Assignment -3

18K41A0587

8) Develop a simple linear regression model using stochastic gradient descent optimizer.

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 using SGD for 2 iterations. for 2 samples.

Sol:- step1 : $x, y, \eta = 0.1$, epochs $= 2$, ns $= 2$, $m = 1$, $c = -1$

step2 : itr $= 1$

step 3 : Sample $= 1$

step 4 : $E = \frac{1}{2}(y_i - mx_i - c)^2$

$$\frac{\partial E}{\partial m} = -(y_i - mx_i - c)x_i$$

$$= -(3.4 - (1)(0.2) + 1)(0.2)$$

$$= -0.84$$

$$\frac{\partial E}{\partial c} = -(y_i - mx_i - c)$$

$$= -(3.4 - (1)(0.2) + 1)$$

$$= -4.2$$

step5 : $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-0.84) = 0.084$

$$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-4.2) = 0.42$$

step 6 : $m = m + \Delta m$

$= 1 + 0.084 = 1.084$

$c = c + \Delta c$

$= -1 + 0.42 = -0.58$

step 7 : sample = sample + 1 = 1 + 1 = 2

step 8 : if (sample > ns)

$2 > 2$ ⇒ false

goto step9

else

goto step4

step 4 : $\frac{\partial \epsilon}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58)(0.4)$

$= -1.5785$

$\frac{\partial \epsilon}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58)$

$= -3.9464$

step5 : $\Delta m = -(0.1)(-1.5785) = 0.1578$

$\Delta c = -(0.1)(-3.9464) = 0.3946.$

step 6 : $m = m + \Delta m = 1.084 + 0.1578 = 1.2418$

$c = c + \Delta c = -0.58 + 0.3946 = -0.1854.$

step 7 : sample = sample + 1 = 2 + 1 = 3.

step 8 : if (sample > ns)

$3 > 2$ ⇒ (True)

goto next step

else

goto step 4.

step 9: itr = itr+1 = 1+1 = 2

step 10: if (itr > epochs)

2 > 2 (false)

goto nextstep

else

goto step3

step 3: sample 1

step 4: $\frac{\partial E}{\partial m} = -(3.4-(1.2)(0.2)+0.18)(0.2)$

$= -0.668$

$\frac{\partial E}{\partial c} = -(3.4-(1.2)(0.2)+0.18)$

$= -3.34$

step 5: $\Delta m = -(0.1)(-0.668)$

$= 0.0668$

$\Delta c = -(0.1)(-3.34)$

$= 0.334$

Step 6: $m = m+\Delta m = 1.24+0.066 = 1.3$

$c = c+\Delta c = 0.18+0.33 = 0.15$

step 7: sample = sample + 1 = 1 + 1 = 2

step 8: if (sample > ns)

2 > 2

goto step9

else

goto step 4.

step 4: $\frac{\partial E}{\partial m} = (-3.8-(1.3)(0.4)-0.15)(0.4)$

$= -1.25$

$$\frac{\partial \epsilon}{\partial c} = -(3.8 - (1.3)(0.4) - 0.15) = -3.13$$

step 5 : $\Delta m = -(0.1)(-1.25) = 0.12$

$\Delta c = -(0.1)(-3.13) = 0.31$

step 6 : $m = m + \Delta m = 1.3 + 0.12 = 1.42$

$c = c + \Delta c = 0.15 + 0.31 = 0.46$

step 7 : sample = sample + 1 = 2 + 1 = 3

step 8 : if (sample > ns)

3 > 2

goto step 9

else

goto step 4

step 9 : itr = itr + 1

= 2 + 1 = 3

step 10 : if (itr > epochs)

3 > 2

goto step 11

else

goto step 3

step 11 : print m and c values

m = 1.42

c = 0.46