Assignment-3

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Q) Develop a simple linear regression model using a stochastic gradient descent optimizer.

Sample (i)	X_i	Y_i
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

Do manual calculation for two iterations with first two samples.

Sol) 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: $\frac{\partial E}{\partial m} = -(3.4-(1)(0.2)-(-1))\,0.2$

$= -0.84$

$\frac{\partial E}{\partial c} = -(3.4-(1)(0.2)-(-1))$

$= -4.2$

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 $= 1+1 = 2$

Step-8: if $(2>2)$

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-6: $m = m + \Delta m = 1.084 + 0.1578 = 1.2418$

$c = c + \Delta c = -0.58 + 0.3946 = -0.1854$

Step-7: sample $= 2+1 = 3$

Step-8: if $(3>2)$

goto step-9

step-9: itr = 1+1 = 2

step-10: if (~~it~~ 2 > 2)
goto step-11
else
goto step3

step-3: sample = 1

step-4: $\frac{\partial E}{\partial m} = -(3.4-(1.2)(0.2)+0.18)\,0.2$

$= -0.668$

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

$= -3.34$

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

$\Delta c = -(0.1)(-3.34) = 0.33$

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 = 2

Step-8: if (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 $= 2+1 = 3$

Step-8: if (sample > ns)

$3 > 2$

goto step 9

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

Step-10: if ($3 > 2$)

goto step 11

Step-11: $m = 1.42$

$c = 0.46$