Assignment-7

18K41A05F4

Batch Gradient Descent

steps

1) Read dataset [x, y], epochs = 2, m = 1, c = -1, $\eta = 0.1$, $n_s = 2$

x	y
0.2	3.4
0.4	3.8

2) ptr = 1

3) $E = \frac{1}{2n_s} \sum_{i=1}^{n_s} (y_i - mx_i - c)^2$

$$\frac{\partial E}{\partial m} = \frac{-1}{n_s} \left[\sum_{i=1}^{n_s} (y_i - mx_i - c) x_i \right]$$

$$= \frac{-1}{2} [(3.4 - (1)(0.2) + 1)(0.2) + (3.8 - (1)(0.4) + 1)(0.4)]$$

$$= \frac{-1}{2} [(3.4 - 0.2 + 1)(0.2) + (3.8 - 0.4 + 1)(0.4)]$$

$$= \frac{-1}{2} [(4.2)(0.2) + (4.4)(0.4)] = \frac{-1}{2} [0.84 + 1.76]$$

$$\frac{\partial E}{\partial m} = -1.3$$

$$\frac{\partial E}{\partial c} = \frac{-1}{n_s} \left[\sum_{i=1}^{n_s} (y_i - mx_i - c) \right] = \frac{-1}{2} [4.2 + 4.4] = \frac{-1}{2} [8.6]$$

$$= -4.3$$

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

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

5) $m = 1 + 0.13 = 1.13$

$c = -1 + 0.93 = -0.57$

6) ptr = ptr + 1 = 1 + 1 = 2

7) if $2 > 2 \Rightarrow$ false
goto step 3

8) $\frac{\partial E}{\partial m} = -\frac{1}{n_s}\left[\sum_{i=1}^{n_s}(y_p - mx_p - c)\,x_p\right]$

$= -\frac{1}{2}\left[[(3.4-(1.13\times0.2)+0.57)\times0.2]+[(3.8-(1.13\times0.4)+0.57)\times0.4]\right]$

$= -\frac{1}{2}\left[(3.744)\times(0.2)+(3.918)\times0.4\right]$

$\frac{\partial E}{\partial m} = -\frac{1}{2}\left[3.2994+1.5672\right] = -2.4333$

$\frac{\partial E}{\partial c} = -\frac{1}{2}\left[3.744+3.918\right] = -3.831$

9) $\Delta m = -\eta\frac{\partial E}{\partial m} = -(0.1)\times(-2.4333) = 0.24333$

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

10) $m = m+\Delta m = 1.13+0.24333 = 1.37333$

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

11) $\text{iter} = \text{iter}+1 = 2+1 = 3$

12) if iter > epoch $\Rightarrow 3 > 2$
goto nextstep

13) Print m, c

$m = 1.37333$
$c = -0.1869$

14) $mse = [+3.4 - (1.37333 \times 0.2) + 0.1869]^2 + [3.8 - (1.37333 \times 0.4) + 0.1869)]^2$

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

$$mse = 11.39388$$