
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

Batch-1	
0.2	3.4
0.8	4.6

Batch-2	
0.4	3.8
0.6	4.2

bs = 2

step-1 :- [x, y], m = 1, c = -1, η = 0.1, epochs = 2, bs = 2

step-2 :- split training data on batch size, $n_b = \frac{n_s}{b_s}$

$$\Rightarrow n_b = \frac{4}{2} = 2$$

step-3 :- epoch = 1

step-4 :- batch = 1

step-5 :- $$E = \frac{1}{2b_s} \sum_{i=1}^{b_s} (y_i - mx_i - c)^2$$

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

$$= \frac{1}{2} \sum_{i=1}^{2} (y_i - mx_i - c) x_i$$

$$= \frac{1}{2} \left[(y_1 - mx_1 - c) x_1 + (y_2 - mx_2 - c) x_2 \right]$$

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

$$\frac{\partial E}{\partial m} = -1.3$$

$$\frac{\partial E}{\partial c} = \frac{-1}{2} \sum_{i=1}^{2} (y_i - mx_i - c)$$

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

$$= -4.3$$

Step-6:

$$\Delta m = -\eta \cdot \frac{\partial E}{\partial c} = -(0.1)(-4.3) = 0.43$$

$$\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-1.3) = 0.13$$

$$\therefore \boxed{\Delta m = 0.13} \qquad \boxed{\Delta c = 0.43}$$

Step 7:

$$m = m + \Delta m = 1 + 0.13 = 1.13$$

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

$$\boxed{m = 1.13} \qquad \boxed{c = -0.57}$$

Step 8 : batch = 1+1 = 2

Step 9 : If (batch > nb)

. Step 10

Else

goto step 5.

Step 5 : $\frac{\partial E}{\partial m} = \frac{-1}{2} \sum_{i=1}^{2} (y_i - mx_i - c) x_i$

$= \frac{-1}{2} [(4.2 - ((1.13)(0.6) + 0.57)) 0.6 + 4.6 - (1.13)(0.8) + (0.57)(0.8)]$.

$= -2.934$.

$\frac{\partial E}{\partial c} = \frac{-1}{2} [(4.2 - (1.13 \times 0.6) + 0.057) + (4.6 - (1.13 \times 0.8) + 0.57)]$

$= -4.179$.

Step 6 : $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-2.934) = 0.2934$.

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-4.179) = 0.4179$.

Step 7 : $m = m + \Delta m = 1.13 + 0.2934 = 1.4234$.

$c = c + \Delta c = -0.57 + 0.4179 = -0.152$

step 8: batch = 2+1 = 3

step 9: if (batch > nb) yes, goto step 10

step 10: eta = 1+1 = 2

step 11: if (eta > epochs) no, else goto step 5

step 4: batch = 1

step 5: $\frac{\partial E}{\partial m} = -\frac{1}{2}[(4.2-(1.523\times0.6)-0.1804)0.6) + (4.6-(1.5237\times0.8)-(0.1804\times8))(0.8)]$

$= -2.2484.$

$\frac{\partial E}{\partial c} = \frac{-1}{2}[(4.2-(1.5237\times0.6)-0.1804) + (4.6-(1.5237\times0.8)-0.1804\times8)]$

$= -3.1529817.$

step 7: $\Delta m = -\eta \cdot \frac{\partial E}{\partial m} = -(0.1)(-2.21184) = 0.221184.$

$\Delta c = -\eta \cdot \frac{\partial E}{\partial m} = -(0.1)(-3.15298) = 0.31529.$

step 8: $m = m + \Delta m = 1.523 + 0.221184 \pm 1.744139$

$c = c + \Delta c = 0.1804 + 0.31529 = 0.49570$

Step 9 : batch = 2+1 = 3

Step 10 : If (batch > n) yes, goto step 11.

Step 11 : qtr = 2+1 = 3.

Step 12 : If (qtr > epoch) yes, goto next step

Step 13 : print m and c

m = 1.7444913994.

c = 0.4935706