# ASSIGNMENT-5

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let us consider a sample dataset have one input ($x_i^a$) and one output ($y_i^a$) and no.of samples 4. Develop a simple linear regression model using MGBD

| 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 two iterations with batch size=2
- write the python code to build simple linear regression model using MGBD 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 |

step1: [x-y], m=1, c=1, $\eta$=0.1, epochs=2, bs=2

step2: $nb = \frac{ns}{bs} = \frac{4}{2} = 2$

step3: itr = 1

step4: Batch=1

step5: $\frac{\partial E}{\partial m} = \frac{-1}{bs} \sum_{i=1}^{bs} (y_i - m x_i - c) x_i$

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

$= -1.34$

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

$$= -4.3$$

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

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

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

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

Step 8: Batch t = 1

1 + 1 = 2

Step 9: if (Batch > nb)

goto step-10

2 > 2

else

goto step5

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

$= -2.932$

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

$= -4.1762$

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

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

Step 7: $m += \Delta m = 1.134 + 0.2932 = 1.4276$

$c += \Delta c = -0.57 + 0.4176 = -0.1523$

Step 8: Batch t = 1

2 + 1 = 3

Step 9: if (Batch > nb)

goto step-10

3 > 2

else

goto step-5

Step-10: itr = itr+1

1+1=2

Step-11: if (itr > epochs)

goto step-12

2>2

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: $m+ = \Delta m$

$= 1.4272 + 0.1002 = 1.5274$

$c+ = \Delta c$

$= 0.1523 + 0.332 = 0.1797$

Step-8: Batch += 1

1+1=2

Step-9: if (Batch > nb)

goto step-10

2 > 2

else

goto step-7

Step-5: $\frac{\partial E}{\partial m} = \frac{-1}{2}[(4.2 - (1.5274)(0.6) - (0.1797)0.6 + (4.6 - (1.5276)(0.8) - (0.1797)0.8]$

$= -2.21$

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

Step7: $m + \Delta m = 1.5274 + 0.221$

$= 1.748$

$c + \Delta c = 0.1797 + 0.315$

$= 0.494$

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

$= 0.221$

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

$= 0.315$

Step 8: Batch += 1

2+1=3

Step 9: if (Batch > nb)

goto step-10

else

goto step-5

Step-10: itr += 1

2+1=3

Step-11: if (itr > epochs)

3 > 2 goto step-12

else

goto step-4

Step-12: print m, c

m = 1.748, c = 0.494