Assignment-6

Polynomial Regression model:

X	Y
7.6	157
7.1	174

Step 1: Read dataset, $\eta = 0.1$, epochs = 1, $m_1 = 1, m_2 = 1, c = -1$

Step 2: iter = 1

Step 3: sample $i = 1$

Step 4: $y_p^i = m_2 (x_i)^2 + m_1 x_i + c$

$y_p^i = (1)(7.6)^2 + (1)(7.6) - 1 = 64.36$

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

$= \frac{1}{2}(157 - 64.36)^2$

$E = 4291.08$

Step 6: $\frac{\partial E}{\partial m_1} = -\left[y_i - m_2 x_i^2 - m_1 x_i - c\right] x_i$

$= -\left[157 - (1)(7.6)^2 - (1)(7.6) + 1\right](7.6)$

$\frac{\partial E}{\partial m_1} = -704.06$

$\frac{\partial E}{\partial m_2} = -\left[y_i - m_2 x_i^2 - m_1 x_i - c\right] x_i^2$

$= -\left[157 - (1)(7.6)^2 - (1)(7.6) + 1\right](7.6)^2$

$\frac{\partial E}{\partial m_2} = -5350.88$

$\frac{\partial E}{\partial c} = -\left[y_i - m_2 x_i^2 - m_1 x_i - c\right]$

$= -\left[157 - (1)(7.6)^2 - (1)(7.6) + 1\right]$

$\frac{\partial E}{\partial c} = -92.64$

step 7: $\Delta m_1 = -\eta \frac{\partial E}{\partial m_1} = -(0.1)(-704.06) = 70.4$

$\Delta m_2 = -\eta \frac{\partial E}{\partial m_2} = -(0.1)(-5350.88) = 535.08$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-92.64) = 9.26$

step 8: $m_1 = m_1 + \Delta m_1 = 1 + 70.4 = 71.4$

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

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

step 9: Sample $\Rightarrow i = i+1 = 1+1 = 2$ & $i \leq n_s$ T $\rightarrow$ step ④
$2 \quad 2$

Step 4: $y_p^i = m_2 (x_i)^2 + m_1 x_i + c$

$= (536.08)(7.1)^2 + (71.4)(7.1) + 8.26$

$= 27023.79 + 506.94 + 8.26$

$y_p^i = 27538.99$

step 5: $E = \frac{1}{2}(y_i - y_i^p)^2 = \frac{1}{2}(174 - 27538.99)^2$

$E = 374421338.9$

step 6: $\frac{\partial E}{\partial m_1} = -[y_i - m_2 x_i^2 - m_1 x_i - c] x_i$

$= -[174 - (536.08)(7.1)^2 - (71.4)(7.1) - 8.26](7.1)$

$= -(174 - 27023.79 - 506.94 - 8.26)(7.1)$

$= -(-27364.99)(7.1)$

$\frac{\partial E}{\partial m_1} = 194291.429$

$\frac{\partial E}{\partial m_2} = -[y_i - m_2 x_i^2 - m_1 x_i - c] x_i^2$

$= -(-27364.99)(7.1)^2$

$\frac{\partial E}{\partial m_2} = 1379469.14$

$\frac{\partial E}{\partial c} = -[y_i - m_2 x_i^2 - m_1 x_i - c]$

$= -(-27364.99)$

$\frac{\partial E}{\partial c} = 27364.99$

Step 7: $\Delta m_1 = -\eta \frac{\partial E}{\partial m_1} = -(0.1)(194291.429) = -19429.14$

$\Delta m_2 = -\eta \frac{\partial E}{\partial m_2} = -(0.1)(1379469.14) = -137946.91$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(27364.99) = -2736.49$

Step 8: $m_1 = m_1 + \Delta m_1 = 71.4 - 19429.14 = -19357.74$

$m_2 = m_2 + \Delta m_2 = 536.08 - 137946.91 = -137410.83$

$c = c + \Delta c = 8.26 - 2736.49 = -2728.23$

Step 9: sample $i = i+1 = 2+1 = 3$ & $i \leq n_s$ (3, 2) F → next step

Step 10: iter = iter + 1 = 1 + 1 = 2, iter > epochs (2, 1) T → next step

Step 11: End / stop.