18K41A05F9

Assignment-09

Momentum Gradient Descent

X	y
0.2	3.4
0.4	3.8

ns = 2

Step-1: [x, y], m = 1, c = -1

epoch = 2, $v_m = v_c = 0$,

$\gamma = 0.9$, $\eta = 0.1$

Step-2: iter = 1

Step-3: sample = 1

Step-4:

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

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

$$= -0.84$$

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

$$= -4.2$$

Step-5:

$$v_m = \left(\gamma * v_m - \eta \frac{\partial E}{\partial m}\right) = (0.9)(0) - (0.1)(-0.84)$$

$$= 0.084$$

$$v_c = \left(\gamma * v_c - \eta \frac{\partial E}{\partial c}\right) = (0.9)(0) - (0.1)(-4.2)$$

$$= 0.42$$

Step-6: $m = m + v_m$

$= 1 + 0.084 = 1.084$

$c = c + v_c$

$= -1 + 0.42 = -0.58$

Step-7: Sample = Sample + 1 = 2 ≤ ns → True

Goto step-4

$$\frac{\partial E}{\partial m} = -\left(3.8 - (1.084)(0.4) - (-0.58)\right)(0.4)$$

$$= -1.57856$$

$$\frac{\partial E}{\partial c} = -\left(3.8 - (1.084)(0.4) - (-0.58)\right)$$

$$= -3.9464$$

Step-8:

$$v_m = v_m * \gamma - \eta \frac{\partial \epsilon}{\partial m}$$

$$= (0.084 \times 0.9) - (0.1)(-1.5\,7856)$$

$$= 0.233456$$

$$v_c = v_c * \gamma - \eta \frac{\partial \epsilon}{\partial c}$$

$$= (0.42 \times 0.9) - (0.1)(-3.96464)$$

$$= 0.77264$$

Step-9:

$$m = m + v_m = 1.084 + 0.233456$$

$$= 1.317456$$

$$c = c + v_c = -0.58 + 0.77264$$

$$= 0.19264$$

Step-10: sample = 2+1 = 3 ≤ ns → False

Goto next step

Step-11: iter = iter+1 = 2 ≤ epochs → true

Goto step-3

Step-12: sample = 1

Step-13: $\frac{\partial \epsilon}{\partial m} = -\left(3.4 - (1.317456)(0.2) - (0.19264)\right) 0.2$

$$= -0.58877$$

$$\frac{\partial \epsilon}{\partial c} = -2.9438688$$

Step-14:

$$v_m = (0.9 \times 0.233456) - (0.1)(-0.5887$$

$$= 0.2689874$$

$$v_c = (0.9 \times 0.77264) - (0.1)(-2.9438$$

$$= 0.989762$$

Step-15:

$$m = m + \Delta m$$

$$= 1.317456 + 0.2689874$$

$$= 1.5864372$$

$$c = c + \Delta c$$

$$= 0.19264 + 0.989762$$

$$= 1.182402$$

Step-16: sample = 2 ≤ ns → True

go to step-4

Step-17:

$$\frac{\partial E}{\partial m} = -0.7932092$$

$$\frac{\partial E}{\partial c} = -1.983023$$

Step-18:

$$v_m = (0.9 \times 0.2689874) - (0.1)(-0.7932092)$$

$$= 0.34840928$$

$$v_c = (0.9 \times 0.989762) - (0.1)(-1.983023)$$

$$= 1.0890881$$

Step-19:

$$m = m + v_m$$

$$= 1.5864372 + 0.34840928$$

$$= 1.934846$$

$$c = c + v_c$$

$$= 1.182402 + 1.0890881$$

$$= 2.2714901$$

Step-20: sample = 3 ≤ ns — False

next step

Step-21: iter = 3 ≤ epoch — false

next step

Step-22:

print (m, c)

(1.934846 , 2.2714901)

Step-23:

Mean Square Error

$$= \frac{(3.4 - 5.811)^2 + (3.8 - 6.4859)^2}{2}$$

$$= 6.5134$$