ASSIGNMENT-3

18KU1A05-15

Let us consider a sample dataset having one input (x_i^a) and one output (y_i^a) and no. of samples 4. Develop a simple linear regression model using SGD 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

Iteration 1:-

Consider $m=1$, $c=1$, $\eta=0.1$, $ns=2$

$$\epsilon = \frac{1}{2}[y_i - mx_i - c)^2$$

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

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

for $i=1$

$$\frac{\partial E}{\partial m} = -(y_1 - mx_1 - c)x_1$$

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

$$= -0.44$$

$$\frac{\partial E}{\partial c} = -(y_1 - mx_1 - c)$$

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

$$= -2.2$$

⇒ calculating delta values

$$\Delta m = -\eta \cdot \frac{\partial E}{\partial m} = -(0.1)(-0.44)$$
$$= -0.044$$

$$\Delta c = -\eta \cdot \frac{\partial E}{\partial c} = -(-0.01)(-2.2)$$
$$= -0.22$$

⇒ updating the values of m & c.

$$m = m + \Delta m = 1 - 0.044$$
$$= 0.956$$

$$c = c + \Delta c = 1 - 0.22$$
$$= 0.78$$

Iteration 2: $m = 0.956$ and $c = 0.78$, $i = 2$

$$\frac{\partial E}{\partial m} = -(y_2 - mx_2 - c)x_2$$
$$= -(3.8 - (0.956)(0.4) - 0.78)(0.4)$$
$$= -1.05504$$

$$\frac{\partial E}{\partial c} = -(y_2 - mx_2 - c)$$
$$= -(3.8 - (0.956)(0.4) - 0.78)$$
$$= 2.6376$$

⇒ Calculating delta values

$$\Delta m = -\eta \cdot \frac{\partial E}{\partial m} = -(-0.1)(-1.05504)$$
$$= -0.105504$$

$\Delta c = -\eta \cdot \frac{\partial E}{\partial c} = -(0.1)(-2.6376)$

$= -0.26376$

$\Rightarrow$ updating values of m and c

$m = m + \Delta m = 0.956 - 0.105504$

$= 0.8504$

$c = c + \Delta c = 0.78 - 0.26376$

$= 0.51624$

Iteration 3: $m = 0.8504, c = 0.51624$ and its

$\frac{\partial E}{\partial m} = -(y_3 - mx_3 - c)x_3$

$= -(3.4 - (0.8504)(0.2) - 0.51624)$

$= -2.7136$

$\Rightarrow$ calculating delta values

$\Delta m = -\eta \cdot \frac{\partial E}{\partial m} = -(-0.1)(-0.5427)$

$= -0.054273$

$\Delta c = -\eta \cdot \frac{\partial E}{\partial c} = -(-0.1)(-2.7136)$

$= -0.27136$

$\Rightarrow$ updating m and c values

$m = m + \Delta m = 0.9576 - 0.05427$

$= 0.79622$

$$C = C + \Delta C = 0.51624 - 0.27136$$

$$= 0.24488$$

⇒ update sample = 1+1 = 2, i = 2

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

$$= -(3.8 - (0.79622)0.4 - 0.24488)0.4$$

$$= -1.29468$$

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

$$= -(3.8 - (0.79622)0.4 - 0.24488)$$

$$= -3.236$$

⇒ calculating delta values

$$\Delta m = -\eta \cdot \frac{\partial E}{\partial m} = -(-0.1)(-1.29468) = -0.129$$

$$\Delta c = -\eta \cdot \frac{\partial E}{\partial c} = -(-0.1)(-3.236) = -0.3236$$

⇒ updating m & c values.

$$m = m + \Delta m = 0.79622 + (-0.129)$$

$$= 0.66$$

$$c = c + \Delta c = 0.24488 + (-0.323)$$

$$= -0.079$$