

Assignment-3

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Let us consider a sample dataset have file (x_i^a) and file (y_i^a) and number of samples 4. Develop a simple Linear Regression model using stochastic gradient descent Algorithm

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

Manual Calculations for iterations, 2 samples,

Step 1 : $x, y, m=1, c=-1, \eta=0.1, \text{epochs}=2, N=2$

Step 2 : iter=1

Step 3 : sample=1

$$\begin{aligned} \text{Step 4 : } \frac{\partial E}{\partial m} &= -(y - mx - c) x \\ &= -(3.4 - 1)(0.2) - (-1)(0.2) \\ &= -0.84 \end{aligned}$$

$$\begin{aligned} \frac{\partial E}{\partial c} &= -(y - mx - c) \\ &= -(3.4 - 1)(0.2) + 1 \\ &= -4.2 \end{aligned}$$

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

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

$$\begin{aligned} \text{Step 6 : } m &= m + \Delta m = 1 + 0.084 = 1.084 \\ c &= c + \Delta c = -1 + 0.42 = -0.58 \end{aligned}$$

$$\text{step 7: Sample} = \text{Sample} + 1 \\ = 1 + 1 = 2$$

$$\text{step 8: if (sample} > n_s)$$

$$2 > 2$$

goto step 9

else

goto step 4

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

$$= -1.5785$$

$$\frac{\partial F}{\partial C} = -(3.8 - (1.084)(0.4) + 0.58)$$

$$= -3.9464$$

$$\text{step 5: } \Delta m = -(0.1)(-1.5785) = 0.1578$$

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

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

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

$$\text{step 7: Sample} = \text{Sample} + 1$$

3

$$3 > 2$$

goto step 9

else

goto step 4

$$\text{step 9: } \text{iter} = \text{iter} + 1$$

$$1 + 1 = 2$$

Step 10: if (iter > epochs)
 $2 > 2$
 goto step 11
 else
 goto step 3

Step 3: Sample = 1

Step 4: $\frac{\partial E}{\partial m} = -(y - mx - c) \times$
 $= -(3.4 - (1.2)(0.2) + 0.18) 0.2$
 $= -(3.34) 0.2$
 $= -0.668$

Step 5: $\Delta m = -(0.1) (-0.668)$
 $= 0.066$
 $\Delta c = -(0.1) (-3.34)$
 $= 0.33$

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 step 9
 else
 goto step 4.

Step 4: $\frac{\partial E}{\partial m} = -(3.8 - (1.3)(0.4) - 0.15) 0.4$
 $= -(3.8 - 0.52 - 0.15) 0.4$
 $= -1.25$

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

$$= -3.13$$

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 : $\text{sample} = \text{sample} + 1$

$$= 2 + 1 = 3$$

Step 8 : if (sample > ns)

$$3 > 2$$

goto step 9

else

step 4

Step 9 : $\text{iter} = \text{iter} + 1$

$$= 2 + 1$$

$$= 3$$

Step 10 : if (iter > epochs)

$$3 > 2$$

goto step 11

else

goto step 3

Step 11 : Print m & c

$$m = 1.42 \quad c = 0.46$$