Assignment 7:

Manual calculations

Batch Gradient Descent

step 1: Read Dataset (x, y), epochs = 2

m = 1, c = 1, η = 0.1 ns = 2

x	y
0.2	3.4
0.4	3.8

step 2: iter = 1

step 3: $\epsilon = \frac{1}{2ns} \sum (y_i - mx_i - c)^2$

$$\frac{\partial \epsilon}{\partial m} = -\frac{1}{ns}\left[\sum_{i=1}^{ns} (y_i - mx_i - c)(x_i)\right]$$

$$= -\frac{1}{2}\left[(3.4 - (1)(0.2) + 1)(0.2) + (3.8 - (1)(0.4) + 1)(0.4)\right]$$

$$= -1.3$$

$$\frac{\partial \epsilon}{\partial c} = \frac{-1}{ns}\left[\sum_{i=1}^{ns} (y_i - mx_i - c)\right] = -\frac{1}{2}\left[4.2 + 4.4\right] = -\frac{1}{2}[8.6]$$

$$= -4.3$$

step 4: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = -(0.1) \times (-1.3) = 0.13$

$\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = -(0.1) \times (-4.3) = 0.43$

step 5: $m = 1 + 0.13 = 1.13$

$c = -1 + 0.43 = -0.57$

step 6: iter = iter + 1 = 1 + 1 = 2

step 7: if $2 > 2 \Rightarrow$ false

Go to step 3

step 3: $\frac{\partial \epsilon}{\partial m} = -\frac{1}{ns}\left[\sum_{i=1}^{ns} (y_i - mx_i - c)\, x_i\right]$

$$= -\frac{1}{2}\left[((3.4 - (1.13 \times 0.2) + 0.57) \times 0.2) + ((3.8 - (1.13 \times 0.4) + 0.57) \times 0.4)\right]$$

$$= -2.4333$$

$$\frac{\partial \epsilon}{\partial c} = -\frac{1}{2}\left[3.744 + 3.9128\right] = -3.8284$$

step 4: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = -(0.1) * (-2.4333) = 0.24333$

$\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = -(0.1) * (-3.831) = 0.3831$

step 5: $m = m + \Delta m = 1.13 + 0.24333 = 1.37333$

$c = c + \Delta c = -0.57 + 0.3831 = -0.1869$

step 6: iter = iter + 1 = 2 + 1 = 3

step 7: if iter > epoch ⇒ 3 > 2 ⇒ go to step 8

step 8: print(m, c) = (1.37333, -0.1869)

step 9: mse of ~~data~~

$$mse = \frac{[3.4 - (1.3 + 333 \times 0.2) + 0.1869]^2 - [3.8 - (1.373 \times 0.04) + 0.1869]^2}{2}$$

$$= 11.39388$$