

Parshvaneth Charteble Fruit!

A P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai) (Religious Jain Minority)

Subject: Machine Learning

Semester: VII

Numerical on Multiple Linear Regression solved using matrix concept

Q1. The data in the following table relate plant dry weight in grams (y) to percent soil organic matter (x1) and kilograms of supplemental soil nitrogen added per 1000 square metres (x2). Obtain the multiple regression equation.

Sol: The regression equation for the given data will be of the form:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 \alpha_1 + \hat{\beta}_2 \alpha_2$$

We want to estimate the coefficients Bo, B, and B2 using matrices.

first, we have to write the data in matrix form

Y	21	2/2
18.5	7	2.6
74.3		2.9
104.3	11_	5.6
84.6	11	3.1
95.9	7	5.2
109.2	11	5.5
102.7	3	7.1

$$X = \begin{bmatrix} 1 & 4 & 2.6 \\ 1 & 1 & 2.9 \\ 1 & 11 & 5.6 \\ 1 & 11 & 3.1 \\ 1 & 7 & 5.2 \\ 1 & 11 & 5.5 \\ 1 & 3 & 7.1 \end{bmatrix}$$

Dept.of Computer Engineering

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Now we find X TX matrix

$$X^{T}.X = \begin{bmatrix} 7 & 51 & 32 \\ 51 & 491 & 235 \\ 32 & 235 & 163.84 \end{bmatrix}$$

find the inverse of the matrix (xTx)

$$(x^{T}.x)^{-1} = \begin{bmatrix} 1.7996 & -0.0685 & -0.2532 \\ -0.0685 & 0.0101 & -0.0011 \\ -0.2532 & -0.0011 & 0.0571 \end{bmatrix}$$

The estimated regression coefficients is given by:

$$\hat{\beta} = (X^T X)^{-1} X^T Y$$

$$= \begin{bmatrix} 51.6 \\ 1.5 \\ 6.72 \end{bmatrix}$$

.. We get the multiple regression equation $\hat{y} = 51.6 + 1.5 \times 1 + 6.7 \times 2$