Assignment - 5 HTNO: 18K4A05A5

Do manual calculations for two iterations with batch size 2

Let consider a sample dataset have one input $(x_i^a)$ & one output $(y_i^a)$ and number of samples 4. Develop a simple linear regression model using MBGD

| 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 |

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, η = 0.1, epochs = 2,
bs = 2

Step 2: $nb = \frac{ns}{bs} = \frac{4}{2} = 2$

Step 3: itr = 1

Step 4: Batch = 1

Step 5: $\frac{\partial \epsilon}{\partial m} = \frac{-1}{bs} \sum_{i=1}^{bs} (y_i - mx_i - c)x_i$

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

$= -1.34$

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

$= -4.3$

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

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

Step 7: $m = m + \Delta m = 1 + 0.134 = 1.134$

$c = c + \Delta c = -1 + 0.43 = -0.5$

Step 8: Batch = 1 + 1 = 2

Step 9: if (batch > nb).
2 > 2
Goto step 5

step 5:

$$\frac{\partial E}{\partial m} = -\frac{1}{2}\left[(4.2-(1.134)(0.6)+0.5\times)\right.$$

$$0.6+(4.6-(1.134)(0.8)+0.5\times)0.8\Big]$$

$$= -2.932$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2}\left[(4.2-(1.134)(0.6)+0.5\times)+\right.$$

$$\left.(4.6-(1.134)(0.8)+0.5\times)\right]$$

$$= -4.1762$$

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

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

step 7: $m = 1.134 + 0.2932$

$$\boxed{m = 1.4272}$$

$c = -0.5\times + 0.4176$

$$\boxed{c = -0.1523}$$

step 8: Batch $= 2+1 = 3$

step 9: if (batch > nb)

$3 > 2 \rightarrow \checkmark$

goto step - 10

step 10: itr $= 1+1 = 2$

step 11: if (itr > epochs)

$2 > 2$ go to step 12

else

goto step 4

Step 4: Batch=1

Step 5: $\frac{\partial E}{\partial m} = \frac{-1}{2}[(3.4 - (1.4272)(0.2) + 0.1523)0.2 + (3.8 - (1.4272)(0.4) + 0.1523)0.4]$

$= -1.0029$

$\frac{\partial E}{\partial c} = \frac{-1}{2}[(3.4) - (1.4272)(0.2) + 0.1523) + (3.8 - (1.4272)(0.4) + 0.1523)]$

$= -3.3241$

Step 6: $\Delta m = (-0.1)(-1.0029)$

$= 0.1002$

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

$= 0.332$

Step 7: $m = 1.4272 + 0.1002$

$\boxed{m = 1.5274}$

$c = -0.1523 + 0.332$

$\boxed{c = 0.1797}$

Step 8: Batch = 1+1 = 2

Step 9: if (Batch > $n_b$)

272

Goto step - 10

else Goto step 5

Step-5:

$$\frac{\partial E}{\partial m} = -\frac{1}{2}[(4.2 - (1.5274)(0.6) - 0.1797)0.6 + (4.6 - (1.5274)(0.8) - 0.1797)0.8]$$

$$= -2.21$$

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

Step-6: $\Delta m = -0.1 \times -2.21 = 0.221$

$\Delta c = -0.1 \times -3.151 = 0.315$

Step-7: $m = m + \Delta m = 1.5274 + 0.221$

$= 1.745$

$c = 0.1797 + 0.315$

$= 0.494$

Step 8: Batch + 1 = 1

2 + 1 = 3

Step-9: if (batch > nb) 3 > 2 → ✓

Goto step 10.

Step 10: itr = 2 + 1 = 3.

Step-11: if (itr > epochs)

3 > 2

Goto Step 12

Step-12: $m = 1.748$, $c = 0.494$.