Assignment-7

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BGD (Batch Gradient Descent).

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

(a) Do manual Calculations for 2 iterations with first two samples

step1: m=1, c=-1, η=0.1, epochs=~~10~~ 2

iter=0 ns=2

step2: iter=1

step3: $E = \frac{1}{2ns}\sum_{i=1}^{ns}(y_i - mx_i - c)^2$.

y_{pred}.

$$\frac{\partial E}{\partial m} = \frac{-1}{ns}\sum_{i=1}^{ns}(y_i - mx_i - c)x_i$$

$$= \frac{-1}{2}\sum_{i=1}^{2}(y_i - mx_i - c)x_i$$

$$= \frac{-1}{2}\left[(3.4-(0.2)+1)(0.2) + (3.8-0.4+1)(0.4)\right]$$

$$= \frac{-1}{2}[0.84 + 1.76]$$

$$\frac{\partial E}{\partial m} = -1.30$$

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

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

$$= \frac{-1}{2}\left[(3.4-0.2+1) + (3.8-0.4+1)\right] = \frac{-1}{2}[4.2+4.4]$$

$$\frac{\partial E}{\partial c} = -4.30$$

step4:

$\Delta m = -\eta\left[\frac{\partial E}{\partial m}\right] = -(0.1)[-1.30] = 0.130$

$\Delta c = -\eta\left[\frac{\partial E}{\partial c}\right] = -(0.1)(-4.30) = 0.430$

step5:

$m = m + \Delta m = 1 + (0.130) = 1.130$

$c = c + \Delta c = -1 + 0.430 = \cancel{3.300}\ -0.57$

step6

$iter = iter + 1 = 1 + 1 = 2$

step7 Convergence criteria

if (iter > epochs)

$2 > 2$ ×

go to step3

step3

$$\frac{\partial E}{\partial m} = \frac{-1}{ns}\sum_{i=1}^{ns}(y_i - mx_i - c)x_i$$

$$= \frac{-1}{2}\left[(3.4 - (1.13)(0.2) + 0.57)(0.2) + (3.8 - (1.13)(0.4) + 0.57)(0.4)\right]$$

$$= \frac{-1}{2}\left[(0.74) + 1.567\right]$$

$$\frac{\partial E}{\partial m} = -1.15$$

$$\frac{\partial E}{\partial c} = \frac{-1}{2}\left[(3.4 - (1.13)(0.2) + 0.57) + (3.8 - (1.13)(0.4) + 0.57)\right]$$

$$= \frac{-1}{2}[3.74 + 3.91] = -3.82$$

step4

$\Delta m = -\eta\left[\frac{\partial E}{\partial m}\right] = -(0.1)[-1.15] = 0.115$

$\Delta c = -\eta\left[\frac{\partial E}{\partial c}\right] = -(0.1)(-3.82) = 0.382$

step5 :

$m = m + \Delta m$

$= 1.130 + 0.115 = 1.245$

$c = c + \Delta c = -0.57 + 0.38 = -0.19$

step6

iter = 2 + 1 = 3

step7

if (3 > 2)

go to next step

step8

print (m) = 1.245

c = -0.19

Optimal m & c we got after 2 iterations for BGD

Batch Gradient Decent

over 2 samples.