Assignment - 3

let consider a sample dataset have i/p & o/p & number of samples. Develop a simple linear regression using stochastic gradient Descent optimizer

→ Do manual calculations for 2 iterations with 1st two 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

step 1 :- $m=1, c=-1, \eta=0.1$, epoches $=2$, ns $=2$

step 2 :- iter $=1$

step 3 :- sample $=1$

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

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

$$\frac{\partial \epsilon}{\partial m} = -(y_1 - mx_1 - c)x_1$$

$$\frac{\partial \epsilon}{\partial m} = -(3.4 - 0.2 + 1)0.2$$

$$= -(4.2)0.2$$

$$\frac{\partial \epsilon}{\partial m} = 0.84$$

$$\frac{\partial \epsilon}{\partial c} = -(y_1 - mx_1 - c)$$

$$= -(3.8 - 0.4 + 1)$$

$$= -(4.4)$$

$$\frac{\partial \epsilon}{\partial c} = -4.4$$

step 5 = $-\eta$ $\Delta m = -\eta \times \frac{\partial \epsilon}{\partial m}$

$\Delta m = -0.1 \times -0.84$

$= 0.084$

$\Delta c = -0.1 \times -4.4$

$= 0.44$

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

$= 1 + 0.084$

$= 1.084$

$c = c + \Delta c$

$= -1 + 0.44$

$= -0.56$

step 7 :- sample = sample + 1 = 2

step 8 :- if (sample > ns)

2 > 2

go to step 9

else

goto step 4

step 4 :- $\frac{\partial E}{\partial m} = -(y_2 - mx_2 - c)x_2$

$= -(3.8 - (1.084 \times 0.4) + 0.56)0.4$

$= -(3.9264)0.4$

$= -1.57056$

$\frac{\partial E}{\partial c} = -(y_2 - mx_2 - c)$

$= -(3.8 - (1.084 \times 0.4) + 0.56)$

$= -3.9264$

step 5 :- $\Delta m = -\eta \times \frac{\partial E}{\partial m}$

$= -0.1 \times -1.57056$

$= 0.157$

$\Delta c = -\eta \times \frac{\partial E}{\partial c}$

$= -0.1 \times -3.9264$

$= 0.3926$

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

$= 1.084 + 0.157$

$= 1.241$

$c = c + \Delta c$

$= +0.56 + 0.3926$

$= -0.167$

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

step 8 :- if (sample > ns)

$3 > 2$

goto step 9

else

goto step 4

step 9 :- iter $= 1 + 1 = 2$

step 10 :- if (iter > epoches)

$2 > 2$

goto step 11

else

goto step 3

step 11 :- sample $= 1$

step 4 :- $\frac{\partial \epsilon}{\partial m} = -(y_1 - mx_1 - c)x_1$

$= -(3.4 - 1.24 \times 0.2 + 0.167)0.2$

$= -(3.319)0.2$

$= -0.6638$

$\frac{\partial \epsilon}{\partial c} = -(y_1 - mx_1 - c)$

$= -(3.4 - 1.24 \times 0.4 + 0.167)$

$= -3.319$

step5 :- $\Delta m = -\eta \times \frac{\partial E}{\partial m}$

$= -0.1 \times -0.6638$

$\Delta m = 0.06638$

$\Delta c = -\eta \times \frac{\partial E}{\partial m}$

$= -0.1 \times -3.319$

$\Delta c = 0.3319$

step6 :- $m = m + \Delta m$

$= 1.241 + 0.0663$

$m = 1.306$

$c = c + \Delta c$

$= 0.167 + 0.331$

$c = 0.164$

step7 :- sample = t+1 = 2

step8 :- if (sample > ns)

2 > 2

goto step9

else

goto step4

step9 :- $\frac{\partial E}{\partial m} = -(y_2 - mx_2 - c)x_2$

$= -(3.8 - 1.306 \times 0.4 - 0.164)0.4$

$= -(3.1136)0.4$

$\frac{\partial E}{\partial m} = 1.24$

$\frac{\partial E}{\partial c} = -(y_2 - mx_2 - c)$

$= -(3.8 - 1.306 \times 0.4 - 0.164)$

$\frac{\partial E}{\partial c} = -3.1136$

step 5 :- $\Delta m = -\eta \times \frac{\partial E}{\partial m}$

$= -0.1 \times 1.24$

$\Delta m = 0.1124$

$\Delta c = -\eta \times \frac{\partial E}{\partial c}$

$= -0.1 \times -3.1136$

$\Delta c = 0.31136$

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

$= 1.306 + 0.1124$

$m = 1.418$

$c = c + \Delta c$

$= 0.164 + 0.31136$

$c = 0.475$

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

step 8 :- if (sample > ns)

$3 > 2$

goto step 9

else

goto step 4

step 9 :- iter $= 2 + 1 = 3$

step 10 :- if (iter > epoches)

$(3 > 2$

goto step 11

else

goto step 3

step 11 :- print m, c

$m = 1.418$ $c = 0.475$