INTRODUCTION TO BUSINESS ANALYTICS

Regression Analysis

Regression Analysis is a statistical technique that explores the relationships between two or more variables.

Problem

In an electrochemical machining process, the amount of metal removed (y) is related to the gap (x) between tool and work piece. The following observations are obtained from the experiment. Fit a linear regression model and find its coefficients and coefficient of determination

y (in grams)	28	20	25	11	17
x (in mm)	5	3	4	1	2

Matrix Equations to solve problem

By Applying Method of Least squares Criteria, we obtain normal equations in matrix form

$$Y = \beta_0 + \beta_1 x$$

$$X'X\hat{\beta} = X'y$$

$$\hat{\beta} = (X'X)^{-1} X'y$$

Use this matrix equation for all regression problems

Matrix approach

Data for simple linear regression

y	x
y_1	x_1
y_2	x_2
$\vdots$	$\vdots$
y_n	x_n

Regression equation

$$Y = \beta_0 + \beta_1 x$$

$$\mathbf{y} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} \quad \mathbf{X} = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \quad \boldsymbol{\beta} = \begin{bmatrix} \beta_0 \\ \beta_1 \end{bmatrix}$$

Problem

In an electrochemical machining process, the amount of metal removed (y) is related to the gap (x) between tool and work piece. The following observations are obtained from the experiment.   Fit a linear regression model and find its coefficients and coefficient of determination

Solution:

y (in grams)	28	20	25	11	17
x (in mm)	5	3	4	1	2

$$Y = \beta_0 + \beta_1 x$$

Using the matrix approach we get $\beta = \begin{bmatrix} 7.6 \\ 4.2 \end{bmatrix}$

The estimated fitted line is $\hat{y}$ = 7.6 + 4.2 x