ASSIGNMENT-7

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Let us 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 BGD

Samples (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:

Step1: [x, y], epochs = 2, $m=1$, $c=-1$, $\eta=0.1$, $n_s=2$

x	y
0.2	3.4
0.4	3.8

Step2: for r = 1

Step3: $E = \frac{1}{2n_s} \sum_{i=1}^{n_s} (y_i - mx_i - c)^2$

$$\frac{\partial E}{\partial m} = -\frac{1}{n_s} \left[\sum_{i=1}^{n_s} (y_i - mx_i - c)\, x_i \right]$$

$$= \frac{-1}{2} \left[(3.4 - (1)(0.2) + 1)(0.2) + (3.8 - (1)(0.4) + 1)(0.4) \right]$$

$$= -\frac{1}{2} \left[(4.2)(0.2) + (4.4)(0.4) \right] = -1.3$$

$$\frac{\partial E}{\partial c} = -\frac{1}{n_s}\left[\sum_{i=1}^{n_s}(y_i - mx_i - c)\right]$$

$$= -\frac{1}{2}\left[4.2 + 4.4\right] = -4.3$$

step 4: $\Delta m = -\eta \frac{\partial E}{\partial m}$

$= -(0.1)(-1.3) = 0.13$

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

$= -(0.1)(-4.3) = 0.43$

step 5: $m = m + \Delta m$

$= 1 + 0.13 = 1.13$

$c = c + \Delta c$

$= -1 + 0.43 = 0.57$

step 6: $ifr = ifr + 1$

$= 1 + 1 = 2$

step 7: if $(ifr > epochs)$

$2 > 2$

false → goto step 3

step 3: $\frac{\partial E}{\partial m} = -\frac{1}{2}\left[(3.4 - (1.13)(0.2) + 0.57)(0.2) + (3.8 - (1.13)(0.4) + 0.57)(0.4)\right]$

$= -\frac{1}{2}\left[(3.744)(0.2) + (3.918)(0.4)\right]$

$= -2.4333$

$\frac{\partial E}{\partial c} = -\frac{1}{2}\left[3.744 + 3.918\right]$

$= -3.831$

Step 4: $\Delta m = -\eta \frac{\partial E}{\partial m}$

$= -(0.1)(-2.4333) = 0.24333$

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

$= -(0.1)(-3.831) = 0.3831$

Step 5: $m = m + \Delta m$

$= 1.13 + 0.24333 = 1.37333$

$c = c + \Delta c$

$= -0.57 + 0.3831 = -0.1869$

Step 6: $ifr = ifr + 1$

$= 2 + 1 = 3$

Step 7: if $(ifr > epochs)$

$3 > 2$

goto next step

Step 8: print m, c

$m = 1.37333$

$c = -0.1869$

Step 9: MSE

$$= \frac{\left[3.4 - (1.37333 \times 0.2) + 0.1869\right]^2 + \left[3.8 - (1.37333 \times 0.4) + 0.1869\right]^2}{2}$$

$= 11.39388$