Assignment-5

let us consider a sample dataset have one input (x_i) and one output (y_i) and number of samples of, develop a SLR 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 2 iterations with bs = 2

	x	Y
batch 1 →	0.2	3.4
	0.4	3.8
batch 2 →	0.6	4.2
	0.8	4.6

step1: [x, Y], m = 1, c = -1, η = 0.1, epochs = 9, bs = 2

step2: $nb = \frac{ns}{bs} = \frac{4}{2} = 2$

step3: iters = 1

step4: Batch = 1

step5: $\frac{\partial E}{\partial m} = -\frac{1}{bs} \sum_{i=1}^{bs} (y_i - mx_i - c)x_i$

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

$= -1.34$

$\frac{\partial E}{\partial c} = -\frac{1}{2}[(3.4-0.24+1) + (3.8-0.4+1)]$

$= -4.3$

step6: $\Delta m = -(0.1)(-1.34) = 0.134$

$\Delta c = -(0.1)(-4.3) = 0.43$

step7: $m = m + \Delta m = 1 + 0.134 = 1.134$

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

step8: Batch $+= 1$

$1 + 1 = 2$

step9: if (Batch $>$ nb) : goto step10

$2 > 2$

else : goto step5

step5: $\frac{\partial E}{\partial m} = -\frac{1}{2}\left[(4.2 - (1.134)(0.6) + 0.57)\,0.6 + (4.6 - (1.134)(0.8) + 0.57)\,0.8\right]$

$= -2.932$

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

$= -4.1762$

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

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

step7: $m += \Delta m = 1.134 + 0.2932 = 1.4272$

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

step8: Batch $+= 1 \Rightarrow 2 + 1 = 3$

step9: if (batch $>$ nb) : goto step10

$3 > 2$

else : goto step5

step-10 : iter = iter + 1

= 1 + 1 ⇒ 2

step 11: if (iter > epochs) : goto step12

2 > 2

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

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

step 7 : $m_t = \Delta m \Rightarrow 1.4272 + 0.1002 = 1.5274$

$c_t = \Delta c \Rightarrow -0.1523 + 0.332 = 0.1797$

step 8 : Batch t = 1 ⇒ 1 + 1 ⇒ 2

step 9 : if (Batch > nb) : goto step10

2 > 2

else : goto step 7

step 10 : $\frac{\partial E}{\partial m} = \frac{-1}{2}[(4.2 - (1.5274)(0.6) - 0.1797)0.6 +$

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

$= -2.21$

$\frac{\partial E}{\partial c} = -3.151$

step6 : $\Delta m = -0.1 \times -2.21$

$= 0.221$

$\Delta c = -0.1 \times -3.151 \Rightarrow 0.315$

step7 : $m += \Delta m = 1.5274 + 0.221 = 1.748$

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

step8 : Batch += 1

$= 2 + 1 = 3$

step9 : if (Batch > nb): goto step10

$3 > 2$

else: goto step5

step10 : iter += 1 $\Rightarrow 2+1 \Rightarrow 3$

step11 : if (iter > epochs): goto step12

$3 > 2$

else : goto step4

step12 : print m, c

$m = 1.748$, $c = 0.494$