18K41A04C8

Assignment -3 :

Let consider a sample dataset have one input (x_i^a) and one output (y_i^a), and number of samples 4. Develop a simple linear regression model using stochastic gradiant 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 $= 2$, $ns = 2$

Step 2: iter $= 1$

Step 3: sample $= 1$

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

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

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

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

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

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

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

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

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 step 4.

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

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

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

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

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

$\Delta m = 0.1578$

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

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

Step 9: iter = iter + 1 = 1 + 1 = 2

Step 10: if (iter > epochs)

2 > 2 false

goto step ③

Step 3: sample = 1

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

$\frac{\partial E}{\partial m} = -0.668$

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

$\frac{\partial E}{\partial c} = -3.337$

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

$\Delta m = 0.066$

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

$\Delta c = 0.33$

Step 6: $m = m + \Delta m = 1.24 + 0.066 = 1.306$

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

Step 7: sample = sample + 1

Step 8: if (sample > ns)

2 > 2 false

goto step 4.

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

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

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

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

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

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

Step 6 : $m = m + \Delta m = 1.306 + 0.125$

$m = 1.431$

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

$c = 0.458$

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

Step 8 : if (sample > ns)

3 > 2 → True

goto next step

Step 9 : iter = iter + 1 = 2 + 1 = 3

Step 10 : if (iter > epochs)

3 > 2 True

goto next step

Step 11 : print m & c

$m = 1.431, \quad c = 0.458$.