

Assignment - 07

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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.

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 two samples.

* write the python code to build simple linear regression model using BGD optimizes (considers all 4 samples).

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

$$n_s = 2$$

Step 2 : $it=1$

$$\text{Step 3 : } \frac{dE}{dm} = -\frac{1}{n_s} \sum_{i=1}^{n_s} (y_i - m x_i - c) x_i$$

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

$$= -1.34$$

$$\frac{dE}{dc} = \frac{-1}{2} [(3.4 - 0.2 + 1) + (2.8 - 0.4 + 1)]$$

$$= -4.3$$

step 4: $\Delta m = -\eta \frac{dE}{dm}$

$$= -0.1 \times -1.34$$

$$= 0.134$$

$$\Delta c = -\eta \frac{dE}{dc}$$

$$= -0.1 \times 4.3$$

$$= 0.43$$

step 5: $m + = \Delta m$

$$= 1 + 0.134$$

$$= 1.134$$

$$c + = \Delta c$$

$$= -1 + 0.43$$

$$= -0.57$$

step 6: $itr + = 1$

$$itr = 2$$

step 7: if (itr > epochs)

go to step-8

else

go to step 3

$$\text{Step 3 : } \frac{dE}{dm} = -\frac{1}{2} \left[\frac{(3.4 - (1.134)(0.2) + 0.57)(0.2)}{(3.8 - (1.134)(0.4) + 0.57)(0.4)} \right]$$

$$= -1.157$$

$$\frac{dE}{dc} = -\frac{1}{2} \left[\frac{(3.4 - (1.134)(0.2) + 0.57)}{(3.8 - (1.134)(0.4) + 0.57)} \right]$$

$$= -3.829$$

$$\text{Step 4 : } \Delta m = -0.1 \times -1.157 = 0.1157$$

$$\Delta c = -0.1 \times 3.829 = 0.3829$$

$$\text{Step 5 : } m + = \Delta m$$

$$= 1.134 + 0.1157$$

$$= 1.2497$$

$$c + = \Delta c$$

$$= -0.57 + 0.3829$$

$$= -0.187$$

$$\text{Step 6 : } \text{itr} + = 1$$

$$2+1=3$$

Step 7 : if (itr > epochs)
 3 > 2
 go to step-8
 else
 go to step 3

$$\text{Step 8 : } m = 1.2497, c = -0.187$$