

Assignment - 5

(SLR) mini batch gradient descent

Samples	x	y
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

batch-1

x	y
0.2	3.4
0.4	3.8

batch-2

x	y
0.6	4.2
0.8	4.6

S-1 :- $[x, y]$, $m=1$, $c=-1$, $\eta=0.1$, epochs = 2, $b_s=2$

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

S-3 :- $ite = 1$

S-4 :- batch = 1

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

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

$$\frac{\partial E}{\partial m} = -1.34$$

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

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

$$\frac{\partial E}{\partial c} = -4.3$$

$$\underline{s-6} :- \Delta m = -\eta \cdot \frac{\partial E}{\partial m} = -0.1 (-1.34) = 0.134$$

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

$$\underline{s-7} :- m = m + \Delta m = 1 + 0.134 = 1.13$$

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

$$\underline{s-8} :- \text{batch} + 1 = 1 + 1 = 2$$

$$\underline{s-9} :- \text{if } (\text{batch} > n_b)$$

goto step - 10

else

goto step - 5

$$\underline{s-5} :- \frac{\partial E}{\partial m} = -\frac{1}{2} \left[\left[4.2 - (1.13)(0.6) + 0.57 \right] 0.6 + \left[4.6 - (1.13)(0.8) + 0.57 \right] 0.8 \right]$$

$$\frac{\partial E}{\partial m} = -2.932$$

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

$$\frac{\partial E}{\partial c} = -4.17$$

$$\underline{s-6} :- \Delta m = (-0.1)(-2.932) = 0.29$$

$$\Delta c = (-0.1)(-4.17) = 0.417$$

$$\underline{s-7} :- m = m + \Delta m = 1.134 + 0.29 = 1.42$$

$$c = c + \Delta c = -0.57 + 0.417 = -0.152$$

$$\underline{s-8} + \text{batch} + 1$$

$$2 + 1 = 3$$

S-9 :- if (batch > nb)

3. > 2

goto step-10

S-10 :- ita = ita + 1
= 1 + 1 = 2

S-11 :- if (ita > epochs) : goto S-12
else goto S-4

S-4 :- batch = 1

S-5 :- $\frac{\partial E}{\partial m} = -\frac{1}{2} \left[(3.4 - (1.42)(0.2) + 0.15)0.2 + \right.$
 $\left. (3.8 - (1.42)(0.4) + 0.15)0.4 \right]$

$$\frac{\partial E}{\partial m} = -1.002$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2} \left[(3.4 - (1.42)(0.2) + 0.15) + \right.$$
$$\left. (3.8 - (1.42)(0.4) + 0.15) \right]$$
$$= -3.32$$

S-6 :- ~~m = m + Δm = 1.427~~

$$\Delta m = (-0.1)(-1.002) = 0.1002$$

$$\Delta c = (-0.1)(-3.32) = 0.332$$

$$\text{S-7 :- } m = m + \Delta m = 1.427 + 0.1002 = 1.527$$

$$c = c + \Delta c = -0.152 + 0.332 = 0.179$$

S-8 :- batch + 1 ⇒ 1 + 1 = 2

S-9 :- if (batch > nb) : goto S-10
else
goto S-3

$$s-5: \frac{\partial E}{\partial m} = -\frac{1}{2} \left[(4.2 - (1.52)(0.6) - 0.17)0.6 + (4.6 - (1.52)(0.8) - 0.17)0.8 \right]$$

$$= -2.21$$

$$\frac{\partial E}{\partial c} = -3.15$$

$$s-6: \Delta m = (-0.1)(-2.21) = 0.221$$

$$\Delta c = (-0.1)(-3.15) = 0.315$$

$$s-7: m = m + \Delta m = 1.52 + 0.221 = 1.74$$

$$c = c + \Delta c = 0.179 + 0.315 = 0.49$$

$$s-8: \text{batch} \neq 1 \Rightarrow 2+1=3$$

$$s-9: \text{if (batch > nb)}; \text{goto } s-10$$

$$3 > 2$$

$$s-10: \text{if (ita > epos)}; \text{goto } s-12$$

$$3 > 2$$

$$s-12: \text{print } m, c$$

$$m = 1.74; c = 0.49$$