## Mini Batch gradient Descent optimizes

setup

| X | Y | |
|---|---|---|
| 0.2 | 3.4 | } 1 |
| 0.4 | 3.8 | |
| 0.6 | 4.2 | } 2 |
| 0.8 | 4.6 | |

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

epochs $= 2$, batch size $(bs) = 2$

step2 :- Slipting data

$$b = 4/2 = 2$$

step3 : itu $= 1$

step4 i - Batch $= 1$

step5 :- $\frac{\partial t}{\partial m} = \frac{-1}{bs} \sum\limits_{y=1}^{bs} [y_i - mx_i - c)x_i]$

$$= \frac{-1}{2} \left\{ \begin{array}{l} [3.4 - (1)(0.2) - (-1)](0.2) + \\ (4.6) - (1)(0.6) - (-1))0.8)] \end{array} \right.$$

$$= \frac{-1}{2} [0.84 + 3.84] = \frac{-1}{2} (4.68)$$

$$= -2.34$$

$$\frac{\partial t}{\partial C} = \frac{-1}{n \, bs} \sum_{i=1}^{bs} \left[y_i - mx_i - c\right]$$

$$= \frac{-1}{2} \left[(3\cdot 4 - (1)(0\cdot 2) - (-1)) + (4\cdot 6 - (1)x_i - (-1))\right]$$

$$= \frac{-1}{2} \left[4\cdot 2 + 4\cdot 8\right] = \frac{1}{2}(9) = -4\cdot 5$$

**Step 6 :-** $\Delta m = -n \frac{\partial t}{\partial m} = -(0\cdot 1)(-2\cdot 34) = 0\cdot 234$

$$\Delta c = -n \frac{\partial t}{\partial c} = -(0\cdot 1)(-4\cdot 5) = 0\cdot 45$$

**Step 7 :-** $m = m + \Delta m = 1 + 0\cdot 234 = 1\cdot 234$

$$c = c + \Delta c = -1 + 0\cdot 45 = -0\cdot 55$$

**Step 8 :-** $Batch = batch + 1 = 2 \leq n_b \rightarrow True$

**Step 9 :-** $\frac{\partial t}{\partial m} = \frac{-1}{2} \left[(3\cdot 8) - (1)(0\cdot 4) - (-1)(0\cdot 4) + (4\cdot 2 - (1)(0\cdot 6) - (-1)(0\cdot 6)\right]$

$$= -1\cdot 97416$$

$$\frac{\partial t}{\partial C} = -3\cdot 933$$

**Step 10 :-** $\Delta m = -n \frac{\partial t}{\partial m} = -(0\cdot 1)(-1\cdot 97416)$

$$= 0\cdot 197416$$

$$\Delta c = -n \frac{\partial t}{\partial c} = -(0\cdot 1)(-3\cdot 933) = 0\cdot 3933$$

**Step 11 :-** $m = m + \Delta m = 1\cdot 234 + 0\cdot 197416 = 1\cdot 4314$

$$c = c + \Delta c = 0\cdot 3933 + (-0\cdot 55) = -0\cdot 1567$$

**Step 14:-** Batch = Batch+1 = 3 ≤ $n_b$

**step 15:-** iti = iti +1 = 2 ≤ epochs

**step 16:-** Batch = 1

**step 17:-** $\dfrac{\partial E}{\partial m} = \dfrac{-1}{2}\left[(3\cdot4) - (1\cdot4314)(0\cdot2) - \dfrac{(-0\cdot1567)}{(0\cdot2)}\right] +$

$$\left[4\cdot6 - (1\cdot4314)(0\cdot8) - (-0\cdot1567)(0\cdot8)\right]$$

$$= -1\cdot77167$$

$\dfrac{\partial E}{\partial c} = -3\cdot441$

**step 18:-** $\Delta m = -\eta\dfrac{\partial E}{\partial m} = 0\cdot177167$

$$\Delta c = -\eta\dfrac{\partial c}{\partial c} = 0\cdot3441$$

**step 19:-** $m = m + \Delta m = 1\cdot4314 + 0\cdot177167 = 1\cdot60856$

$c = c + \Delta c = -0\cdot1567 + 0\cdot3441 = 0\cdot1874$

**Step 20:-** batch = batch+1 = 2 ≤ $n_b$

**step 21:-** $\dfrac{\partial E}{\partial m} = \dfrac{-1}{2}\left[\begin{array}{l}(3\cdot8 - (1\cdot60856)(0\cdot4) - \\ \qquad (0\cdot1874))(0\cdot4) + \end{array}\right.$

$$(4\cdot2) - (1\cdot60856)(0\cdot6) - (0\cdot1874))(0\cdot6)$$

$$= -1\cdot50807$$

$\dfrac{\partial E}{\partial c} = \dfrac{-1}{2}\left[(3\cdot8 - (1\cdot60856)(0\cdot4) - (0\cdot1874)) + \right.$

$$(4\cdot2) - (1\cdot60856)(0\cdot8) - (0\cdot1874)]$$

$$= -3\cdot0083$$

$$\Delta m = -\eta \frac{\partial L}{\partial m} = 0.150807$$

$$\Delta c = -\eta \frac{\partial L}{\partial c} = 0.300831$$

Step23:- $m = m + \Delta m = 1.608 56 + 0.150807$

$$= 1.759067$$

$c = c + \Delta c = 0.1874 + 0.300831 = 0.488231$

step24:- batch = batch + 1

$$= 2 + 1 = 3 \le n_b$$

Step25:- it = it + 1 = 3 \le epochs

step26:- print (m, c)

step27:- $(3.4 - 0.84004)^2 + (3.8 - 1.9185)^2 +$

$$\frac{(4.2 - 1.54367)^2 + (4.6 - 1.89548)^2}{4}$$

$$= \underline{6.91}$$