18K41A05F9

Assignment-07

Batch Gradient Descent

X	Y
0.2	3.4
0.4	3.6

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

$lr = \eta = 0.1$

epochs = 2

ns = 2

Step-2: iter = 1 Step-3: ~~sample = 1~~

Step-4:

$$\frac{\partial E}{\partial m} = -\frac{1}{ns}\sum_{i=1}^{ns}(y_i - mx_i - c)x_i$$

$$= -\frac{1}{2}\Big[\big((3.4) - (1)(0.2) - (-1)\big)(0.2) + \big((3.6) - (1)(0.4) - (-1)\big)(0.4)\Big]$$

$$= \frac{-1}{2}\Big[0.84 + 1.76\Big] = \frac{-1}{2}(2.60)$$

$$= -1.3$$

$$\frac{\partial E}{\partial c} = \frac{-1}{ns}\sum_{i=1}^{ns}(y_i - mx_i - c)$$

$$= \frac{-1}{2}\Big[\big((3.4) - (1)(0.2) - (-1)\big) + \big((3.6) - (1)(0.4) - (+1)\big)\Big]$$

$$= \frac{-1}{2}\Big[4.2 + 4.4\Big] = \frac{-1}{2}(8.6) = -4.3$$

Step-4: $\Delta m = -\frac{\partial E}{\partial m}(\eta) = -(-1.3)(0.1) = 0.13$

$\Delta C = -\eta \frac{\partial E}{\partial C} = -(0.1)(-4.3) = 0.43$

Step-5:

$m = m + \Delta m = 1 + 0.13 = 1.13$

$C = C + \Delta C = -1 + 0.43 = -0.57$

Step-6: iter = iter + 1 = 2 ≤ epochs → True

Go to step-3

Step-7: $\frac{\partial E}{\partial m} = -\frac{1}{2}\Big(\big(3.4 - (1.13)(0.2) - (-0.57)\big)0.2$

$+ \big(3.6 - (1.13)(0.4) - (-0.57)\big)0.4 \Big)$

$= -\frac{1}{2}(3.2994 + 1.5672) = -2.4333$

$\frac{\partial E}{\partial C} = -\frac{1}{2}\Big((3.4 - (1.13)(0.2) - (-0.57) +$

$(3.6 - (1.13)(0.4) - (-0.57))$

$= -\frac{1}{2}(3.744 + 3.918) = -3.831$

Step-8: $\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.1)(-2.4333) = 0.24333$

$\Delta C = -\eta \frac{\partial E}{\partial C} = -(0.1)(-3.831) = 0.3831$

Step-9: $m = m + \Delta m = 1.13 + 0.24333 = 1.37333$

$C = C + \Delta C = -0.57 + 0.3831 = -0.1869$

Step-10: iter = iter + 1 = 3 ≤ epochs → False

Goto next step.

Step-11: print(m, c)

(1.37333 , -0.1869)

Step-12:

Mean Square Error

$$= \frac{\left(3.4 - (1.37333)(0.2) - (-0.1869)\right)^2 + \left(3.6 - (1.37333)(0.4) - (-0.1869)\right)^2}{2}$$

$$= \frac{(10.97089) + (11.81687)}{2}$$

$$= 11.39388$$