Assignment-5

18K41A05F4

x	y
0.2	3.4
0.4	3.8
0.6	4.2
0.8	4.6

Mini-Batch Gradient Descent

Steps

1) Read dataset, $\eta = 0.1$, $m = 1$, $c = -1$, epochs = 2.
batch size = 2.

2) splitting data into batches

Batch 1

x	y
0.2	3.4
0.8	4.6

Batch 2

x	y
0.4	3.8
0.6	4.2

3) iter = 1

4) batch = 1

5) Calculate gradient descents

$$\frac{\partial E}{\partial m} = -\frac{1}{2}\left[(3.4 - 1(0.2) - (-1))(0.2) + (4.6 - 1(0.8) - (-1)(0.8)\right]$$

$$= -\frac{1}{2}\left[(3.4 - 0.2 + 1)(0.2) + (4.6 - 0.8 + 1)(0.8)\right]$$

$$= -\frac{1}{2}\left[(4.2)(0.2) + (4.8)(0.8)\right]$$

$$= -\frac{1}{2}\left[4.68\right] = -2.34$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2}\left[4.2 + 4.8\right] = -9/2 = -4.5$$

6) $\Delta w = -\eta \frac{\partial E}{\partial w} = 0.234$ $\quad \Delta C = 0.45$

9) $w = w + \Delta w = 1 + 0.234 = 1.234$

$C = C + \Delta C = -1 + 0.45 = -0.55$

8) batch = batch + 1 = 1 + 1 = 2

9) if batch > no of batches $\quad 2 > 2 \Rightarrow$ False

goto step 5

10) $\frac{\partial E}{\partial w} = \frac{-1}{n_b} \sum_{i=1}^{n_b} (y_T - w x_i - C) x_i$

$= -\frac{1}{2} [(3.8 - (1.234 \times 0.4) + 0.55)(0.4)$

$+ (4.2 - (1.234 \times 0.6) + 0.55)(0.6)]$

$= -\frac{1}{2} \times [(3.8564)(0.4) + (4.0096)(0.6)]$

$= -1.97416$

$\frac{\partial E}{\partial C} = -\frac{1}{2} [3.8564 + 4.0096] = -3.933$

11) $\Delta w = \eta \frac{\partial E}{\partial w} = 0.197416$

$\Delta C = -\eta \frac{\partial E}{\partial C} = 0.3933$

12) $w = 1.234 + 0.197416 = 1.4314$

$C = -0.55 + 0.3933 = -0.1567$

13) batch = batch + 1 = 2 + 1 = 3

14) if batch > $n_b \Rightarrow 3 > 2$

goto step 15

15) step = step + 1 = 1 + 1 = 2.

16) if step > epoch $\Rightarrow 2 > 2 \rightarrow$ False

goto step 4

17) batch = 1

18) $\frac{\partial E}{\partial m} = \frac{-1}{2} \times [(3.4 - (1.4314)(0.2) + 0.1567)(0.2)$

$+ (4.6 - (1.4314)(0.8) + 0.1567)(0.8)]$

$= \frac{-1}{2} \times [(3.27042)(0.2) + (3.61158)(0.8)]$

$= -\frac{1}{2} \times [0.65408 + 2.88926] = -1.77167$

$\frac{\partial E}{\partial c} = -\frac{1}{2} [3.27042 + 3.61158] = -3.441$

19) $\Delta m = -\eta \frac{\partial E}{\partial m} = 0.177167$

$\Delta c = -\eta \frac{\partial E}{\partial c} = 0.3441$

20) $m = m + \Delta m = 1.4314 + 0.177167 = 1.60856$

$c + c + \Delta c = -0.1567 + 0.3441 = 0.1874$

21) batch = batch + 1 = 1 + 1 = 2.

22) if batch > n_b = 2 > 2 ⇒ false

goto steps

23) $\frac{\partial E}{\partial m} = \frac{-1}{2} [(3.8 - (1.60856)(0.4) - 0.1874)$

$(0.4) + (4.2 - (1.60856)(0.6) - 0.1874)(0.6)]$

$= -\frac{1}{2} [(3.96917)(0.4) + (3.047464)(0.6)]$

$= -\frac{1}{2} [1.187668 + 1.828478] = -1.50807$

$\frac{\partial E}{\partial c} = \frac{-1}{2} [6.01663] = -3.00831$

24) $\Delta w = 0.150807$, $\Delta C = 0.300831$

25) $w = 1.608856 + 0.150807 = 1.759067$

$C = 0.1874 + 0.300831 = 0.488231$

26) batch $= 2+1 = 3$

27) if batch $> n_b = 3 > 2$

goto next step

28) $epu = epu + 1 = 2+1 = 3$

29) if $epu > epoch \Rightarrow 3 > 2 \Rightarrow$ goto next step

30) Print w, C

$w = 1.759067$

$C = 0.488231$

31) MSE

$$mse = \frac{(3.4 - 0.84004) + (3.8 - 1.19185) + (4.2 - 1.54367) + (4.6 - 1.89548)}{4}$$

$mse = 2.63224$