Assignment - 6

Polynomial Regression (Manual calculation)

Data :-

X	Y
7.6	157
7.1	174

Eqn :- $y = m_2 x^2 + m_1 x + c$ (degree 2)

step ① :- Initialize - $m_1 = 1$, $m_2 = 1$, $c = -1$, epochs = 1,
$\eta = 0.1$, $ns = 2$

step ② :- Iter = 1

step ③ :- sample = 1

step ④ :- $\frac{\partial E}{\partial m_1} = -(y - m_2 x^2 - m_1 x - c)(x)$

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

$= -(92.64)(7.6)$

$= -704.064$

$\frac{\partial E}{\partial m_2} = -(y - m_2 x^2 - m_1 x - c)(x^2)$

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

$= -(92.64)(7.6)^2 = -5350.8$

$\frac{\partial E}{\partial c} = -(y - m_2 x^2 - m_1 x - c)$

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

$= -92.64$

step ⑤ :-

$\Delta m_1 = -\eta\left(\frac{\partial E}{\partial m_1}\right) = -(0.1)(704.064)$

$= 70.4$

$$\Delta m_2 = -\eta\left(\frac{\partial E}{\partial m_2}\right) = -(0.1)(-53050.8)$$

$$= 535.08$$

$$\Delta C = -\eta\left(\frac{\partial E}{\partial C}\right) = -(0.1)(-92.64)$$

$$= 9.26$$

Step (6) :-

$$m_1 = m_1 + \Delta m_1 = 1 + 70.4 = 71.4$$

$$m_2 = m_2 + \Delta m_2 = 535.08 + 1 = 536.08$$

$$C = C + \Delta C = -1 + 9.26 = 8.26$$

Step (7) :-

sample += 1 (sample = 2)

Step (8) :-

if (sample <= ns)

↳ True

go to Step (4)

Step (4) :-

$$\frac{\partial E}{\partial m_1} = -(y - m_2x^2 - m_1x - c)x$$

$$= -(174 - 71.4)(7.1) - (536.08)(7.1)^2$$

$$- 8.26)(7.1)$$

$$= -(-27364.9)(7.1) = 194290.7$$

$$\frac{\partial E}{\partial m_2} = -(y - m_2x^2 - m_1x - c)(x^2)$$

$$= -(174 + 71.4)(7.1) - (536.08)(7.1)^2$$

$$- 8.26)(7.1)^2$$

$$= (27364.9)(7.1)^2$$

$$= 1379464.6$$

$$\frac{\partial E}{\partial c} = -(y - m_2x^2 - m_1x - c)$$

$$= -(-27364.9)$$

$$= 27364.9$$

Step (5) :-

$$\Delta m_1 = -\eta\left(\frac{\partial E}{\partial m_1}\right) = -(0.1)(194290.7)$$

$$= -19429$$

$$\Delta m_2 = -\eta\left(\frac{\partial E}{\partial m_2}\right) = -(0.1)(1379464.6)$$

$$= 137946.4$$

$$\Delta C = -\eta\left(\frac{\partial E}{\partial C}\right) = -(0.1)(+27364.9)$$

$$= 2736.4$$

Step (6) :-

$$m_1 = m_1 + \Delta m_1 = 71.4 - 19429 = -19357.6$$

$$m_2 = m_2 + \Delta m_2 = 536.08 - 137946.4$$

$$= -137410.32$$

$$c = c + \Delta C = 8.26 + 2736.4 = 2744.6$$

Step (7) :-

sample += 1 (sample = 3)

Step (8) :- 3 <= 2

if (sample <= ns)

↳ False

go to next step.

Step (9) :-

iter += 1 (iter = 2)

Step (10) :- 2 <= 1

if (iter <= epochs)

↳ false (go to next step)

Step (11) :-

print model parameters, training errors, testing errors.

Step (12) :-

Deployment.