Stochastic Gradient Descent (SGD)

X	Y
0.2	3.4
0.4	3.8
0.6	4.2
0.8	4.6

Step1 : m=1, c=-1, η=0.1, epochs=2
ns=2

Step2 : ptu=1 Step3 : Sample=1

Step4 : $E = \frac{1}{2}(y_i - mx_i - c)^2$

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

$= (-3.4 + 0.2 - 1)$

$\Rightarrow -0.84$

$\frac{\partial E}{\partial c} \Rightarrow -(y_i - mx_i - c) \Rightarrow (-1)(3.4 - (1)0.2 + 1) \Rightarrow -4.2$

Step5 : $\Delta m = -\eta \frac{\partial E}{\partial m}$

$= -0.1(-0.84) \Rightarrow 0.084$

$\Delta c = -\eta \frac{\partial E}{\partial m}$

$= -0.1(-4.2) \Rightarrow 0.42$

Step6 :

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

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

Step7 : Sample = Sample + 1.

Iter = 1

Sample = 2

$$\frac{\partial E}{\partial m} = -(3.8 - 1.084(0.4) - (-0.58))0.4$$

$$= -1.57$$

$$\frac{\partial E}{\partial c} = -(3.8 - 1.084(0.4) - (-0.58))$$

$$= -3.94$$

$$\Delta m = -(0.1)(-1.57) \Rightarrow 0.157$$

$$\Delta c = -(0.1)(-3.94) \Rightarrow 0.394$$

$$m = 1.084 + 0.157 \Rightarrow 1.241$$

$$c = -0.58 + 0.394 \Rightarrow -0.19$$

Iter = 2

Sample = 1

$$\frac{\partial E}{\partial m} = -(3.4 - 1.241(0.2) - (-0.19))0.2$$

$$\Rightarrow -0.668$$

$$\frac{\partial E}{\partial c} = -(3.4 - 1.241(0.2) - (-0.19))$$

$$\Rightarrow -3.34$$

$$\Delta m = -(0.1)(+0.668) \Rightarrow 0.0668$$

$$\Delta c = -(0.1)(-3.34) \Rightarrow 0.334$$

$$m = 1.241 + 0.0668 \Rightarrow 1.307$$

$$c = -0.19 + 0.334 \Rightarrow 0.144$$

Epoch = 2

Sample = 2

$$\frac{\partial E}{\partial m} = -(3.8 - 1.307(0.4) - 0.144)\,0.4$$

$$\Rightarrow -1.25$$

$$\frac{\partial E}{\partial c} \Rightarrow -(3.8 - 1.307(0.4) - 0.144)$$

$$\Rightarrow -3.13$$

$$\Delta m = -(0.1)(-1.25) \Rightarrow 0.125$$

$$\Delta c = -(0.1)(-3.13) \Rightarrow 0.313$$

$$m = 1.307 + 0.125 \Rightarrow 1.432$$

$$c = 0.144 + 0.313 \Rightarrow 0.457$$