Assignment - 9

Develop a simple linear regression model using momentum optimizer.

→ Do manual calculations for '2' iterations with first '2' samples using given dataset.

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

Step 1: $[x, y]$, $m=1$, $c=-1$, $\eta=0.1$,

epochs $= 2$, $\gamma = 0.9$,

$V_m = V_c = 0.$

Sample (i)	x_i^a	y_i^a
1	0.2	3.4
2	0.4	3.8

Step 2: iter = 1

Step 3: Sample = 1

Step 4: $E = \frac{1}{2}(y_i - m x_i - c)^2$

$$g_m = \frac{\partial E}{\partial m} = -(y_i - m x_i - c) x_i$$

$$= -(3.4 - (1)(0.2) + 1)(0.2)$$

$$= -0.84$$

$$g_c = \frac{\partial E}{\partial c} = -(y_i - m x_i - c)$$

$$= -(3.4 - (1)(0.2) + 1)$$

$$= -4.2$$

Step 5: $V_m = \gamma V_m - \eta g_m$

$$= (0.9)(0) - (0.1)(-0.84) = 0.084$$

$$V_c = \gamma V_c - \eta g_c$$

$$= (0.9)(0) - (0.1)(-4.2) = 0.42$$

step6: $m = m + V_m$, $c = c + V_c$

$= 1 + 0.084$, $= -1 + 0.42$

$m = 1.084$ $c = -0.58$.

step7: Sample = Sample + 1 = 1+1 = 2

step8: if (sample > n_s) $\quad 2 > 2$

no

else

goto step4.

Step4: $g_m = \frac{\partial E}{\partial m} = -(y_i - m x_i - c) x_i = -(3.8 - (1.084 \times 0.4) + 0.58)(0.4)$

$= -1.57856$

$g_c = \frac{\partial E}{\partial c} = -(y_i - m x_i - c) = -(3.8 - (1.084 \times 0.4) + 0.58)$

$= -3.9464$.

Step5: $V_m = \gamma V_m - \eta g_m$

$= (0.9)(0.084) - (0.1)(-1.57856)$

$= 0.233456$ //

$V_c = \gamma V_c - \eta g_c$

$= (0.9)(0.42) - (0.1)(-3.9464)$

$= 0.77264$ //

Step6: $m = m + V_m = 1.084 + 0.233456 = 1.317456$ //.

$c = c + V_c = -0.58 + 0.77264 = 0.19264$ //

step7: Sample = 2+1 = 3

step8: if (sample > n_s) $\quad 3 > 2$ yes goto step 9.

step9: iter = 1+1 = 2

step10: if (iter > epochs) $\quad 2 > 2$ no. else go to Step 3.

Step3: Sample = 1

Step.4: $g_m = \frac{\partial E}{\partial m} = -(y_i - m x_i - c) x_i$

$= -(3.4 - (1.3174)(0.2) - 0.19264)(0.2)$

$= -0.58877376$ //

$g_c = \frac{\partial E}{\partial c} = -(y_i - m x_i - c) = -(3.4 - (1.317456)(0.2) - 0.19264)$

$= -2.9438688$ //

Step 5: $V_m = \gamma V_m - \eta g_m$

$= (0.9)(0.233456) - (0.1)(-0.58877376)$

$= 0.268987776$

$V_c = \gamma V_c - \eta g_c$

$= (0.9)(0.77264) - (0.1)(-2.9438688)$

$= 0.98976288$

Step 6: $m = m + V_m = 1.317456 + 0.268987776$

$= 1.58644376$ //

$c = c + V_c = 0.19264 + 0.9897688$

$= 1.18240288$ //

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

$2 > 2$

Step 2: if (sample $> n_s$) no

else go to step 4.

Step 4: $g_m = \frac{\partial E}{\partial m} = -(y_i - m x_i - c) x_i$

$= -(3.8 - (1.58644 \times 0.4) - 1.182402)(0.4)$

$= -0.7932088$ //.

$g_c = \frac{\partial E}{\partial c} = -(y_i - m x_i - c)$

$= -(3.8 - (1.58644 \times 0.4) - 1.182402)$

$= -1.983022$ //.

Step 5: $V_m = \gamma V_m - \eta g_m$

$= (0.9)(0.26898) - (0.1)(-0.7932088)$

$V_m = 0.32140288$ //.

$V_c = \gamma V_c - \eta g_c$

$= (0.9)(0.98976288) - (0.1)(-1.983022)$

$= 1.089088792$ //.

Step 6: $m = m + V_m$, $c = c + V_c$

$= 1.58644376 + 0.32140288$, $= 1.18240288 + 1.089088792$

$m = 1.90784$, $c = 2.27148$.

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

$3 > 2$

Step 8: if (sample $> n_s$) goto step 9.

Step 9: iter = 2 + 1 = 3

Step 10: if (iter > epochs) yes, goto step 11.
$3 > 2$

Step 11: print(m, c), m = 1.90784.

c = 2.27148 //.