

Assignment - 3

Let us consider sample dataset have one input (x_i, a) and one output (y_i, a) and number of samples. Develop a sample regression model using stochastic gradient descent of dimensions.

| 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 |

→ Do manual calculations for 2 iterations, 2 samples.

Step 1: $x, y, m=1, c=-1, \eta=0.1, \text{epochs}=2, n_s=2$

Step 2: $i^{th} = 1$

Step 3: sample = 1

$$\begin{aligned}\text{Step 4: } \frac{\partial E}{\partial m} &= -(8 \cdot 4 - 4)(0.2) - (-1) \cdot 0.2 \\ &= -0.84\end{aligned}$$

$$\begin{aligned}\frac{\partial F}{\partial c} &= -(3 \cdot 4)(0.2 + 1) \\ &= -4.2\end{aligned}$$

$$\text{Step 5: } \Delta m = -(0.1)(-0.84) = 0.084$$

$$\begin{aligned}\Delta c &= -(0.1)(-4.2) \\ &= -0.42\end{aligned}$$

$$\text{Step 6: } m = m + \Delta m$$

$$= 1 + 0.084$$

$$= 1.084$$

$$\begin{aligned}c &= c + \Delta c \\ &= -1 + 0.42 = -0.58\end{aligned}$$

step 7: sample + = 1

$$= +1 \\ = 2$$

step 8: if (sample > ns)

2 > 2

goto step 9

else

goto step 4

step 4: $\frac{\partial E}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58) \cdot 0.4$

$$= -1.5785$$

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

$$= -3.8464$$

step 5: $\Delta m = -(0.1)(-1.5785) = 0.1578$

$$\Delta c = -(0.1)(-3.8464) = 0.3846$$

step 7: sample + = 2 + 1 = 3

step 6: $m = m + \Delta m = 1.084 + 0.1578 = 1.2418$

$$c = c + \Delta c = -0.58 + 0.3846 = -0.1954$$

step 8: if (sample > ns)

3 > 2

goto step 9

else

goto step 4.

step 7: iter + = 1

$$= 1 + 1 = 2$$

step 10: if (iter > epochs)

2 > 2

goto step 1,

else

goto step 3.

step 3: sample + 1

step 4

$$\begin{aligned}\frac{\partial E}{\partial m} &= -(3.4 - (1.2)(0.2) + 0.18)0.2 \\ &= -(3.34)0.2 \\ &= -0.668\end{aligned}$$

$$\begin{aligned}\frac{\partial E}{\partial c} &= -(3.4 - (1.2)(0.2) + 0.18) \\ &= -3.34\end{aligned}$$

step 5: $\Delta m = -(0.1)(-0.668)$

$$= 0.0668$$

$$m = m + \Delta m = 1.24 + 0.066 = 1.3$$

step 6: $m = m + \Delta m = 1.24 + 0.066 = 1.3$

$$c = c + \Delta c = 0.18 + 0.33 = 0.15$$

step 7: sample + 1
= 1 + 1 = 2

step 8: if (sample > ns)

2 > 2

goto step 9

else

goto step 4.

step 4: $\frac{\partial E}{\partial m} = -(3.8 - (1.3)(0.4) - 0.15)0.4$

$$= -1.25$$

$$\begin{aligned}\frac{\partial E}{\partial c} &= -(3.8 - (1.3)(0.4) - 0.15) \\ &= -3.13\end{aligned}$$

step 5: $\Delta m = -(0.1)(-1.25) = 0.12$

$$\Delta c = -(0.1)(-3.13) = 0.31$$

step 6: $m = m + \Delta m = 1.3 + 0.12 = 1.42$

$$c = c + \Delta c = 0.15 + 0.31 = 0.46$$

step 7: sample = sample + 1
= 2 + 1 = 3

Step 8: if ($\text{sample} > \text{ns}$)

$$3 > 2$$

goto step 9

else

goto step 4

Step 4: $\text{iter} = \text{iter} + 1$

$$= 2 + 1 = 3$$

Step 10: ~~if~~ if ($\text{iter} > \text{cpoches}$)

$$3 > 2$$

goto step 11

else

goto step 3.

Step 11: print m & c

$$m = 1.42 \quad c = 0.46$$