Assignment 3

5F3

Stochastic Gradient Descent

X	Y
0.2	3.4
0.4	3.8
0.6	4.2
0.8	4.6

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

Step 2: Pick a value at random

Step 3: sample = 2

Step 4: error $E = \frac{1}{2} \times (3.4 - (1 \times 0.2) - 1))^2$

$E = \text{error} = \frac{1}{2}(y_i - mx_i - c)^2$

$= 0.5(3.4 + 0.8)^2$

$= 8.82$

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

$= -(3.4 - 0.2 + 1)(0.2)$

$= (4.2)(0.2)$

$= 0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -(4.2)$

$= -4.2$

Step 5

$$\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(0.84)$$

$$= 0.084$$

$$\Delta \eta = -\eta \frac{\partial E}{\partial c} = -(0.1)(-4.2)$$

$$= 0.42$$

Step 6

$$m = m + \Delta m \Rightarrow 1 + 0.084 = 1.084$$

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

Step 7:

sample = sample + 1

= 1 + 1

= 2

Step 8: If (sample > 100 of samples)

go to step 9

else

go to step 4

Here 2 < 4

$$y = (1.084)(0.4) - 0.58$$

$$y = -0.1464$$

From step 4

$$E = (0.5) * (3.8 + 0.1464)^2$$

$$= 7.75$$

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

$$= -(3.8 - (1.054)(0.4) + 0.58)0.4$$

$$= -(3.8 + 0.1464) * 0.4$$

$$= -1.58$$

$$\frac{dE}{dc} = -(y_i - mx_i - c) = -3.94$$

Step iii: $\Delta m = -\eta \frac{dE}{dm} = -(0.1)(-1.58)$

$$= 0.158$$

$$\Delta m = -\eta \frac{dE}{dc} = -(0.1)(-3.94)$$

$$= 0.394$$

$$m = m + \Delta m = 1.054 + 0.158 = 1.242$$

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

Step iv: sample = sample+1

$$2 + 1$$

$$= 3$$

sample = 3 ? no. of sample

go to next step