Assignment-11

18K41A05F4

Nesterov Accelerated Gradient Descent.

steps

1) Read [x,y], m=1, c=-1, η=0.1, γ=0.9, v_m=0, v_c=0, epochs= 2, no of samples=2

x	y
0.2	3.4
0.4	3.8

2) iter=1

3) sample=1

4) $g_m = -(y_i - (m + \gamma v_m)x_i - ((c + \gamma v_c))x_i$

$= -(3.4 - (1 + (0.4) \times 0) \times 0.2 - ((-1) + 0)) \times 0.2$

$= -(3.4 - 0.2 + 1) \times 0.2 = -(4.2 \times 0.2) = -0.84$

$g_c = -4.2$

5) $v_m = \gamma v_m - \eta g_m = 0.9(0) - (0.1)(-0.84)$

$= 0.084$

$v_c = \gamma v_c - \eta g_c = 0 - (0.1)(-4.2) = 0.42.$

6) $m = m + v_m = 1 + 0.084 = 1.084$

$c = c + v_c = -1 + 0.42 = -0.58$

7) sample = 1+1 = 2.

8) if sample > no of sample => 2 > 2 => false

goto step 4

9) $g_m = -(3.8 - (1.084 + (0.9) \times (0.084)) \times 0.4 -$

$(-0.58 + (0.9) \times 0.42))) \times 0.4$

~~$g_m = (3.8)$~~

$g_m = -(3.8 - (1.1596 \times 0.4) + 0.958) \times 0.4$

$= -(4.29416) \times 0.4 = -1.717664$

$g_c = -4.29416$

10) $v_m = \gamma v_m - \eta g_m = 0.9(0.084) - (0.1)(-1.717664)$

$= 0.2473664$

$v_c = \gamma v_c - \eta g_c = 0.9(0.42) - (0.1)(-4.29416)$

$= 0.807416$

11) $m = m + v_m = 1.084 + 0.24736 = 1.33136$

$c = c + v_c = -0.58 + 0.807416 = 0.227416$

12) Sample = 2+1 = 3

13) if sample > no of sample = 3 > 2 => true

goto next step

14) iter = 1+1 = 2.

15) if iter > epochs => 2 > 2 => false

goto step3

16) Sample = 1

17) $g_m = -(y_i - (m + \gamma v_m) x_i - (c + \gamma v_c)) x_i$

$= -(3.4 - [1.33136 + [0.9 \times (0.24736)]] \times 0.2$

$-(0.227416 + 0.9 \times 0.807416)$

$= -(3.4 - [1.553984] \times 0.2 - [0.95409])$

$g_m = -2.13511$

$g_c = -(3.4 - 1.553984 - 0.95409) = -0.891926$

18) $v_m = \gamma v_m - \eta g_m = 0.9 \times 0.2473664 - (0.1) \times (-2.13$

$= 0.43614$

$v_c = \gamma v_c - \eta g_c = (0.9)(0.807416) - (0.1) \times (-0.89192$

$= 0.815867$

19) $m = m + V_m = 1.3316 + 0.43614 = 1.76774$

$c = c + V_c = 0.227416 + 0.815867 = 1.043283$

20) sample = sample + 1 = 1 + 1 = 2.

21) if sample > ns $\Rightarrow$ 2 > 2 $\Rightarrow$ false

repeat step 4

22) $g_m = -(y_p - (m + \gamma V_m) x_p - (c + \gamma V_c)) x_i$

$= -[3.8 - (1.76774 + (0.9) \times 0.43614)] \times 0.4 -$

$(1.043283 + (0.9) \times 0.815867)] \times 0.4$

$= -[3.8 - (2.160266) \times 0.4 - 1.77756633] \times 0.4$

$= -0.463333$

$g_c = -[3.8 - (2.160266 \times 0.4) - 1.77756633]$

$= -1.15833303$

23) $V_m = \gamma V_m = \eta \frac{\partial E}{\partial m}$

$= (0.9) \times 0.43614 - (0.1) \times (+0.463332)$

$= 0.4388592$

$V_c = \gamma V_c - \eta \frac{\partial E}{\partial c}$

$= (0.9) \times (0.815867) - (0.1) \times (-1.15833303)$

$= 0.85011133$

24) $m = 1.76774 + 0.4388592 = 2.2065992$

$c = 1.043283 + 1.15833303 = 2.2016133$

25) sample = 2 + 1 = 3 > 2 $\Rightarrow$ sample > epochs

goto next step

26) epoch = 2 + 1 = 3 > epochs

goto next step

27) Print m, c

$m = 2.2065992$

$c = 2.2016133$

28) Mean Squared Error

$$mse = (3.4 - (2.2065992 \times 0.2) - 2.2016133)^2 + (3.8 - (2.2065992 \times 0.4) - 2.2016133)^2$$

$$= \frac{0.57315 + 0.512293}{2}$$

$$= \frac{1.085443}{2}$$

$mse = 0.542721$