# ASSIGNMENT-5.    18K41A0588

Let us consider a sample dataset have one input $(x_i9)$ and one, output $(y_i9)$ and number of samples 4, Develop a simple linear reggresion model using MBGD.

| (1) Sample | $x_i9$ | $y_i9$ |
|------------|--------|--------|
| 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 reggresion model using MBGD optimizer (consider All 4 Samples)

Batch 1

$$\begin{array}{c|c} x & y \\ 0.2 & 3.4 \\ 0.4 & 3.8 \end{array}$$

Batch 2

$$\begin{array}{c|c} x & y \\ 0.6 & 4.2 \\ 0.8 & 4.6 \end{array}$$

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

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

Step 3 : itr = 1

Step 4 : Batch = 1

Step 5 : $\dfrac{\partial E}{\partial m} = \dfrac{-1}{bs} \cdot \displaystyle\sum_{i=1}^{bs} (y_i - mx_i - 6)x_i$

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

$0.4]$

$= -1.34$

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

$= -4.3$

Step 6 : $Dm = -(0.1)(-1.34) = 0.134$

$Dc = -(0.1)(-4.3) = 0.43$

Step 7 : $m = m + Dm = 1 + 0.134 = 1.134$

$C = C + DC = -1 + 0.43 = -0.57$

Step 8 : if ( Batch t = 1

$1 + 1 = 2$

Step 9 : if ( Batch > nb)

goto step -10

$2 > z$

else

goto step 5

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

$\left. - (1.34)(0.8) + 0.57)0.8 \right]$

$= -2.932$

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

$$= -4.1762$$

Step 6 : $DM = (0.1)(-2.932) = 0.2932$

$$DC = -(0.1)(-4.1762) = 0.41762$$

Step 7 : $M + DM = 1.134 + 0.2932 = 1.4272$

$$C + DC = -0.57 + 0.4176 = -0.1523$$

Step 8 : Batch += 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: $\dfrac{\partial E}{\partial m} = -\dfrac{1}{2}[(3.4 - (1.4272)(0.2) + 0.1523)0.2 +$

$(3.8 - (1.4272)(0.4) + 0.1523)0.4]$

$= -1.0029$

$\dfrac{\partial E}{\partial c} = -\dfrac{1}{2}[(3.4) - (1.4272)(0.2) + 0.1523) +$

$(3.8 + (1.4272)(0.4) + 0.1523]$

$= -3.3241$

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

$= 0.1002$

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

$= 0.332$

Step 7: $m_1 = \Delta m$

$= 1.4272 + 0.1002 = 1.5274$

$c_1 = \Delta c$

$= -0.1523 + 0.332 = 0.1797$

Step 8: Batch$_1 = 1$

$1 + 1 = 2$

Step 9: if (Batch > nb)

goto step -10

$2 > 2$

else

goto step -7

Step 5: $\dfrac{\partial E}{\partial m} = -\dfrac{1}{2}[(4.2 - (1.5274)(0.6) - 0.1797)0.6 +$

$(4.6 - (1.5274)(0.8) - 0.1797)$

$0.8] = -2.21.$

$$\frac{\partial \epsilon}{\partial c} = -3 \cdot 151$$

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

$\quad = 0.221$

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

$\quad = 0.315$

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

$\quad = 1.748$

$c + \Delta c = 0.1797 + 0.315$

$\quad = 0.494$

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

$m = 1.748, c = 0.494.$