18K41A05F4

Assignment-3

Stochastic Gradient Descent

X	Y
0.2	3.4
0.4	3.8

Steps

1) epoches = 2, $\eta = 0.1$, $m = 1$, $c = -1$

2) iteration = 1

3) sample = 1

4) Error(E) $= \frac{1}{2} \times (3.4 - (1 \times 0.2 - 1))^2$

$= 0.5 \times (3.4 + 0.8)^2$

$= 8.82$

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

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

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

$= -0.84$

$\frac{\partial E}{\partial c} = -(y_i - mx_i - c) = -4.2$

5) $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-0.84) = 0.084$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-4.2) = 0.42$

6) $w = w + \Delta w = 1 + 0.084 = 1.084$

$c = c + \Delta c = -1 + 0.42 = -0.58$

7) sample = sample + 1 = 1 + 1 = 2.

8) sample < total no of samples $\Rightarrow$ True

go to step next.

9) $y = (1.084)(0.4) - 0.58$

$y = -0.1464$

$E = (0.5)(3.8 + 0.1464)^2 = 7.79$

$\frac{\partial E}{\partial w} = -(y_i - wx_i - c)\, x_i$

$= -(3.8 - (1.084)(0.4) + 0.58)\, 0.4$

$= -(3.8 + 0.1464) * 0.4 = -1.58$

$\frac{\partial E}{\partial c} = -(y_i - wx_i - c) = -3.94$

10) $\Delta w = -\eta \frac{\partial E}{\partial w} = -(0.1)(-1.58) = 0.158$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.1)(-3.94) = 0.394$

11) $w = w + \Delta w = 1.084 + 0.158 = 1.242$

$c = c + \Delta c = -0.58 + 0.394 = -0.186$

12) sample = 2 + 1 = 3

13) sample > no of samples

goto next step

14) $t = t + 1 = 2$.

15) $t < \text{epochs}$

goto step 3

16) sample = 1

17) $y = (1.242)(0.2) + (-0.186) = 0.0624$

$E = \frac{1}{2}(3.4 - 0.0624) = 1.6688$

$\frac{\partial E}{\partial w} = -(3.4 - 0.0624)\,0.2 = -0.667\,52.$

$\frac{\partial E}{\partial c} = -3.3376$

18) $\Delta w = -\eta\left(\frac{\partial E}{\partial w}\right) = -(0.1)(-0.66752) =$

$0.066752.$

$\Delta c = -(0.1)(-3.3376) = 0.33376$

19) $w = w + \Delta w = 1.242 + 0.66752 = 1.90952.$

$c = c + \Delta c = -0.186 + 0.33376 = 0.14776$

20) sample = 1 + 1 = 2.

21) sample < no of samples

goto step4

22) $\frac{\partial E}{\partial w} = -(3.8 - (1.90952)(0.4) - (0.14776))(0.4)$

$= -(2.888432)(0.4) = -1.155372$

$\frac{\partial E}{\partial c} = -2.888432.$

23) $\Delta m = -\eta\left(\frac{\partial E}{\partial m}\right) = 70.1155372$

$\Delta c = 70.2888432$

24) $m = m + \Delta m$

$= 2.025057$

$c = c + \Delta c = 0.4366032.$

25) Sample = 2+1 = 3

26) Sample > no of samples

goto next step

27) iter = iter + 1 = 2+1 = 3

28) iter > epochs

goto next step

29) Print m, c

$m = 2.025057$

$c = 0.4366032.$

30) compute mse

$$= \frac{(3.4 - 0.841614) + (3.8 - 1.246626)}{2}$$

$$= \frac{(2.558386) + (2.553374)}{2}$$

mse = 2.556063