Assignment 3.

Let us consider sample dataset have one input(x_i; a) and one output (y_i; a) and no of samples. Develop a sample 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 for 2 iterations, 2 samples.

step1: [x, y], m=1, c=1, η=0.1, ns=2, epthos=2

step2: iter=1

step3: sample=1

step4: $E = \frac{1}{2}(y_i - mx_i - c)^2$

$E = \frac{1}{2}(3.4 - 0.2 + 1)^2$

$= \frac{1}{2}(17.64) = +8.82$

$\frac{\partial E}{\partial m} = (y_1 - mx_i - c)x_i$

$= (3.4 - 0.2 + 1)0.2$

$= -0.84$

$$\frac{dE}{dc} = -(y_i - mx_i - c)$$

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

$$= -4.2$$

step5: $\Delta m = -\eta \frac{dE}{dm} = -(0.1)(-0.84)$

$$= 0.084$$

$$\Delta c = -\eta \frac{dE}{dc} = -(0.1)(-4.2)$$

$$= 0.42$$

step6: $m = m + \Delta m = 1 + 0.084 = 1.084$

$c = c + \Delta c = -1 + 0.48 = -0.58$

step7: sample = sample + 1

step8: if(sample > ns)

2 > 2 then true go to step 9

false go to step 4

step4: $\frac{dE}{dm} = -(3.8 - (1.084)(0.4) + 0.58)0.4$

$$= -1.57$$

$$\frac{dE}{dc} = -(3.8 - (1.084)(0.4) + 0.58$$

$$= -3.84$$

step5: $\Delta m = -(0.1)(-1.57) = 0.15$

$\Delta c = -(0.1)(-3.44) = 0.39$

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

$= 1.084 + 1.57 = 1.24$

$c = c + \Delta c$

$= -0.58 + 0.39 = -0.18$

step 7: sample = sample + 1

step 8: if (sample > ns)

3 > 2 true go to next step

else go to step 4

step 9: iter = iter + 1

$= 1 + 1 = 2$

step 10: if (iter > epochs)

2 > 2 true go to next step

false go to step 3.

step 3: sample = 1

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

$= -(3.34)0.2$

$= -0.668$

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

$= -3.34$

step 5: $\Delta m = -(0.1)(-0.66)$

$= 0.066$

step6: $m = m + \Delta m = 1.24 + 0.06 = 1.3$

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

step7: sample = sample + 1

$= 1 + 1 = 2$

step8: if (sample > ns)

$2 > 2$

True next step

False go to step 4

step4: $\frac{\partial E}{\partial m} = -(3.8 - (1.3)(0.4) - 0.15)0.4$

$= -1.25$

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

$= -3.13$

step5: $\Delta m = -(0.1)(-1.25) = 0.12$

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

step6: $m = m + \Delta m = 1.3 + 0.12 = 1.42$

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

step7: sample = sample + 1

$= 2 + 1 = 3$

step8: if (sample > ns)

$3 > 2$

True go to next step

false goto step 4

step 9: iter = iter + 1

= 2 + 1 = 3

step 10: if (iter > epochs)

3 > 2

True go to next step

False go to step 3

step 11: print values of m & c

m = 1.42

c = 0.46