Sovled Example: Multiple Linear Regression

Dataset: $n = 4$

Predictor variables = > Independent Variables: X_1 and X_2

Response variable => Dependent Variables: y

Step 1: Prepare Regression Table

	X_1	X_2	y
	50	20	120
	62	25	150
	70	16	200
	75	11	215
Sum	**257**	**72**	**685**
Mean	**64.25**	**18**	**171.25**

	X_1^2	X_2^2	$X_1 X_2$	$X_1 y$	$X_2 y$
	2500	400	1000	6000	2400
	3844	625	1550	9300	3750
	4900	256	1120	14000	3200
	5625	121	825	16125	2365
Σ	**16869**	**1402**	**4495**	**45425**	**11715**
Reg Σ	**356.75**	**356.75**	**-131**	**1413.75**	**-615**

Step 2: Calculate Regression Sums

$\Sigma x_1^2 = \Sigma X_1^2 - (\Sigma X_1)^2 / n =$ 356.75

$\Sigma X_2^2 = \Sigma X_2^2 - (\Sigma X_2)^2 / n =$ 106

$\Sigma X_1X_2 = \Sigma X_1X_2 - (\Sigma X_1 \Sigma X_2) / n =$ -131

$\Sigma X_1y = \Sigma X_1y - (\Sigma X_1 \Sigma y) / n =$ 1413.75

$\Sigma X_2y = \Sigma X_2y - (\Sigma X_2 \Sigma y) / n =$ -615

Step 3: Calculate b_0, b_1, and b_2

$b_1 = [(\Sigma X_2^2)(\Sigma X_1y) - (\Sigma X_1X_2)(\Sigma X_2y)] / [(\Sigma x_1^2)(\Sigma X_2^2) - (\Sigma X_1X_2)^2] =$ 3.3548

$b_2 = [(\Sigma X_1^2)(\Sigma X_2y) - (\Sigma X_1X_2)(\Sigma X_1y)] / [(\Sigma x_1^2)(\Sigma X_2^2) - (\Sigma X_1X_2)^2] =$ -1.6558

$b_0 = \bar{y} - b_1\bar{x}_1 - b_2\bar{x}_2 =$ -14.4937

Step 4: Place b_0, b_1, and b_2 in the estimated linear regression equation.

Estimated linear regression equation; $\hat{y}$

$\hat{y} = b_0 + b_1X_1 + b_2X_2$

$\hat{y} = -14.494 + 3.355 * X_1 + -1.656 * X_2$

Interpret a Multiple Linear Regression Equation

$b_0 = -14.494$ means => if $X_1 = X_2 = 0$, then $y = -14.494$

$b_1 = 3.355$ => 1 unit increase in X_1 is associated with a 3.355 unit increase in y; if X_2 is constant.

$b_2 = -1.656$ => 1 unit increase in X_2 is associated with a -1.656 unit decrease in y; if X_1 is constant.

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