Assignment -5 (Manual calculation) 19K41F05B1

Multiple Linear Regression

Data:-

x_1	x_2	x_3	y
5551.82	4983.17	4888.4	5072.96
4983.17	4888.4	5072.96	5196.26

eqn:- $y = m_1x_1 + m_2x_2 + m_3x_3 + c$

Step ①:- Initialize — $m_1=1, m_2=1, m_3=1, c=-1,$

$\eta = 0.1$, epochs $=1$, ns $= 2$

Step ②:- iter $= 1$

Step ③:- sample $= 1$

Step ④:- $\frac{\partial E}{\partial m_1} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)x_1$

$= -(5072.96 - 5551.8 - 4983.1 - 4888.4)$

(5551.8)

$= -(10350.4)(5551.8)$

$= -57463350.72$

$\frac{\partial E}{\partial m_2} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)x_2$

$= -(10350.4)(4983.1)$

$= -51577078.24$

$\frac{\partial E}{\partial m_3} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)x_3$

$= -(10350.4)(4888.4)$

$= -50596895.36$

$\frac{\partial E}{\partial c} = -10350.4$

Step ⑤ :-

$$\Delta m_1 = -\eta\left(\frac{\partial E}{\partial m_1}\right) = -(0.1)(-57463350.72)$$
$$= 5746335$$

$$\Delta m_2 = -\eta\left(\frac{\partial E}{\partial m_2}\right) = -(0.1)(-51577078.24)$$
$$= 51577078.24$$

$$\Delta c = -\eta\left(\frac{\partial E}{\partial c}\right) = -(0.1)(-10350.4)$$
$$= 1035$$

$$\Delta m_3 = -\eta\left(\frac{\partial E}{\partial m_3}\right) = -(0.1)(-50596895.36)$$
$$= 5059689.536$$

Step ⑥ :-

$$m_1 = m_1 + \Delta m_1$$
$$= 1 + 5746335 = 5746336$$

$$m_2 = m_2 + \Delta m_2$$
$$= 1 + 51577078.8 = 51577078.8$$

$$m_3 = m_3 + \Delta m_3$$
$$= 1 + 5059689.5 = 5059690$$

$$c = c + \Delta c$$
$$= -1 + 1035 = 1034$$

Step ⑦ :-

Sample = Sample + 1 = 2

Step ⑧ :-

2 <= 2

if (sample <= ns)

↳ true

go to step ④

Step (4):-

$$\frac{\partial E}{\partial m_1} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)x_1$$

$$= -(5196.26 - (5746336)(4983.17)$$

$$-(5157708.8)(4888.4) - (5059689.5)$$

$$(5072.9) - 1034)(4983.1)$$

$$=$$

$$\frac{\partial E}{\partial m_2} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)x_3$$

$$= -(5196.26 - (5746336)(4983.17) - (5157708.8)$$

$$(4888.4) - (5059689.5)(5072.96) - 1034)$$

$$(4888.4)$$

$$=$$

$$\frac{\partial E}{\partial m_3} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)x_3$$

$$= -(5196.26 - (5746336)(4983.17) - (5157708.8)$$

$$(4888.4) - (5059689.5)(5072.96) - 1034)(5072.9)$$

$$=$$

$$\frac{\partial E}{\partial c} = -(y - m_1x_1 - m_2x_2 - m_3x_3 - c)$$

$$= -(5196.26 - (5746336)(4983.17) - (5157708.8)$$

$$(4888.4) - (5059689.5)(5072.96) - 1034)$$

$$=$$

step (5) :-

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

=

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

=

$$\Delta m_3 = -\eta \left(\frac{\partial E}{\partial m_3}\right) = -(0.1)\left(\frac{\partial E}{\partial m_3}\right)$$

=

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

=

step (6) :-

$m_1 = m_1 + \Delta m_1 =$

$m_2 = m_2 + \Delta m_2 =$

$m_3 = m_3 + \Delta m_3 =$

$c = c + \Delta c =$

step (7) :- sample = sample + 1 = 3

step (8) :- if (sample $\overset{3}{<=}$ $\overset{2}{ns}$)

↳ false

go to step (9)

step (9) :- iter = iter + 1 = 1 + 1 = 2

step (10) :- if (iter $\overset{2}{<=}$ epochs)

↳ false

go to ~~next~~ step

step (11) :- print model parameters, ~~training~~ errors, testing errors.