Assignment - 3 : (18K41A04D0)

Let us consider a Sample dataset have One i/p (x_i^a) and One o/p (y_i^a), and no. of Samples 4. 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 for two Iterations with first 2 Samples.

Step 1) $x, y, m=1, c=-1, \eta=0.1$, epochs=2, ns = 2

2) iter = 1

3) sample = 1

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

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

$\frac{\partial E}{\partial m} = -0.84$

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

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

$\frac{\partial E}{\partial c} = -4.2$

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

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

6) $m = m + \Delta m = 1 + 0.084 = 1.084$

$c = c + \Delta c = -1 + 0.42 = -0.58$

7) Sample = sample + 1 = 1 + 1 = 2

8) if (Sample > n_s)

2 > 2 false

goto step 4

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

$\frac{\partial E}{\partial m} = -1.5785$

$\frac{\partial E}{\partial c} = -(3.8 - (1.084)(0.4) + 0.58)$

$\frac{\partial E}{\partial c} = -3.9464$

5) $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-1.5785)$

$\Delta m = 0.1578$

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

6) $m = m + \Delta m = 1.084 + 0.1578 = 1.2418$

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

7) Sample = Sample + 1 = 2 + 1 = 3

8) if (sample > n_s)

3 > 2 true

goto next step

9) iter = iter + 1 = 1 + 1 = 2

10) if (iter > epochs)

2 > 2 false

goto step 3

3) Sample = 1

4) $\frac{\partial E}{\partial m} = -(3.4 - (1.24)(0.2) + 0.185)(0.2)$

$= -0.668$

$\frac{\partial E}{\partial c} = -(3.4 - (1.24)(0.2) + 0.185)$

$= -3.337$

5) $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-0.668)$

$\Delta m = 0.066$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-3.337)$

$\Delta c = 0.33$

6) $m = m + \Delta m = 1.24 + 0.066 = 1.306$

$c = c + \Delta c = -0.185 + 0.33 = 0.145$

7) Sample = Sample + 1

8) if(Sample > ns)

2 > 2 false

goto step 4

4) $\frac{\partial E}{\partial m} = -(3.8 - (1.306)(0.4) - 0.145)(0.4)$

$\frac{\partial E}{\partial m} = -1.25$

$\frac{\partial E}{\partial c} = -(3.8 - (1.306)(0.4) - 0.415)$

$\frac{\partial E}{\partial c} = -3.13$

5) $\Delta m = -(0.1)(-1.25) = 0.125$

$\Delta c = -(0.1)(-3.13) = 0.313$

6) $m = m + \Delta m = 1.306 + 0.125$

$m = 1.431$

$c = c + \Delta c = 0.145 + 0.313$

$c = 0.458$

7) sample = sample + 1 = 2 + 1 = 3

8) if (sample > ns)

3 > 2

true

goto next step.

9) iter = iter + 1 = 2 + 1 = 3.

10) if (iter > epochs)

3 > 2.

true

goto next step.

11) print m & c.

$m = 1.431$, $c = 0.458$