Assignment-1

① Read dataset $\{x_i^q, y_i^q\}$ $\eta_s = 2$

$x_1^q = 7.6$	$y_1^q = 157$
$x_i^q = 7.1$	$y_i^q = 174$

initializing $\eta = 0.1$ epochs = 1

$m = 1$ $c = -1$ randomly

② set iteration = 1

③ set sample $i = 1$

④ calculate y using slope eqn

$$y = m x_i^q + c \quad \text{---(2)}$$

$$y_1 = 1(7.6) - 1 = 7.6 - 1 = 6.6$$

⑤ calculate error (objective function)

$$E = \frac{1}{2}(y_i^q - m x_i^q + c)^2$$

$$= \frac{1}{2}(157 - 1(7.6) - 1)^2$$

$$= \frac{1}{2}(22022.56) = 11011.28$$

⑥ calculate gradients of error using

$$\frac{dE}{dm} = -(y_i^q - m x_i^q - c) x_i^q$$

$$= -(157 - 1(7.6) - 1) 7.6$$

$$= -1127.84$$

$$\frac{dE}{dc} = -(y_i^q - m x_i^q - c)$$

$$= -148.4$$

(7) calculate step lengths Δm and Δc

$$\Delta m = -\eta \frac{dE}{dm} = -0.1(-1127.84) = 112.784$$

$$\Delta c = -\eta \frac{dE}{dc} = 14.84$$

(8) update m and c

$$m = m + \Delta m = 1 + 112.78 = 113.78$$

$$c = c + \Delta c = -1 + 14.84 = 13.84$$

(9) sample $i = i+1 = 2$

$i < n_1 = 2 < 2$ false goto the step 4

(4) $y = mx_i^q + c = 113.78(7.1) + 13.84$

$$y_2 = 821.678$$

(5) calculate Error

$$E = \frac{1}{2}[174 - (113.78)(7.1) + 13.84]^2$$

$$E = -309.999$$

(6) calculate gradient of error

$$\frac{dE}{dm} = -(y_i^q - mx_i^q - c)x_i^q$$

$$= -(174 - 113.78(7.1) - 13.84)7.1$$

$$\frac{dE}{dm} = 4598.5122$$

$$\frac{dE}{dc} = -(y_i^q - mx_i^q - c) = -(174 - 113.78(7.1) - 13.84)$$

$$= 647.678.$$

(7) Calculate step length

$\Delta m = -\eta \frac{df}{dm} = -0.1(4598.512)$

$= -459.8512$

$\Delta c = -\eta \frac{df}{dc} = -0.1(647.6768)$

$= -64.7676$

(8) Update m and c

$m = m + \Delta m = 113.72 - 459.85$

$= -346.07$

$c = c + \Delta c = 13.84 - 64.769$

$= -50.929$

(9) $i = i + 1 = 2 + 1 = 3$

if $(i < n_s) = 3 < 2 \rightarrow$ True $\rightarrow$ go to next step

(10) iteration = iteration $+ 1 = 1 + 1 = 2$,

if (iteration > epochs)

$(2 > 1) \rightarrow$ True - goto next step

(11) Calculate error $MSE = \frac{1}{n_s} \sum_{i=1}^{n_s} (y_i^p - y_i)^2$

$= \frac{1}{2} \sum_{i=1}^{2} (y_i^p - y_i)^2$

$= \frac{1}{2}(y_1^p - y_1)^2 + \frac{1}{2}(y_2^p - y_2)^2$

$= \frac{1}{2}(157 - 6.6)^2 + \frac{1}{2}(174 - 821.67)^2$

$MSE = 221048.294$

$RMSE = \sqrt{221048.29} = 470.157$

$MAE = \frac{221048.29 + 470.157}{2} = 110759.22$