20K45A0405

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

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

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

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

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

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

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

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

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

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:- $m_1 = m_1 + \Delta m_1 \Rightarrow 1 + 70.4 \Rightarrow 71.4$

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

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

Step-9:- Sample $\Rightarrow i = i+1$

$= 1+1 \Rightarrow 2$ & $i \leq ns$ T → 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:- $E = \frac{1}{2} [y_i - y_i^p]^2$

$= \frac{1}{2} [174 - 27538.99]^2$

$= 374421338.9$

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)

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

$= -[-27364.99](7.1)$

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

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

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

$\therefore \frac{\partial E}{\partial m_2} = 13794469.14$

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

$$= -(-27364.99)$$

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

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:- $m_1 = m_1 + \Delta m_1 = 71.4 - 19429.14$

$$\Rightarrow -19357.14$$

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

$$\Rightarrow -137410.83$$

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

$$= -2728.23$$

step - 9:- sample $i = i+1 \Rightarrow 2+1 \Rightarrow 3$ & $i \leq ns$ F → next step
3 2

step-10:- iter = iter + 1 => 1+1 = 2 iter > epochs T -> next step
2 1

step-11:- End / stop