Assignment 5:

Manual calculations

Mini Batch Gradient Descent:

x	y
0.2	3.4
0.4	3.8
0.6	4.2
0.8	4.6

Step 1: read dataset (x, y), $\eta = 0.1$, $m = 1$, $c = -1$

epochs = 2, batch-size = 2

step 2: splitting data into batches

Step 3: iter = 1

step 4: batch = 1

step 5: calculate gradient descents

$$\frac{\partial \epsilon}{\partial m} = -\frac{1}{2}\left[(3.4 - (1))(0.2) - (-1)(0.2) + (4.6 - (1))(0.8 - (-1)(0.8)\right]$$

$$= -\frac{1}{2}\left[(4.2)(0.2) + (4.8)(0.8)\right] = -\frac{1}{2}\left[4.68\right]$$

$$= -2.34$$

$$\frac{\partial \epsilon}{\partial c} = -\frac{1}{2}\left[4.2 + 4.8\right] = -\frac{9.0}{2} = -4.5$$

step 6: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = 0.234$, $\Delta c = 0.45$

step 7: $m = m + \Delta m \Rightarrow 1 + 0.234 = 1.234$

$$c = c + \Delta c = -1 + 0.45 = -0.55$$

Step 8: batch = batch + 1 = 1 + 1 = 2

step 9: if batch > no of batch 2 > 2 = false
then go to step 5

step 5: $\frac{\partial \epsilon}{\partial m} = -\frac{1}{nb} \sum_{i=x}^{nb} (y_i - mx_i - c) x_i$

$= -\frac{1}{2} \times [3.8564 \times 0.4 + 4.00961 \times 0.8]$

$= -1.97416$

$\frac{\partial \epsilon}{\partial c} = -\frac{1}{2} [3.8564 + 4.0096] = -3.933$

step 6: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = 0.197416$ $\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = 0.39633$

step 7: $m = 1.234 + 0.197416 = 1.4314$

$c = -0.55 + 0.3933 = -0.1567$

step 8: batch = batch + 1 = 2 + 1 = 3

step 9: if batch > nb ⇒ 3 > 2 then go to step 10

step 10: iter = iter + 1 = 1 + 1 = 2

step 11: if iter > epoch 2 > 2 ⇒ false
go to step 4

step 4: batch = 1

step 5: $\frac{\partial \epsilon}{\partial m} = -\frac{1}{2} [(3.4 - (1.4314)(0.2) + 0.1567 \times 0.2 + (4.6 - (1.4314)(0.8) + 0.1567 \times 0.8]$

$= -1.77167$

$\frac{\partial \epsilon}{\partial c} = -\frac{1}{2} [3.27062 + 3.61155] = -3.441$

step 6: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = 0.177167$

$\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = 0.3441$

step 7: $m = m + \Delta m = 1.4314 + 0.177167 = 1.60856$

$c = c + \Delta c = -0.1567 + 0.3441 = 0.1874$

step 9 : if batch > n_b = 2 > 2 ⇒ false

go to step 5

step 5: $\frac{\partial E}{\partial m} = -\frac{1}{2}[(3.8-(1.6085)(0.04)-0.1874)(0.04)+(4.2-(1.6085)(0.6-(0.1874)(0.6))]$

$= -\frac{1}{2}[1.0187668+2.0828478] = -1.550807$

$\frac{\partial E}{\partial C} = -\frac{1}{2}[6.01663] = -3.008331$

step 6: $\Delta m = 0.150807$, $\Delta C = 0.300831$

step 7: $m = 1.60856 + 0.150807 = 1.759067$

$C = 0.1874 + 0.300831 = 0.488231$

step 8: batch = 2 + 1 = 3

step 9: if batch > n_b = 3 > 2 go to step 10

step 10: iter = iter + 1 = 2 + 1 = 3

step 11: if iter > epoch ⇒ 3 > 2 = go to step 12

step 12: print(m, C) ⇒ 1.759067, 0.488231

step 13: mean square error

$$= \frac{(3.4-0.84004)+(3.8-1.19185)+(4.2-1.54)+(4.6-1.89548)}{4}$$

mse = 2.063224.