Assignment 6 - Manual calculations

Polynomial regression

Data:

x	y
7.6	157
7.1	174

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

Step ①: Intialize → $m_1 = 1$, $m_2 = 1$, $c = -1$, epochs = 1, $\eta = 0.1$, $n_s = 2$.

Step ②: Iter = 1.

Step ③: sample = 1

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

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

$$= -(92.64)(7.6)$$

$$= -704.064$$

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

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

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

$$= -5350.8$$

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

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

$$= -92.64.$$

step ⑤: $\Delta m_1 = -\eta \left(\dfrac{\partial E}{\partial m_1}\right)$

$= -(0.1)(704.064)$

$= +70.4$

$\Delta m_2 = -\eta \left(\dfrac{\partial E}{\partial m_2}\right)$

$= -(0.1)(-5350.8)$

$= 535.08$

$\Delta c = -\eta \left(\dfrac{\partial E}{\partial c}\right)$

$= -(0.1)(-92.64)$

$= 9.26$

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 (sample² <=² ns)

⤷ True

go to step ④.

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

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

$= -(-7239.7)(7.1)$ $\qquad -8.26)(7.1)$

$= 51401.8$

$= +(+27364.9)\,7.1 = 194290.7$

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

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

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

$$= 1379464.6$$

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

$$= +(27364.9)$$

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 : if (sample <= ns)
$$3 <= 2$$
↳ False
go to next step.

Step ⑨ : iter + = 1 (iter = 2)

Step ⑩ : if (iter <= epochs)
$$2 <= 1$$
↳ False (go to next step)

Step ⑪ : print model parameters, training errors, testing errors.

Step ⑫ : Deployment.