

Assignment - 9

18K41A0545

Let us Consider a sample dataset have 1 input (x_i) and one output (y_i) and no. of Samples 4. Develop a Simple linear regression model using momentum optimiser.

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 2 iterations with 1st 2 Samples.

Step 1:- $[X, Y] m=1, c=-1, \eta=0.1, \text{epochs}=2, \theta=0.9, v_m=v_c=0, ns=2.$

Step 2: $itr=1$

Step 3: Sample = 1

$$\begin{aligned}\text{Step 4: } g_m &= \frac{\partial E}{\partial m} = -(y_i - mx_i - c)x_i \\ &= -(3.4 - (1)(0.2) + 1)(0.2) \\ &= -0.84\end{aligned}$$

$$\begin{aligned}g_c &= \frac{\partial E}{\partial c} = -(y_i - mx_i - c) \\ &= -(3.4 - 0.2 + 1)\end{aligned}$$

$$\begin{aligned}\text{Steps: } v_m &= \theta v_m - \eta g_m \\ &= (0.9)0 - (-0.1)(-0.84) \\ &= -0.084\end{aligned}$$

$$\begin{aligned}v_c &= \theta v_c - \eta g_c \\ &= 0.9 \times 0 - (-0.1)(-4.2) \\ &= -0.42\end{aligned}$$

Step 6: $m = m + \dot{V}_m$
 $= 1 + (-0.84)$
 $= -0.916$

$C = C + \dot{V}_C$
 $= -1 - 0.42$
 $= -1.42$

Step 7: Sample + 2
 $1 + 1 = 2$

Step 8: if (sample > ns)
 goto step-9

$2 > 2$

else
 goto step-4

Step 4: $g_m = \frac{\partial E}{\partial m} = -(3.8 - 10.916)(0.4) + 1.12)(0.4)$
 $= -1.941$

Step 5: $g_C = \frac{\partial E}{\partial C} = -4.853$

$\hookrightarrow \dot{V}_m = \eta \dot{V}_m - \eta g_m$

$= (0.9)(-0.084) - [-0.1 \times 1.941]$
 $= -0.2697$

$\dot{V}_C = \eta \dot{V}_C - \eta g_C$

$= (0.9)(-0.42) - [-0.1 \times 4.853]$
 $= -0.863$

Step 6: $m = m + \dot{V}_m$
 $= 0.916 + (-0.2697)$
 $= 0.6463$

$C = C + \dot{V}_C$
 $= -1.42 - 0.863$
 $= -2.283$

Step 7: Sample = Sample + 1
 $= 2 + 1 = 3$

Step 8: if (sample > ns)
 goto step-9

else

goto step-4

Step-9: $itr + 21$

$l + 1 = 2$

Step 10: if ($itr > epochs$)

goto step-4

else

goto step-3

Step-3: Sample = 1

$$\text{Step 4: } g_m = \frac{\partial E}{\partial m} = -(3.4 - (0.646)(0.2) + 2.283)(0.2) \\ = -1.110$$

$$g_c = \frac{\partial E}{\partial c} = -(3.4 - (0.646)(0.2) + 2.283) \\ = -5.553$$

Step 5: $V_m = \eta g_m$

$$= (0.9)(-0.2697) - [-0.1 \times 1.110]$$

$$= -0.353$$

$V_c = \eta g_c$

$$= (0.9)(-0.863) - [-0.1 \times 5.53]$$

$$= -1.332$$

Step 6: $m = m + V_m$

$$= 0.6463 + (-0.353)$$

$$= 0.293$$

$C = C + V_c$

$$= -2.283 - 1.332$$

$$= -3.615$$

Step 7: Sample + 1

$l + 1 = 2$

Step 8: if (Sample > ns)

goto step-9

else

goto step 4

$$\text{Step 4: } g_m = -(3.8 - (0.293)(0.4) + 3.615)(0.4) \\ = -2.919$$

$$g_c = -(3.8 - (0.293)(0.4) + 3.615) \\ = -7.297$$

$$\text{Step 5: } V_m = (0.9)(-0.353) - [-0.1 \times -2.919] \\ = -0.6096$$

$$V_c = (0.9)(-1.332) - [-0.1 \times -7.297] \\ = -1.9285$$

$$\text{Step 6: } m_t = V_m \\ 0.293 - 0.609 = -0.316 \\ C_t = V_c \\ -3.615 - 1.928 = -5.543$$

$$\text{Step 7: Sample } t = 1 \\ 2 + 1 = 3$$

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

$$\text{Step 9: } i_{tr} = 1 \\ 2 + 1 = 3$$

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

Step 11: print m, c
 $m = -0.316$, $c = -5.543$