Assignment 11

Let consider a sample dataset have 1 input (X_i^a) and one output (y_i^a) and number of samples 4. Develop a simple linear regression model using Nesterov Accelerated Gradient (NAG) 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 2 iterations with first 2 samples.

Step1 :- [x, y], m = 1, c = -1, η = 0.1, epoches = 2, γ = 0.9

$v_m = v_c = 0$, ns = 2

Step2 :- iter = 1

Step3 :- sample = 1

Step 4

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

$$= -(3.4 - (1+(0.9)(0))0.2 - (-1+(0.9)(0))0.2$$

$$= -0.84$$

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

$$= -(3.4 - (1+0.9\times 0)0.2 - (-1+(0.9)(0))$$

$$= -4.2$$

Step 5:

$$v_m = \gamma v_m - \eta g_m$$

$$= (0.9)(0) - (-0.1) \times (-0.84)$$

$$= 0 - 0.084$$

$$= -0.084$$

$$v_c = \gamma v_c - \eta g_c$$

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

$$= -0.42$$

Step 6

$$m = m + v_m = 1 - 0.084 = 0.916$$

$$c = c + v_m = -1 - 0.42 = -1.42$$

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

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

Step 4 :- $g_m = \frac{\partial E}{\partial m}$

$= -(3.8 - [0.916 + (0.9x - 0.084)]0.4 - (-1.42 + (0.9x - 0.084))0.4$

$= -1.983$

$g_c = \frac{\partial E}{\partial c} = -4.959$

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

$= (0.9 \times - 0.084) - (-0.1 \times -1.983)$

$= -0.2739$

$v_c = (0.9 \times - 0.42) - (-0.1 \times -4.959)$

$= -0.8739$

Step 6 :- $m = m + v_m = 0.916 - 0.2739 = 0.6421$

$c = c + v_c = -1.42 - 0.8739 = -2.2939$

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

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

else goto step 4

Step 9 :- iter = iter + 1.

= 1 + 1 = 2

Step 10 :- if (iter > epoches) goto step 11

2 > 2

else goto step 3.

Step 3 :- sample 1

Step 4 :-

$$\frac{\partial E}{\partial M} = -\left[\frac{3.4 - (0.642 + (0.9x - 0.273))x0.2 - (-2.293 + (0.9x - 0.27}{0.2}\right.$$

$$gm = -1.171$$

$$\frac{\partial E}{\partial c} = -5.859 = g_c$$

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

$= [(0.9)x - 0.273] - (-0.1 \times -1.171)$

$= -0.2457 - 0.117$

$= -0.3627$

$V_c = \gamma v_c - \eta g_c$

$= (0.9)(-0.873) - (-0.1)(-5.879)$

$= -0.7857 - 0.587$

$= -1.3707$

Step 6 :- $m = m + v_m = 0.6421 + (-0.3627) = 0.2794$

$c = c + v_c = -2.2939 - 1.3707 = -3.6646.$

Step 7 : sample = sample + 1 = 1 + 1 = 2.

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

3 > 2

else goto step 4

Step 4 :-

$\frac{\partial E}{\partial M} = -(3.8 - (0.2794 + 0.9x - 0.3627)) \times 0.4 - (-3.6646 + (0.9x - 0.3627))) \times 0.4$

$g_m = -2.985$

$\frac{\partial E}{\partial c} = -7.4645 = g_c$

Step 5 :- $v_m = [0.9x - 0.3627] - [-0.1 \times -2.985]$

$= -0.6249$

$v_c = [0.9x - 1.3707] - [-0.1 \times -7.4645]$

$= -1.9800$

Step 6 :- $m = m + V_m = 0.2974 + (-0.6249) = -0.3275$

$c = c + V_c = -3.6646 - 1.9800 = -4.6446.$

Step 7 :- sample = sample + 1

= 2 + 1

= 3

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

3 > 2

else goto step 4

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

Step 10 :- if (iter > epoches) goto step 4

3 > 2

else goto step 3

Step 11 :- print m, c

m = 0.3275

c = -4.6446