

Assignment - 3

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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)

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

Step 2: $\text{itr} = 1$

step 3 : sample = 1

$$\text{step 4 : } \frac{dE}{dm} = - (8.4 - (-1)) (0.2) - (-1) 0.2 \\ = -0.84$$

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

$$\text{step 5 : } \Delta m = - (0.1) (-0.84) = 0.084$$

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

$$\text{step 6 : } m = m + \Delta m \\ = 1 + 0.084 = 1.084$$

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

step 7 : sample + 1

$$1 + 1 = 2$$

step 8 : if (sample > ns)

$$2 > 2$$

goto step - 9

else
go to step - 4

$$\text{step 4 : } \frac{dE}{dm} = - (3.8 - (1.084)) (0.4 + 0.58) 0.4 \\ = -1.5785$$

$$\frac{dE}{dc} = -(3.8 - (1.084)(0.4) + 0.58)$$

$$= -3.9464$$

step 5: $\Delta m = -(0.1)(-1.5785) = 0.1578$

$$\Delta c = -(0.1)(-3.9464) = 0.3946$$

step 6: $m = m + \Delta m = 1.084 + 0.1578$

$$= 1.2418$$

$$c = c + \Delta c = -0.58 + 0.3946$$

$$= -0.1854$$

step 7: Sample += 1

$$2+1 = 3$$

step 8: if (sample > n_s)

$$3 > 2$$

goto step 9

else

goto step 4

step 9: $itr += 1$

$$1+1 = 2$$

step 10: if ($itr > epochs$)

$$2 > 2$$

goto step -11

else

goto step -3

step 3 : sample $t = 1$

$$\text{step 4 : } \frac{dE}{dm} = -(3.4 - (1.2)(0.2) + 0.18) 0.2$$

$$= -(3.34) 0.2$$

$$= -0.668$$

$$\frac{dE}{dc} = -(3.4 - (1.2)(0.2) + 0.18)$$

$$= -3.34$$

$$\text{step 5 : } \Delta m = -(0.1)(-0.668)$$

$$= 0.0668$$

$$\text{step 6 : } m = m + \Delta m = 1.24 + 0.066 = 1.3$$

$$c = c + \Delta c = 0.18 + 0.33 = 0.15$$

step 7 : sample $t = 1$

$$1+1 = 2$$

step 8 : if (sample $> n_s$)
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go to step - 9

else go to step - 4

$$\text{step 4 : } \frac{dE}{dm} = -(3.8 - (1.3)(0.4) - 0.15) 0.4$$

$$= -1.25$$

$$\frac{dE}{dc} = -(3.8 - (1.3)(0.4) - 0.15)$$

$$= -3.13$$

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

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

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

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

step-7 : $sample = sample + 1$

$2 + 1 = 3$

step 8 : if ($sample > n_s$)

$3 > 2$

goto step-9

else

goto step 4

step 9 : $it_0 = it_0 + 1$

$= 2 + 1 = 3$

step 10 : if ($it_0 > epochs$)

$3 > 2$

goto step 11

else

goto step-3

step 11 : print m & C

$m = 1.42$, $C = 0.46$