

Assignment 1

Let us consider a sample dataset have one input (x_i^a) & one output (y_i^a) & 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 2 iterations with first 2 samples.

Step 1: $[X, Y], m=1, c=1, \eta=0.1, \text{epochs}=2, n_s=2$

Step 2: Iter = 1

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

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

$$= -1.34$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2} [(3.4 - 0.2 + 1) + (3.8 - 0.4 + 1)]$$

$$= -4.3$$

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

$$= -0.1(-1.34) = 0.134$$

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

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

$$\text{step 5: } m = m + \Delta m = 1 + 0.134 = 1.134$$

$$c = c + \Delta c = -0.1 \times -4.3 = 0.43$$

$$\text{step 6: } \text{iter} = \text{iter} + 1 \Rightarrow 1 + 1 = 2$$

$$\text{step 7: if (iter > epochs) : True goto next step} \\ 2 > 2 \quad \text{False : goto step 3}$$

$$\text{step 3: } \frac{\partial E}{\partial m} = -\frac{1}{2} [(3.4 - (1.134)(0.2) + 0.57)(0.2) \\ + (3.8 - (1.134)(0.4) + 0.57)(0.4)] \\ = -1.157$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2} [(3.4 - (1.134)(0.2) + 0.57) \\ + (3.8 - (1.134)(0.4) + 0.57)]$$

$$= -3.829$$

$$\text{step 4: } \Delta m = -0.1(-1.15) = 0.1195$$

$$\Delta c = -0.1(-3.82) = 0.38$$

$$\text{step 5: } m = m + \Delta m = 1.134 + 0.115 = 1.249$$

$$c = c + \Delta c = -0.57 + 0.38 = -0.18$$

$$\text{step 6: } \text{iter} = \text{iter} + 1 = 2 + 1 = 3$$

step 7: if $(iter > ep_{tol})$: true go to step 8

3 > 2
else go to step 3

step 8: $m = 1.249$, $c = -0.18$