Assignment-5:-

1) $[x, y]$, $m=1$, $c=-1$, $\eta=0.1$, epochs $=2$, bs $=2$, ns $=4$

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

2) $nb = \dfrac{ns}{bs} = \dfrac{4}{2} = 2$

3) $it = 1$

4) batch $= 1$

5) $\dfrac{\partial E}{\partial m} = -\dfrac{1}{bs} \sum\limits_{i=1}^{bs} (y_i - mx_i - c) x_i$

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

$$= -\dfrac{1}{2} \left[ 0.64 + 1.76 \right]$$

$$= -\dfrac{2.6}{2} = -1.3$$

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

$$= -\dfrac{1}{2} \left[ 4.2 + 4.4 \right] = -\dfrac{1}{2} (8.6) = -4.3$$

6) $\Delta m = -\eta \dfrac{\partial E}{\partial m} = -(0.1)(-1.3) = 0.13$

$\Delta c = -\eta \dfrac{\partial E}{\partial c} = -(0.1)(-4.3) = 0.43$

7) $m = m + \Delta m = 1 + 0.13 = 1.13$

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

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

9) if (2>2) ✗

↳ 5) $\frac{\partial E}{\partial m} = -\frac{1}{2}\left[ (4.2 - 1.13(0.6) + 0.57) 0.6 + (4.6 - 1.13(0.8) + 0.57) 0.8 \right]$

$= -\frac{1}{2}\left[ 4.092 \times 0.6 + 4.266 \times 0.8 \right]$

$= -\frac{1}{2}\left[ 2.4552 + 3.4128 \right]$

$= -\frac{1}{2}(5.868) = -2.934$

$\frac{\partial E}{\partial m} = -\frac{1}{2}\left[ (4.2 - 1.13(0.6) + 0.57) + (4.6 - 1.13(0.8) + 0.57) \right]$

$= -\frac{1}{2}\left[ 4.092 + 4.266 \right]$

$= -\frac{1}{2}(8.358) = -4.179.$

6) $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-2.934) = 0.2934$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-4.179) = 0.4179$

7) $m = m + \Delta m = 1.13 + 0.2934 = 1.4234$

$C = c + \Delta c = -0.57 + 0.4179 = -0.1521$

8) batch = 2+1 = 3

9) if (3>2) ✓

10) $it = it + 1 = 1 + 1 = 2$

11) $if (2 > 2)$ ✗

    └→ 4) $batch = 1$

        5) $\frac{\partial E}{\partial m} = -\frac{1}{2}\left[(3.4 - 1.423(0.2) + 0.152)\,0.2 + \right.$

$$\left. (3.8 - 1.423(0.4) + 0.152)\,0.4\right]$$

$$= -\frac{1}{2}\left\{3.2674 \times 0.2 + 3.382 \times 0.4\right\}$$

$$= -\frac{1}{2}\left\{0.653 + 1.353\right\}$$

$$= -\frac{1}{2}(2.0064) = -1.003$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2}\left[(3.4 - 1.423(0.2) + 0.152) + \right.$$

$$\left. (3.8 - 1.423(0.4) + 0.152)\right]$$

$$= -\frac{1}{2}\left\{3.2674 + 3.382\right\}$$

$$= -\frac{1}{2}(6.6494) = -3.324$$

6) $\Delta m = -\eta \frac{\partial E}{\partial m} = -0.1(-1.003)$

$$= 0.1003$$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -0.1(-3.324) = 0.3324$

7) $m = m + \Delta m = 1.423 + 0.1003 = 1.523$

   $C = C + \Delta C = -0.152 + 0.3324 = 0.18$

8) $batch = 1 + 1 = 2$

9) $if (2 > 2)$ ✗

   └→ 5) $\frac{\partial E}{\partial m}$

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5) $0 \cdot \frac{\partial E}{\partial m} = -\frac{1}{2}\left[\begin{array}{l}(4.2 - 1.523(0.6) + 0.18)(0.6), \\ (4.6 - 1.523(0.8) - 0.18)(0.8)\end{array}\right]$

$$= -\frac{1}{2}\left[3.106 \times 0.6 + 3.201 \times 0.8\right]$$

$$= -\frac{1}{2}\left[1.863 + 2.560\right]$$

$$= -\frac{1}{2}(4.423) = -2.2119$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2}\left[\begin{array}{l}(4.2 - 1.523(0.6) - 0.18) + \\ (4.6 - 1.523(0.8) - 0.18)\end{array}\right]$$

$$= -\frac{1}{2}\left[3.106 + 3.201\right]$$

$$= -\frac{1}{2}(6.307) = -3.153$$

6) $\Delta m = -\eta \frac{\partial E}{\partial m} = -0.1(-2.2119) = 0.2211$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -0.1(-3.153) = 0.315$

7) $m = m + \Delta m = 1.523 + 0.221 = 1.744$

$c = c + \Delta c = 0.18 + 0.315 = 0.495$

8) batch = 2 + 1 = 3

9) if $(3 > 2)$ ✓

10) it = 2 + 1 = 3

11) if $(3 > 2)$ ✓

12) $m = 1.744$

$c = 0.495$