Assignment - 7

Sample (i)	x_i^a	y_i^a
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

Q. Do manual calculations for two iterations with first 2 samples using BGD

Step.1: Read dataset, $\eta = 0.1$, epochs = 2, m = 1, c = -1

Step.2: set iter = 1

Step.3: $\frac{\partial f}{\partial m}$ $y_i = mx_i + c$

$y_1 = 1(0.2) - 1$
$= -0.8$

$y_2 = 1(0.4) - 1$
$= -0.6$

Step.4: $e = \frac{1}{2n_s} \sum_{i=1}^{n_s} (y_i^a - y_i)^2$

n_s = total no. of samples in dataset

$$e = \frac{1}{2(2)}\left((3.4 - (-0.8))^2 + (3.8 - (-0.6))^2\right)$$

$$= \frac{(4.2)^2 + (4.4)^2}{4}$$

$$= 9.25$$

Step 5: $$\frac{\partial e}{\partial m} = \frac{\sum_{i=1}^{n_s} (y_i - mx_i - c)(-x)}{n_s}$$

$$= \frac{(4.2)(-0.2) + (4.4)(-0.4)}{2}$$

$$= -1.3$$

$$\frac{\partial e}{\partial c} = \frac{\sum_{i=1}^{n_s} (y_i - mx_i - c)(-1)}{n_s}$$

$$= -\frac{8.6}{2}$$

$$= -4.3$$

Step.6: $\Delta m = (-0.1)(-1.3)$

$= 0.13$

$\Delta c = (-0.1)(-4.3)$

$= 0.43$

Step.7: $m = m + \Delta m$

$= 1 + 0.13$

$= 1.13$

$c = -1 + \Delta c$

$= -1 + 0.43$

$= -0.57$

Step.8: iter = iter + 1 = 2 > epochs ⇒ false

Step.9: $y_i = mx_i + c$

$y_1 = 1.13(0.2) - 0.57$

$= -0.344$

$y_2 = 1.13(0.4) - 0.57$

$= -0.118$

Step.10: $e = \frac{1}{2n_s}\sum(y_i^a - y_i)^2$

$= \frac{1}{4}\left((3.4-(-0.344))^2 + (3.8-(-0.118))^2\right)$

$= \frac{1}{4}\left(3.744^2 + 3.918^2\right)$

$= 7.342065$

Step.11: $\frac{\partial e}{\partial m} = \frac{(3.744)(-0.2) + (3.918)(-0.4)}{2}$

$= -1.158$

$\frac{\partial e}{\partial c} = \frac{-3.744 - 3.918}{2}$

$= -3.831$

Step.12: $\Delta m = (-0.1)(-1.158)$

$= 0.1158$

$\Delta c = (-0.1)(-3.831)$

$= 0.3831$

Step : 13 : $m = m + \Delta m$

$= 1.13 + 0.1158$

$= 1.2458$

$c = c + \Delta c$

$= -0.57 + 0.3831$

$= -0.1869$

Step : 14 : iter = iter + 1 = 3 > epochs = true

end

$m = 1.2458$

$c = -0.1869$

$$MSE = \frac{1}{n_s}\sum (y_i^a - y_i)^2$$

$$= \frac{1}{2}\Big((3.4 - 1.2458(0.2) + 0.1869)^2 + (3.8 - 1.2458(0.4) + 0.1869)^2 \Big)$$

$$= \frac{1}{2}(11.14050083 + 12.17019004)$$

$$= 11.65534494$$