Assignment -6

→ Manual calculation for one iteration for first 2 samples.

→ Polynomial Regression Model

X	Y	
7.6	157	Two samples
7.1	174	
8.2	175	

Step-1 $m_1 = 1,\ m_2 = 1,\ c = -1,$ epochs $= 1,\ \eta = 0.1,$ ns $= 2$

Step-2 iter $= 1$

Step-3 sample $= 1$

Step-4

$$\frac{\partial E}{\partial m_1} = -(y_1 - m_3 x_1^3 - m_2 x_2^2 - m_1 x_1 - c) x_1$$

$$= -(157 - 7.6^3 - 7.6^2 - 7.6 + 1) 7.6$$

$$= \cancel{-(2576.2} \quad 2632.1$$

$$\frac{\partial E}{\partial m_2} = -(y_1 - m_3 x_1^3 - m_2 x_2^2 - m_1 x_1 - c) x_1^2$$

$$= -(157 - 7.6^3 - 7.6^2 - 7.6 + 1) 7.6^2$$

$$= \cancel{19519.8} \quad 20004.3$$

$$\frac{\partial E}{\partial m_3} = -(y_1 - m_3 x_1^3 - m_2 x_2^2 - m_1 x_1 - c) x_1$$

$$= -(157 - 7.6^3 - 7.6^2 - 7.6 + 1) 7.6$$

$$= \cancel{2576.2} \quad 2632.1$$

$$\frac{\partial E}{\partial c} = -(y_1 - m_3 x_1^3 - m_2 x_1^2 - m_1 x_1 - c)$$

$$= -(157 - 7.6^3 - 7.6^2 - 7.6 + 1)$$

$$= 346.3$$

step-5

$$\Delta m_1 = -\eta \frac{\partial E}{\partial m_1} = -0.1 * 2632.1 = -263.2$$

$$\Delta m_2 = -\eta \frac{\partial E}{\partial m_2} = -0.1 * 20004.3 = -2000.4$$

$$\Delta m_3 = -\eta \frac{\partial E}{\partial m_3} = -0.1 * 2632.1 = -263.2$$

$$\Delta c = -\eta \frac{\partial E}{\partial c} = -0.1 * 346.3 = -34.6$$

step-6

$$m_1 = m_1 + \Delta m_1 = 1 - 263.2 = -262.2$$

$$m_2 = m_2 + \Delta m_2 = 1 - 2000.4 = -1999.4$$

$$m_3 = m_3 + \Delta m_3 = 1 - 263.2 = -262.2$$

$$c = c + \Delta c = 1 - 34.6 = -35.6$$

step-7

sample = sample + 1 = 1 + 1 = 2

step-8

if (sample <= ns)

2 <= 2

True → step-4

Step-4

$$\frac{\partial E}{\partial m_1} = -(y_2 - m_3 x_2^3 - m_2 x_2^2 - m_2 x_2 - c) x_2$$

$$= -(174 - (-262.2) 7.1^3 - (-1999.4) 7.1^2 - (-262.2) 7.1 + 35.6) 7.1$$

$$= -1396617.2$$

$$\frac{\partial E}{\partial m_2} = -(y_2 - m_3 x_2^3 - m_2 x_2^2 - m_1 x_2 - c) x_2^2$$

$$= -(174 - (-262.2) 7.1^3 - (-1999.4) 7.1^2 - (-262.2) 7.1 + 35.6) 7.1^2$$

$$= -9915982.6$$

$$\frac{\partial E}{\partial m_3} = -(y_2 - m_3 x_2^3 - m_2 x_2^2 - m_1 x_2 - c) x_2$$

$$= -(174 - (-262.2) 7.1^3 - (-1999.4) 7.1^2 - (-262.2) 7.1 + 35.6) 7.1$$

$$= -1396617.2$$

$$\frac{\partial E}{\partial c} = -(y_2 - m_3 x_2^3 - m_2 x_2^2 - m_1 x_2 - c)$$

$$= -(174 - (-262.2) 7.1^3 - (-1999.4) 7.1^2 - (-262.2) 7.1 + 35.6)$$

$$= -196706.6$$

step-5

~~$\Delta m_1 = m_1 + +$~~

$\Delta m_1 = -\eta \frac{\partial E}{\partial m_1} = -0.1 * -1396617.2 = 139661.7$

$\Delta m_2 = -\eta \frac{\partial E}{\partial m_2} = -0.1 * -9915982.6 = 991598.2$

$\Delta m_3 = -\eta \frac{\partial E}{\partial m_3} = -0.1 * -1396617.2 = 139661.7$

$\Delta C = -\eta \frac{\partial E}{\partial C} = -0.1 * -196706.2 = 19670.6$

step-6

$m_1 = m_1 + \Delta m_1 = -262.2 + 139661.7 = 139399.5$

$m_2 = m_2 + \Delta m_2 = -1999.4 + 991598.2 = 989598.8$

$m_3 = m_3 + \Delta m_3 = -262.2 + 139661.7 = 139399.5$

$C = C + \Delta C = -35.6 + 19670.6 = 19635$

step-7

sample = sample + 1 = 2 + 1 = 3

step-8

1396607.1

if(sample $\leq$ ns)

$3 \leq 2$

false → next step

step-9

iter = iter + 1 = 1 + 1 = 2

step-10

if(iter $\leq$ epochs)

$2 \leq 1$

false → next step

Step - 4

Print m_1, m_2, c

Calculate Error Metrics.