

ASSIGNMENT-3

U20-1-1-18K41A0502

Let us consider a sample dataset have one input (x_i^a) and one output (y_i^a), and number of samples 4. Develop a simple linear regression model using stochastic gradient descent optimizer.

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

- Do manual calculations for two iterations with first two samples.
- Write the python code to build simple linear regression model using SGD optimizer (consider all 4 samples).

S-1: $x, y, m=1, c=-1, \eta=0.1, \text{epochs}=2, n_s=2$

S-2: $\text{itr}=1$

S-3: $\text{Sample}=1$

S-4: $\frac{dE}{dm} = -(3.4 - (1)) (0.2) - (-1) 0.2$
 $= -0.84$

S-4: $\frac{dE}{dc} = -(3.4 - (1)) (0.2 + 1) = -4.2$

S-5: $\Delta m = -(0.1) (-0.84) = 0.084$

$\Delta c = -(0.1) (-4.2) = 0.42$

S-8: if (sample > ns)
 $3 > 2$
 goto S-9
 else
 goto S-4

S-9: Ptr += 1
 $1 + 1 = 2$

S-10: If (Ptr > epochs)
 $2 > 2$
 goto S-11
 else
 goto S-3

S-3: sample = 1

$$S-4: \frac{\partial E}{\partial M} = -(3.4 - (1.2)(0.2) + 0.18)0.2$$

$$= -(3.34)0.2$$

$$= -0.668$$

$$S-5: \frac{\partial E}{\partial C} = -(3.4 - (1.2)(0.2) + 0.18)$$

$$= -3.34$$

$$S-5: \Delta m = -(0.1)(-0.668)$$

$$= 0.0668$$

$$S-6: m = m + \Delta m = 1.24 + 0.0668 \approx 1.3$$

$$c = C + \Delta C = 0.18 + 0.33 = 0.5$$

S-7: sample t = 1
 $1 + 1 = 2$

S-8: if (sample > ns)

2 > 2

goto s-9

else

goto s-4

$$S-4: \frac{\partial E}{\partial m} = -(3.8 - (1.3)(0.4) - 0.15)0.4$$

$$= -1.25$$

$$\frac{\partial E}{\partial c} = -(3.8 - (1.3)(0.4) - 0.15)$$

$$= -3.13$$

$$S-5: \Delta m = -(0.1)(-1.25) = 0.12$$

$$\Delta c = -(0.1)(-3.13) = 0.31$$

$$S-6: m = m + \Delta m = 1.3 + 0.12 = 1.42$$

$$c = c + \Delta c = 0.15 + 0.31 = 0.46$$

S-7: sample = sample + 1

$$2 + 1 = 3$$

S-8: if (sample > ns)

3 > 2

goto s-9

else

goto s-4

s-9: ptr = ptr + 1

$$= 2 + 1 = 3$$

S-10: If (iter > epochs)

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goto S-11

else

goto S-3

S-11: print m & c

$m = 1.42, c = 0.46$

x_i, y_i	x_i, x	(i)
0.0	0.0	1
0.6	0.0	2
0.4	1.0	3
1.0	0.0	4

After this, initialize our neural network for two iterations with both weights and biases (consider all 4 samples).
 After the python code to build simple linear regression model using numpy (consider all 4 samples).

Batch 1

x	y
0.0	0.0
0.0	0.6
1.0	0.4
0.0	1.0

Batch 2

x	y
0.0	0.0
0.0	0.6
1.0	0.4
0.0	1.0

2.41 [X Y] $\begin{bmatrix} 0.0 & 0.0 \\ 0.0 & 0.6 \\ 1.0 & 0.4 \\ 0.0 & 1.0 \end{bmatrix}$ $\begin{bmatrix} 0.0 \\ 0.6 \\ 0.4 \\ 1.0 \end{bmatrix}$

$$z = \frac{11}{2} = 5.5$$

2.41