

# Assignment -7

## Batch gradient descent

Step 1:  $[x, y]$ , epochs=2,  $m=1$ ,  $c=-1$ ,  $n=0.01$

$$n_s = 2$$

Consider 2 samples only

| X   | Y   |
|-----|-----|
| 0.2 | 3.4 |
| 0.4 | 3.8 |
| 0.6 | 4.2 |
| 0.8 | 4.6 |

Step 2: iteration=1

Step 3:

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

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

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

$$\Rightarrow -\frac{1}{2} \left[ (4.2)(0.2) + (4.4)(0.4) \right] \Rightarrow -\frac{1}{2} [0.84 + 1.76]$$

$$\Rightarrow -\frac{1.3}{2}$$

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

$$= -\frac{1}{2} [4.2 + 4.4] \Rightarrow -\frac{1}{2} [8.6] \Rightarrow -4.3$$

$$\text{step 4: } \Delta m = -\eta \frac{\partial f}{\partial m} = -(0.1)(-1.3) = 0.13$$

$$\Delta c = -\eta \frac{\partial f}{\partial c} = -(0.1)(-4.3) = +0.43$$

$$\text{step 5: } m = 1 + 0.13 = 1.13$$

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

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

$$\text{step 7: if (iteration > epochs)}$$

$$2 > 2 \text{ false}$$

Then go to step 3

$$\text{step 8: } \frac{\partial f}{\partial m} = -\frac{1}{2} \left[ \sum_{i=1}^n (y_i - mx_i - c) x_i \right]$$

$$= -\frac{1}{2} \left[ (3.4 - (1.13 \times 0.2) + 0.97) \times 0.2 \right] + (3.8 - (1.13 \times 0.4) + 0.57) \times 0.4$$

$$= -\frac{1}{2} [3.744 \times 0.2 + 3.918 \times 0.4] \Rightarrow -\frac{1}{2} [3.2994 + 1.5672]$$

$$\Rightarrow -2.4333$$

$$\frac{\partial f}{\partial c} = -\frac{1}{2} [3.744 + 3.9157] \Rightarrow -3.831$$

$$\text{step 9: } \Delta m = -\eta \frac{\partial f}{\partial m} = -(0.1)(-2.4333) \Rightarrow 0.2433$$

$$\Delta c = -\eta \frac{\partial f}{\partial c} = -(0.1)(-3.831) = 0.3831$$

Step 10:  $m = m + \Delta m = 1.13 + 0.24333 = 1.3733$

$c = c + \Delta c = -0.57 + 0.3831 = -0.1869$

Step 11:  $\text{iteration} = \text{iteration} + 1 \Rightarrow 2 + 1 = 3$

Step 12: if (iteration > epochs)

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go to step 13

Step 13: print(m, c)

1.37833, 0.1869

Step 14: msc of data

$$\text{msc} = \frac{[3.4 - (1.37333 \times 0.2) + 0.1869]^2 + [3.8 - (1.37233 \times 0.4) + 0.1869]^2}{2}$$

$$= \frac{[10.97089] + [11.81681]}{2} \Rightarrow \underline{11.39388}$$