

NNDL Assignment-3

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Let consider a sample dataset have one input (x_i^a) and one output (y_i^a) and number of samples 4. Develop a ~~simple~~ 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: $x, y, m=1, c=-1, \eta=0.1, \text{epochs}=2, \text{ne}=2$

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

Step-3: Sample=1

$$\text{Step-4: } \frac{dE}{dm} = -(2.4(1)/(0.2) - (1-1))0.2$$

$$= -0.84$$

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

$$= -4.2$$

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

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

$$= 0.42$$

$$\text{Step-6: } m = m + \Delta m$$

$$= 1 + 0.084 = 1.084$$

$$c = c + \Delta c$$

$$= -1 + 0.42 = -0.58$$

$$\text{Step-7: sample} + 1$$

$$1 + 1 = 2$$

step-8: if (sample > ns)

$$2 > 2$$

goto step-9

else

goto step-4

$$\text{step-4: } \frac{\partial E}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58)0.4$$

$$= -1.5785$$

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

$$= -3.9464$$

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

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

step-7: sample + 1

$$2 + 1 = 3$$

$$\text{step-6: } m = m + \Delta m = 1.084 + 0.1578$$

$$= 1.2418$$

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

$$= -0.1854$$

step-8: if (sample > ns)

$$3 > 2$$

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 = 1

$$\text{step-4: } \frac{\partial E}{\partial m} = -(3.4 - (1.2)(0.2) + 0.12)0.2$$

$$= -(3.34)0.2$$

$$= -0.668$$

$$\frac{\partial E}{\partial c} = -(3.4 - (1.2)(0.2) + 0.12)$$

$$= -3.34$$

Step-5: $\Delta m = -(0.1)/(-0.668)$
 $= 0.0668$

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 = 1
 $1 + 1 = 2$

Step-8: if (sample > ns)
 $2 > 2$
 goto step-9
 else
 goto step-4

Step-4: $\frac{\partial E}{\partial m} = -(3.8 - (1.3)(0.4) - 0.15)0.4$
 $= -1.25$
 $\frac{\partial E}{\partial c} = -(3.8 - (1.3)(0.4) - 0.15)$
 $= -3.13$

Step-5: $\Delta m = -(0.1)/(-1.25) = 0.12$
 $\Delta c = -(0.1)/(-3.13) = 0.32$

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 > ns)
 $3 > 2$
 goto step-9
 else
 goto step-4

Step-9: itr = itr + 1
 $2 + 1 = 3$

Step-10: if (itr > epochs)
 $3 > 2$
 goto step-11
 else
 goto step-3

step-11: print mfc

$$m=1.42, c=0.46$$

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