Assignment 3: Manual calculations

Step 1: [x, y], epochs = 2, $\eta = 0.1$, m, c = 1

Step 2: iter = 1

Step 3: sample = 1

Step 4: error $\epsilon = \frac{1}{2}[3.4 - (1 \times 0.2 - 1)]^2 = 0.5 \times (3.4 + 0.8)^2 = 8.82$

$$\frac{\partial \epsilon}{\partial m} = -(y_i - mx_i - c)x_i = (3.4 - (1)(0.2) - (-1))(0.2)$$

$$= -(3.4 - 0.2)0.2 = (4.2)(0.2) = -0.84$$

$$\frac{\partial \epsilon}{\partial c} = -(y_i - mx_i - c) = -4.2$$

Step 5: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = (-0.1)(-0.84) = 0.084$

$$\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = -(0.1)(-4.2) = +0.42$$

Step 6: $m = m + \Delta m = 1 + 0.084 = 1.084$

$$c = c + \Delta c = -1 + 0.42 = -0.58$$

Step 7: sample = sample + 1 = 1 + 1 = 2

Step 8: sample < total no of sample = True

go to step 4

Step 4: $y = (1.084)(0.4) - 0.58 = -0.1464$

$$\epsilon = (0.5)(3.8 + 0.1464)^2 = 7.79$$

$$\frac{\partial \epsilon}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58)\,0.4 = -1.58$$

$$\frac{\partial \epsilon}{\partial c} = -(y_i - mx_i - c) = -3.94$$

Step 5: $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-1.58) = 0.158$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-3.94) = 0.394$

Step 6: $m = m + \Delta m = -(0.1)(-1.58) - 0.158$

$c = c + \Delta c = -0.58 + 0.394 = -0.186$

Step 7: Sample = 2+1 = 3

Step 8: sample = 3 > no of samples go to next step

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

Step 10: iter < epochs go to step 3

Step 3: sample = 1

Step 4: $y = (1.242)(0.2) + (-0.186) = 0.0624$

$E = \frac{1}{2}(3.4 - 0.0624) = 1.6888$

$\frac{\partial E}{\partial m} = -(3.4 - 0.0624)0.2 = -0.66752$

$\frac{\partial E}{\partial c} = -3.3376$

Step 5: $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-0.66752) = 0.066752$

$\Delta c = -(0.1)(-3.3376) = 0.3376$

Step 6: $m = m + \Delta m = 1.242 + 0.66752 = 1.90952$

$c = c + \Delta c = -0.186 + 0.3376 = 0.14776$

Step 7: Sample = 1+1 = 2

Step 8: sample < no of samples go to step 4

Step 4: $\frac{\partial E}{\partial m} = (3.8 - (1.90952 \times 0.4) - 0.14776 \times 0.4)$

$= -1.155312$

$\frac{\partial \epsilon}{\partial c} = -2.888432$

Step 6 :- $\Delta m = -\eta\left(\frac{\partial \epsilon}{\partial m}\right) = 0.1156372$

$\Delta c = 0.288$

step 6 :- $m = m + \Delta m = 2.028057$

$c = c + \Delta c = 0.4366032$

step 7 : sample $2+1 = 3$

step 8 : sample > no of samples go to step 9

step 9 : iter = iter + 1 - 2 + 1 = 3

step 10 : iter > epoch go to step 11

step 11 :- print(m, c)

→ $m = 2.028057$

$c = 0.4366032$

step 12 :- mean square error

$= \frac{(3.4 - 0.841614) + (38 - 1.046626)}{2}$

$MSE = 2.556063$