Assignment: 7 Manual calculations

Batch Gradient Descent

STEP-1: Read Dataset [x,y], epochs = 2, ~~iters 1~~,

$m = 1, c = -1, \eta = 0.1, n_s = 2$.

x	y
0.2	3.4
0.4	3.8

STEP-2: iter = 1

STEP-3:

$$E = \frac{1}{2 n_s} \Sigma \left(y_i - m x_i - c\right)^2$$

$$\frac{\delta E}{\delta m} = -\frac{1}{n_s} \left[\sum_{i=1}^{n_s} (y_i - m x_i - c)(x_i) \right]$$

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

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

$$= -\frac{1}{2} \left[(4.2)(0.2) + (4.4)(0.4) \right] = -\frac{1}{2} \left[0.84 + 1.76 \right]$$

$$= -1.3$$

$$\frac{\delta E}{\delta c} = -\frac{1}{n_s} \left[\sum_{i=1}^{n_s} (y_i - m x_i - c) \right] = -\frac{1}{2} \left[4.2 + 4.4 \right] = -\frac{1}{2} \left[8.6 \right]$$

$$= -4.3$$

STEP-4: $\Delta m = -\eta \frac{\delta E}{\delta m} = -(0.1) \times (-1.3) = 0.13$

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

1

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.

Goto step 3.

STEP-8: $\dfrac{\partial E}{\partial m} = -\dfrac{1}{n_s}\left[\sum_{i=1}^{n_s}(y_i - mx_i - c)x_i\right]$

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

$= -\dfrac{1}{2}\left[(3.744)\times(0.2) + (3.918)\times 0.4\right]$

$= -\dfrac{1}{2}\left[3.2994 + 1.5672\right] = -2.4333$

$\dfrac{\partial E}{\partial c} = -\dfrac{1}{2}\left[3.744 + 3.918\right] = -3.831$

STEP-9: $\Delta m = -\eta\dfrac{\partial E}{\partial m} = -(0.1)\times(-2.4333) = 0.24333$

$\Delta c = -\eta\dfrac{\partial E}{\partial c} = -(0.1)\times(-3.831) = 0.3831$

STEP-10: $m = m + \Delta m = 1.13 + 0.24333 = 1.37333$

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

STEP-11: $iter = iter + 1 = 2 + 1 = 3$

STEP-12: if $iter > epoch \Rightarrow 3 > 2 \Rightarrow$ goto step 13.

STEP-13: Point (m, c)

$$= (1.37333, -0.1869)$$

step-14: mse of data.

$$mse = \frac{[3.4 - (1.37333 \times 0.2) + 0.1869]^2 + [3.8 - (1.37.333 \times 0.4) + 0.1869]^2}{2}$$

$$= \frac{[10.97089] + [11.81687]}{2}$$

$$= 11.39388$$

STEP-13: Point (m, c)

$$= (1.37333, -0.1869)$$