# Assignment - 4

Estimate the bicarbonates of well water based on its PH value using simple regression model.

Manual calculation:

Step 1: Read data $m = 1$, $c = 1$, $\eta = 0.1$, epochs = 1, ns = 2.

step 2: iter = 1

step 3: $i = 1$

step 4: $\frac{\partial \epsilon}{\partial m} = -(y_i - mx_i - c)x_i$

$= -(157 - (1)(7.6) + 1)(7.6)$

$= -(158 - 7.6)(7.6)$

$= -(150.4)(7.6)$

$= -(1143.04)$

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

$= -(157 - (1)(7.6) + 1)$

$= -(150.4)$

step 5: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m} = -(0.1) - (1143.04)$

$= 114.304$

$\Delta c = -\eta \frac{\partial \epsilon}{\partial c} = -(0.1)(-150.4)$

$= 15.04$

step 6: $m = m + \Delta m$

$= 1 + 114.304$

$= 115.304$

$c = c + \Delta c$

$= -1 + 15.04$

$= 14.04$

step 7: $i = i+1 = 1+1 = 2$

step 8: if $(i \leq n_s)$

True → step 4

False → Next step

step 4:

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

$$= -(174 - (115.304)(7.1) - 14.04)(7.1)$$

$$= -(159.96 - 115.304)(7.1)$$

$$= -(44.656)(7.1)$$

$$= -(317.057)$$

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

$$= -(174 - (115.304)(7.1) - 14.04)$$

$$= -(44.656)$$

step 5: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m}$

$$= -(0.1)(-317.057)$$

$$= 31.7057$$

$$\Delta c = -\eta \frac{\partial \epsilon}{\partial c}$$

$$= -(0.1)(-44.656)$$

$$= 4.4656$$

step 6: $m = m + \Delta m$

$$= 115.304 + 31.7057$$

$$= 147.0097$$

$$c = c + \Delta c$$

$$= 14.04 + 4.4656 = 18.5056$$

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

step 8: if (i² ≤ n²s)
False → nextstep

step 9: iter = iter + 1 = 1 + 1 = 2

step 10: if (iter ≤ epochs)
False → nextstep

step 11: Read final model parameters
m = 147.0097
c = 18.5056 .

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step 10: if (iter² ≤ epochs²)

step 3: i = 2 .

step 4: $\frac{\partial \epsilon}{\partial m} = -(y_i - mx_i - c)x_i$
$= -(157 - (147.0097 \times 7.1) - 18.5056)(7.1)$
$= (905.27)(7.1) = (6427.44)$

$\frac{\partial \epsilon}{\partial c} = -(y_i - mx_i - c)$
$= -(157 - (147.0097(7.1) - 18.5056)$
$= -(157 - 1043.768 - 18.5056)$
$= 905.27$

step 5: $\Delta m = -\eta \frac{\partial \epsilon}{\partial m}$
$= -(0.1)(-6427.44)$
$= 642.744$

$$\Delta c = -\eta \frac{\partial e}{\partial c}$$

$$= -(0.1)(905.27)$$

$$= -90.527$$

Step 6: $m = m + \Delta m$

$$= 147.0097 + 642.744$$

$$= 789.753$$

$$c = c + \Delta c$$

$$= 18.5056 - 90.527$$

$$= -72.0214$$

Step 7: $i = i + 1 = 2 + 1 = 3$

Step 8: if $(i \leq n_s)$

True → step 4

false → Nextstep

Step 9: iter = iter + 1 = 2 + 1 = 3

Step 10: if (iter ≤ epochs)

false → Nextstep

Step 11: Read final model parameters

$m = 789.753$

$c = -72.0214$

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