ASSIGNMENT-3

— 18K41A0530

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: $x, y, m=1, c=-1, \eta=0.1$, epochs $=2$, $ns=2$

Step-2: itr $=1$

Step-3: Sample $=1$

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

$= -0.84$

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

$= -4.2$

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

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

$= 0.42$

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 goto step-4

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

$= -1.5785$

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

$= -3.9464$

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

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

Step-7: sample += 1

$2 + 1 = 3$

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 > epoches)
2 > 2
goto step-11
else goto step-3

Step-3: Sample = 1

Step-4: $\frac{\partial E}{\partial m} = -(3.4-(1.2)(0.2)+0.18)0.2$
$= -(3.34)0.2$
$= -0.668$

$\frac{\partial E}{\partial c} = -(3.4-(1.2)(0.2)+0.18)$
$= -3.34$

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: $\Delta m = -(0.1)(-1.25) = 0.12$
$\Delta c = -(0.1)(-3.13) = 0.31$

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 > ns)

3 > 2

goto step-9

else goto step-4

Step-9: itr = itr + 1

= 2+1 = 3

Step-10: if (itr > epoches)

3 > 2

goto step-11

else goto step-3

Step-11: print m & c

m = 1.42 , c = 0.46