General Straight-Line Regression Model: Example

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Problem Statement

The torque T needed to turn the torsional spring of a mousetrap through an angle, θ is given below

Angle, θ Radians	Torque, T N · m
0.70	0.19
0.96	0.21
1.13	0.23
1.57	0.25
1.92	0.31

Find the constants k_1 and k_2 of the regression model

$$T = k_1 + k_2\theta$$

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$$k_2 = \frac{n \sum_{i=1}^{n} \theta_i T_i - \sum_{i=1}^{n} \theta_i \sum_{i=1}^{n} T_i}{n \sum_{i=1}^{n} \theta_i^2 - \left(\sum_{i=1}^{n} \theta_i \right)^2}$$

$$k_1 = \bar{T} - k_2 \bar{\theta}$$

θ	T	θ^2	θT
0.70	0.19	0.4900	0.1330
0.96	0.20	0.9216	0.1920
1.13	0.23	1.2769	0.2599
1.57	0.25	2.4649	0.3925
1.92	0.31	3.6864	0.5952
$\sum_{i=1}^{5}$ 6.28 ✓	1.18	8.8398 ✓	1.5726

$$k_2 = \frac{5\sum_{i=1}^{5}\theta_i T_i - \sum_{i=1}^{5}\theta_i \sum_{i=1}^{5} T_i}{5\sum_{i=1}^{5}\theta_i^2 - \left(\sum_{i=1}^{5}\theta_i\right)^2}$$

$$= \frac{5(1.5726) - (6.28)(1.18)}{5(8.8398) - (6.28)^2} = 0.09507$$

$$k_1 = \bar{T} - k_2 \bar{\theta}$$

$$= \left(\frac{1.18}{5}\right) - (0.09507)\left(\frac{6.28}{5}\right)$$

$$= 0.1166$$

$$T = k_1 + k_2 \theta$$

$$\underline{T} = \underline{0.1166} + \underline{0.09507}\,\underline{\theta}$$

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END

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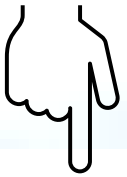

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