

Assignment-5

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Let us consider a sample dataset

sample (i)	x_i	y_i
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 batch size - 2
- Write python code to build simple linear regression model using MBGD optimizer. Consider all 4 samples.

Batch 1

x	y
0.2	3.4
0.4	3.8

Batch 2

x	y
0.6	4.2
0.8	4.6

Step-1: $[X, Y], m=1, C=-1, \eta=0.1, \text{epochs}=2, b_0=-2$

2. $n_b = \frac{n_s}{b_s} = \frac{4}{2} = 2$

3. $\text{iter}=1$

4. $\text{Batch}=1$

$$5. \frac{\partial E}{\partial m} = \frac{-1}{b_s} \sum_{i=1}^{b_s} (y_i - mx_i - c) x_i$$

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

$$= -1.34$$

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

$$= -4.3$$

$$6. \Delta m = -(0.1)(-1.34) = 0.134$$

$$\Delta c = -(0.1)(-4.3) = 0.43$$

$$7. m = m + \Delta m = 1 + 0.134 = 1.134$$

$$c = c + \Delta c = -1 + 0.43 = -0.57$$

$$8. \text{Batch} + 1 = 1 \Rightarrow 1 + 1 = 2$$

9. if (batch > nb)

step 10
2 > 2
else
goto step 5

$$5. \frac{\partial E}{\partial m} = \frac{-1}{2} [(4.2 - (1.134)(0.6) + 0.57) 0.6 + (4.6 - (1.134)(0.8) + 0.57) 0.8]$$

$$= -2.932$$

$$\frac{\partial E}{\partial c} = \frac{-1}{2} [(4.2 - (1.134)(0.6) + 0.57) + (4.6 - (1.134)(0.8) + 0.57)]$$

$$= -4.1762$$

$$6. \Delta m = -(0.1)(-2.932) = 0.2932$$

$$\Delta c = -(0.1)(-4.1762) = 0.41762$$

$$7. m = m + \Delta m = 1.427$$

$$c = c + \Delta c = -0.1523$$

$$8. \text{Batch} + 1$$

$$2 + 1 = 3$$

9. if (batch > nb)
step-10

372
else goto step-5

10. itr = itr + 1
l+1 = 2

11. if (itr > epoches)
step-12

2 > 2
else
goto step-4

4. batch = 1

$$5. \frac{\partial E}{\partial m} = \frac{-1}{2} [3.4 - (1.42)(0.2) + 0.1523] 0.2 + (3.8 - (1.42)(0.4) + 0.1523) 0.4]$$
$$= -1.0029$$

$$\frac{\partial E}{\partial c} = \frac{-1}{2} [(3.4) - (1.427)(0.2) + 0.1523] + (3.8 - (1.42)(0.4) + 0.1523]$$
$$= -3.3241$$

$$\Delta m = (-0.1)(-1.0029)$$
$$= 0.1002$$

$$\Delta c = (-0.1)(-3.3241)$$
$$= 0.332$$

$$m = m + \Delta m$$
$$= 1.5274$$

$$c = c + \Delta c$$
$$= 0.1797$$

$$\text{batch} = \text{batch} + 1$$
$$1+1=2$$

9. if (batch > n_b)
 goto step-10
 2 > 2
 else
 step-5.

5.
$$\frac{\partial E}{\partial m} = \frac{1}{2} [(4.2 - 0.52)(0.6 - 0.179)0.6 + (4.6 - 0.527)(0.7 - 0.179)0.8]$$

$$= -2.21$$

$$\frac{\partial E}{\partial c} = -3.151$$

6.
$$\Delta m = -0.1 \times -2.21$$

$$= 0.221$$

$$\Delta c = -0.1 \times -3.151$$

$$= 0.315$$

7.
$$m + \Delta m = 1.52 + 0.22 = 1.74$$

$$c + \Delta c = 0.179 + 0.315 = 0.494$$

8. batch + 1 = 2
 2 + 1 = 3

9. if (batch > n_b)
 step-10
 else
 step-5

10. itr = 1
 2 + 1 = 3

1. if (itr > epochs)
 3 > 2 step 12
 else
 step 4

2. print m, c
 m = 1.748, c = 0.494.