

Assignment 2
Find global minimum Point and value for
function.

$$f(x, y) = x^2 + y^2 + 16$$

Do manual calculations for 2 iterations

Step 1:- $x = -1, y = 1, \eta = 0.1, \text{epoches} = 2$

Step 2:- iter = 1

$$\text{Step 3:- } \frac{\partial f}{\partial x} = 2x = -2$$

$$\frac{\partial f}{\partial y} = 2y = 2$$

$$\text{Step 4:- } \Delta x = -\eta \frac{\partial f}{\partial x} = -2(-0.1) \div 0.2$$

$$\Delta y = -\eta \frac{\partial f}{\partial y} = -(0.1)(2) = -0.2$$

$$\text{Step 5:- } x = x + \Delta x = -1 + 0.2 = -0.8$$

$$y = y + \Delta y = 1 - 0.2 = 0.8$$

$$\text{Step 6:- } \text{iter} = \text{iter} + 1 = 1 + 1 = 2$$

Step 7:- if $|x| > 2$

 go to step 8

else

 go to step 3

$$\text{Step 3:- } \frac{\partial f}{\partial x} = 2x = 2(-0.8) = -1.6$$

$$\frac{\partial f}{\partial y} = 2y = 2(0.8) = 1.6$$

$$\text{Step 4 :- } \Delta x = -\eta \frac{\partial f}{\partial x} = -0.1(-1.6) = 0.16$$

$$\begin{aligned}\Delta y &= -\eta \frac{\partial f}{\partial y} = -0.1(0.8) = -0.08 \\ &= -(0.1)(1.6) = -0.16\end{aligned}$$

$$\text{Step 5 :- } x = x + \Delta x = 0.8 + 0.16 = 0.96$$

$$y = y + \Delta y = 0.8 - 0.16 = 0.64$$

$$\text{Step 6 :- } it = it + 1 = 2 + 1 = 3$$

Step 7 :- if ($it > \text{epoches}$)

$$3 > 2$$

go to Step 8

else

go to Step 3

$$\text{Step 8 : } x = -0.64$$

$$\begin{aligned}y &= 0.64 \\ f(x, y) &= x^2 + y^2 + 10 \\ &= (-0.64)^2 + (0.64)^2 + 10 \\ &= 0.4 + 0.4 + 10 \\ &= 10.8\end{aligned}$$

Assignment - 3

F	Sample	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

1) $x, y, m = 1, c = -1, \eta = 0.1, \text{epoches} = 2, n_s = 2$

2) $i_t = 1$

3) Sample = 1

$$4) \frac{\partial E}{\partial m} = -(3.4(1))(0.2 + (-1)) 0.2$$

$$= -0.84$$

$$\frac{\partial E}{\partial c} = -(3.4(1))(0.2 + 1)$$

$$= -4.2$$

$$5) \Delta m = -(0.1)(-0.84) = 0.084 \quad (\mu_{m0})$$

$$\Delta c = -(0.1)(-4.2) \quad (\mu_{c0})$$

$$= 0.42$$

$$6) m = m + \Delta m$$

$$= 1 + 0.84$$

$$= 1.084$$

7) Sample + = 1

8) if ($2 > 2$)

go to step 9

else

Step 4

$$4) \frac{\partial F}{\partial m} = -[3.8 - (1.084)(0.4) + 0.58]0.4$$

$$= -1.5785$$

$$\frac{\partial F}{\partial c} = -(3.8 - (1.084)(0.4) + 0.58)$$

$$= -3.9464$$

$$5) \Delta m = -(0.1)(-1.5785) = 0.1578$$

$$\Delta c = -(0.1)(-3.9464) = 0.3946$$

$$6) m = m + \Delta m = 1.84 + 0.1578 = 1.9918$$

$$c = c + \Delta c = -0.58 + 0.3946 = -0.1854$$

7) Sample = +1

8) if ($3 > 2$)

go to step 9

else

Step 4

9) let $t = 1$

10) if ($2 > 2$)

go to step 11

else step 3

$$3) \text{ Sample} = 1$$

$$4) \frac{\partial F}{\partial m} = -(3.4 - (1.2)(0.2) + 0.18) 0.2 \\ = -0.668$$

$$\frac{\partial E}{\partial c} = -(3.4 - (1.2)(0.2) + 0.18) \\ = -3.34 (2.0 + (0.0)(180.1) - 8.8)$$

$$5) \Delta m = -(0.1)(-0.668) = 0.0668$$

$$6) m = m + \Delta m = (1.24 + 0.0668) = 1.3068$$

$$c = \alpha c + c = 0.18 + 0.33 = 0.15$$

$$7) \text{ Sample} = 1$$

$$8) \tilde{w}_j (2 > 2)$$

go to step 9

else

Step 4 = $\alpha w_j + z_j = 2.0 + 0.0$

$$4) \frac{\partial E}{\partial m} = -(3.8 - (1.3)(0.4) - 0.15) 0.4 \\ = -1.25$$

$$\frac{\partial E}{\partial c} = -(3.8 - (1.3)(0.4) - 0.15) \\ = -3.13$$

$$5) \Delta m = -(0.1)(-1.25) = 0.12$$

$$\Delta c = -(0.1)(-3.13) = 0.31$$

$$6) m = m + \Delta m = 1.3 + 0.12 = 1.42$$

$$c = c + \Delta c = 0.15 + 0.31 = 0.46$$

7) Sample tot = 1

8) if ($3 > 2$)

go to step 9

9) $\hat{w}t = \hat{w}t + 1$

10) if ($\hat{w}t > ep$)

$3 > 2$

11) Point m & C

$$m = 1.42$$

$$C = 0.46$$

Assignment - 5

Sample (i) $x_i^a \quad y_i^a$

1	0.2	3.4	$\rightarrow \text{batch} = 1$
2	0.4	3.8	
3	0.6	4.2	$\rightarrow \text{batch} = 2$
4	0.8	4.6	

1) $[x, y]; m=1, c=-1, \eta=0.1, \text{epoch}=2, \text{bs}=2$

$$2) n_b = \frac{n_s}{\text{bs}} = \frac{4}{2} = 2$$

3) it = 1

4) Batch = 1

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

$$= -\frac{1}{2} [(3.4 - (1)(0.2) + 1)0.2] + [3.8 - 0.4 + 1] \\ = -1.34$$

$$\frac{\partial E}{\partial c} = -\frac{1}{2} [(3.4 - 0.241) + (3.8 - 0.4 + 1)] \\ = -4.3$$

$$6) Dm = -(0.1)(-1.34) = 0.134 \\ = -(0.1)(4.3) = 0.43$$

$$7) m = m + Dm = 1 + 0.134 = 1.134 \\ c = c + DC = -1 + 0.43 = -0.57$$

8) Batch +1

9) if ($z > 2$)

[Go to step 10 else Step 5

$$5) \frac{\partial E}{\partial m} = -\frac{1}{2} [4 \cdot 2 - (1.1(0.6)) + 0.57] 0.6 +$$

$$+ (4.6 - (1.134)(0.8) + 0.57) 0.8 \\ + (8.2(0.8) + (8.2)(0.1) - 1.134)$$

$$\approx 2.932$$

$$6) \frac{\partial E}{\partial c} = -\frac{1}{2} [4 \cdot 2 - (1.134)(0.6) + 0.57] + \\ + (4.6 - (1.134)(0.8) + 0.57) \\ = -4.17$$

$$6) \Delta m = 6.2932,$$

$$\Delta c = 0.417$$

$$7) m = 1.13 + 0.293 = 1.42$$

$$c = -0.57 + 0.4 = -0.15$$

8) Batch +1 = 1

9) if (batch > nb)

go to Step 10

10) it +1 = 1

11) if ($z > 2$)

go to Step 2 else Step 4

4) Batch = 1

$$\frac{\partial E}{\partial m} = -\frac{1}{2} \left[3.4 - (1.4)(0.2) + 10.5(0.2) + \right. \\ \left. 3.8 - (1.4)(0.6) + 0.15(0.4) \right]$$
$$= -1.0029 + ((3.4)(1.1) - 8.4)$$

$$= -\frac{1}{2} \left[3.4 - (1.42)(0.2) + 10.1823 + \right. \\ \left. 3.8 - (1.4)(0.4) + 0.15 \right]$$
$$= -3.324$$

$$6) Dm = -0.1(-1.0029) = 0.1002$$

$$\Delta C = -0.1(-3.324) = 0.332$$

$$7) m+ = Dm = 1.42 + 0.1002 = 1.5$$

$$C+ = \Delta C = -0.15 + 0.3 = 0.15$$

8) Batch + b = 1

9) if (2 > 2) go to step 10 else step 7

$$10) \frac{\partial E}{\partial m} = -\frac{1}{2} [4.2 - (1.5)(0.6) - 0.17] 0.6 +$$

$$4.6 - (1.5)(0.8) - 0.17$$

$$= -2.21$$

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

$$6) Dm = -0.1x - 2.21 = 0.221$$

$$\Delta C = -0.1x + 3.15 = 0.315$$

$$7) m+ = Dm = 1.5 + 0.22 = 1.7$$

$$C+ = \Delta C = 0.17 + 0.3 = 0.4$$

8) Batch + = 1

9) if (Batch > nb) go to step 10 else step 5

10) it+ = 1

11) if (3 > 2) go to step 12

12) Print m, C

$$m = 1.74$$

$$C = 0.494$$

Assignment - 7

Sample	x_i	y_i
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

1) $[x, y]; m = 1, c = -1, \eta = 0.1, \text{epochs} = 2, n_s = 2$

$$2) \Delta t = 1$$

$$3) \frac{\partial E}{\partial m} = -\frac{1}{2} [3.4 - (1)(0.2) + 1] 0.2 + [3.8 - (1)(0.4) + 1] 0$$

$$= -1.34$$

$$\frac{\partial E}{\partial b} = -\frac{1}{2} [3.4 - 0.2 + 1] + [3.8 - 0.4 + 1]$$

$$= -4.3$$

$$4) \Delta m = -\eta \frac{\partial E}{\partial m}$$

$$= -0.1 \times -1.34 = 0.134$$

$$5) m+ = m$$

$$= 1 + 0.134$$

$$= 1.13$$

$$c+ = c$$

$$= -0.1 \times -4.3$$

$$= 0.43$$

$$6) \hat{w}t + = 1$$

7) if ($2 > 2$)

go to step 8;

$$3) \frac{\partial E}{\partial m} = \frac{1}{2} [3.4 - (1.134)(0.2) + (0.57)(0.2) + \\ 3.8 - (1.134)(0.4) + 0.57)(0.4)] \\ = -1.157$$

$$\frac{\partial E}{\partial c} = \frac{1}{2} [3.4 - (1.134)(0.2) + (0.57)] + \\ 3.8 - (1.134)(0.4) + 0.57] \\ = -3.829$$

$$4) \Delta m = -0.1 \times 1.157 = 0.1157$$

$$\Delta c = -0.1 \times -3.829 = 0.3829$$

$$5) m+ = \Delta m \Rightarrow 1.134 + 0.1157 = 1.2497$$

$$c+ = \Delta c \Rightarrow -0.57 + 0.3829 = -0.187$$

$$6) \hat{w}t + = 1$$

7) if ($\hat{w}t > \epsilon p_0$) go to step 8
 $3 > 2$

$$8) m = 1.24 \quad c = -0.187$$