Assignment - 11

Do manul calculations for two iterations

with first two samples (NAG optimizer)

Samples	x	y
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

$$V_t = \Im V_{t-1} - \eta \frac{\partial F(x + \Im V_{t-1})}{\partial x}$$

$$x = x + V_t.$$

Step1:- $\eta = 0.1$, $m = 0$, $c = 0$, $V_m = 0$, $V_c = 0$, $\Im = 0.9$, $epoch = 2$

Step2:- iter = 1

Step3:- Sample = 1

Step4:- $y = mx_i + c = 0 \times 0.2 + 0 = 0$

Step5:- $E = \frac{1}{2}(y_i - y)^2 = \frac{1}{2}(3.4 - 0)^2 = \frac{1}{2}(3.4 \times 3.4) = 5.78$

Step6:- $\frac{\partial E}{\partial m} = -(y_i - (m + \Im V_m)x_i - c - \Im V_c)x_i$

$$= -(3.4 - (0 + 0.9 \times 0)0.2 - 0 - 0.9 \times 0)0.2$$

$$= -(3.4) \times 0.2 = -0.68$$

$\frac{\partial E}{\partial c} = -(y_i - (m + \Im V_m)x_i - c - \Im V_c)$

$$= -(3.4 - (0 + 0.9 \times 0)0.2 - 0 - 0.9 \times 0)$$

$$= -(3.4) = -3.4 \qquad \frac{\partial E}{\partial c} = -3.4 \quad \frac{\partial E}{\partial m} = $$

Step 7:-
$$V_m = \vartheta \times V_m - \eta \frac{\partial E}{\partial m} = 0.9 \times 0 - (0.1)(-0.68)$$
$$= 0.068$$

$$V_c = \vartheta \times V_c - \eta \frac{\partial E}{\partial c} = 0.9 \times 0 - 0.1 \times -3.4$$

$$\boxed{V_c = 0.34}$$

$$\boxed{V_m = 0.068}$$

Step 8:- $m = m + V_m = 0 + 0.068 = 0.068$

$$c = c + V_c = 0 + 0.34 = 0.34$$

Step 9:- Sample = 2

Step 10:- if (sample $\overset{2}{>} 2$)

  step 11   else   step 4

Step 4:- $Y = 0.068 \times 0.4 + 0.34$

  $Y = 0.3672$ $m = 0.068, c = 0.34$

Step 5:- $E = \frac{1}{2}(Y_i - y)^2$

  $= \frac{1}{2}(3.8 - 0.36)^2 = 5.91$

Step 6:- $\frac{\partial E}{\partial m} = -(3.8 - (0.068 + 0.9 \times 0.068)0.4$

  $- 0.34 - 0.9 \times 0.34)0.4$

  $= -(3.8 - 0.051 - 0.34 - 0.306)0.4$

  $= -1.24$

$$\frac{\partial E}{\partial c} = -[3.8 - (0.068 + 0.9 \times 0.068)0.4$$

  $-0.34 - 0.9 \times 0.34]$

  $= -(3.8 - 0.051 - 0.34 - 0.306)$

  $= -3.10$

Step 7:- $v_m = \gamma v_m - \eta \frac{\partial F}{\partial m}$

$$= 0.9 \times 0.068 - (0.1)(-1.24)$$

$$\boxed{v_m = 0.185}$$

$$v_c = \gamma v_c - \eta \frac{\partial F}{\partial c}$$

$$= 0.9 \times 0.34 - 0.1 \times (-3.10)$$

$$\boxed{v_c = 0.616}$$

Step 8: $m = m + v_m = 0.068 + 0.185 = 0.253$

$$c = c + v_c = 0.34 + 0.616 = 0.956$$

$$m = 0.25, \; c = 0.95$$

step 9:- sample = 3

Step 10:- if (sample > 2)
    Step 10 ✓
    else
    Step 4

step 11:- iter = 2

step 12:- if (iter > 2)
    step 13
    else
    step 3

Step 3:- sample = 1

Step 4:- $Y = (0.25)(0.2) + 0.95$

$$= 1$$

step 5: $E = \frac{1}{2}(3.4 - 1)^2$

$\cancel{\frac{2.1}{2}} = 2.88$

step 6: $\frac{\partial E}{\partial m} = -(3.4 - (0.25 + 0.9 \times 0.18)0.2$

$\qquad - 0.95 - 0.9 \times 0.61)0.2$

$\qquad = -(3.4 - 0.085 - 0.95 - 0.54)0.2$

$\qquad = -0.36$

$\frac{\partial E}{\partial c} = -(3.4 - 0.085 - 0.95 - 0.54)$

$\qquad = -1.82$

step 7: $V_m = \beta V_m - \eta \frac{\partial E}{\partial m}$

$\qquad = 0.9 \times 0.18 - 0.1 \times (-0.36)$

$\boxed{V_m = 0.19}$

$V_c = \beta V_c - \eta \frac{\partial E}{\partial c}$

$\qquad = 0.9 \times 0.61 - 0.1 \times (-1.82)$

$\boxed{V_c = 0.73}$

step 8: $m = m + V_m = 0.25 + 0.19 = 0.44$

$c = c + V_c = 0.95 + 0.73 = 1.68$

step 9: sample $= 2$

step 10: if $(2 > 2)$

$\qquad$ step 11 $\qquad$ else step 4

Step 4: $y = mx_i + c$

$$y = (0.44)(0.4) + 1.68$$

$$y = 1.85$$

Step 5: $E = \frac{1}{2}(3.8 - 1.8)^2$

$$= \frac{1}{2}(4^2) = 2.$$

Step 6: $\dfrac{\partial E}{\partial m} = -(3.8 - (0.44 + 0.9 \times 0.19)0.4 -$

$$1.68 - 0.9 \times 0.73)_{0.4}$$

$$= -(3.8 - 0.24 - 1.68 - 0.65)0.4$$

$$\frac{\partial E}{\partial m} = -0.49$$

$$\frac{\partial E}{\partial c} = -(3.8 - (0.44 + 0.9 \times 0.19)0.4 -$$

$$1.68 - 0.9 \times 0.73)$$

$$= -(3.8 - 0.24 - 1.68 - 0.65)$$

$$\frac{\partial E}{\partial c} = -1.23$$

Step 7: $V_m = 8V_m - \eta \dfrac{\partial E}{\partial m}$

$$= 0.9 \times 0.19 - 0.1 \times (-0.49)$$

$$\boxed{V_m = 0.22}$$

$$V_c = \gamma v_c - \eta \frac{\partial E}{\partial c}$$

$$= 0.9 \times 0.73 - 0.1 \times (-1.23)$$

$$\boxed{V_c = 0.78}$$

step 8:- $m = m + Vm = 0.44 + 0.22 = 0.66$

$$c = c + Vm = 1.68 + 0.78 = 2.46$$

$$m = 0.66, \quad c = 2.46$$

step 9:- Sample = 3

step 10:- if (3 > 2)
        step 11

step 11:- iter = 3

step 12:- if (3 > 2)
        step 13

Step 13:- m,c $m = 0.66, \quad c = 2.46$

step 14:- $MSE = \frac{1}{n_s} \sum\limits_{i=1}^{n_s} (y_i^a - y_i)^2$

Sample	x_i	y_i	y_i	MSE
1	0.2	3.4	2.59	
2	0.4	3.8	2.72	

$$MSE = \frac{1}{2} \sum\limits_{i=1}^{2} (y_i^a - y_i)^2$$

$$= \frac{1}{2}\left[(3.4 - 2.59)^2 + (3.8 - 2.72)^2\right]$$

$$MSE = 0.911$$