Assignment 5 - Manual calculation

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: $y = m_1 x_1 + m_2 x_2 + m_3 x_3 + c$.

Step ①: Intialize - $m_1 = 1, m_2 = 1, m_3 = 1, c = -1, \eta = 0.1$,
epochs $= 1$, $ns = 2$

Step ②: iter $= 1$

Step ③: Sample $= 1$

Step ④: $\dfrac{\partial E}{\partial m_1} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c) x_1$

$= -(5072.98 - 5551.8 - 4983.1 - 4888.4)$
$\qquad\qquad\qquad\qquad\qquad (5551.8)$

$= -(10350.4)(5551.8)$

$= -57463350.72$

$\dfrac{\partial E}{\partial m_2} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c) x_2$

$= -(10350.4)(4983.1)$

$= -51577078.24$

$\dfrac{\partial E}{\partial m_3} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c) x_3$

$= -(10350.4)(4888.4)$

$= -50596895.36$

Step ⑤: $\dfrac{\partial E}{\partial c} = -10350.4$

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

$\Delta m_2 = -\eta \left(\dfrac{\partial E}{\partial m_2}\right) = -(0.1)(-51577078.24) = 5157707.8$

$$\Delta m_3^c = -\eta \left(\frac{\partial E}{\partial m_3}\right)_c = -(0.1)(-10850.4)$$

$$= 1035$$

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

$$= 5059689.5$$

step ⑥ $m_1 = m_1 + \Delta m_1$

$$= 1 + 5746335 = 5746336.$$

$m_2 = m_2 + \Delta m_2$

$$= 1 + 5157707.8 = 5157708.8$$

$m_3 = m_3 + \Delta m_3$

$$= 1 + 5059689.5 = 5059690.$$

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

Step ⑦: Sample = Sample + 1

$$= 2$$

step ⑧: if (sample $\leq ns$)

↳ True

go to step ④

Step ④: $\dfrac{\partial E}{\partial m_1} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c) x_1$

$$= -(5072.9 - (5746336)(4983.17) -$$
$$5196.26$$

$$(5157708.8)(4888.4) - (5059689.5)$$
$$(5072.9) - 1034)(5551.8)(4983.1)$$

$$=$$

$\dfrac{\partial E}{\partial m_2} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c) x_2$

$$= -(5196.26 - (5746336)(4983.17) - (5157708.$$
$$(4888.4) - (5059689.5)(5072.96) - 1034)$$
$$(4888.4)$$

$$=$$

$$\frac{\partial E}{\partial m_3} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c)\, x_3$$

$$= -(5196 \cdot 26 - (5 \cdot 746336)(4983 \cdot 17) -$$
$$(5157708.8)(4888.4) - (5059689.5)(5072.9)$$
$$- 1034)(5072 \cdot 9)$$

$$=.$$

$$\frac{\partial E}{\partial c} = -(y - m_1 x_1 - m_2 x_2 - m_3 x_3 - c)$$

$$= -(5196.2 - (5746336)(4983.17) - (5157708\!-\!$$
$$(4888.4) - (5059689.5)(5072.9) - 1034)$$

$$=$$

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 $\langle = \rangle$ ns) $3 < = 2$
$$\hookrightarrow False$$
$$go \ to \ step \ ⑨.$$

Step ⑨: iter = iter + 1
$$= 1 + 1 = 2.$$

Step ⑩: if (iter^2 <= epochs)
$$\hookrightarrow \text{false}$$
$$\text{goto next step.}$$

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