

Special cases of Scheffes confidence sets: Applications to simple linear regression

stats545.4 545.4 Multivariate confidence intervals

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The setup

$$y_i \sim n(\alpha + \beta x_i, \sigma^2), \quad i = 1, \dots, n$$

The intercept

C.I. for α alone is the same as before.

The slope

C.I. for slope is the same as before

A simultaneous confidence set for the slope and intercept

Confidence ellipse in the α - β plane

$$\left\{ \psi : \frac{(\hat{\psi} - \psi)' \mathbf{B}^{-1} (\hat{\psi} - \psi) / q}{\|\mathbf{y} - \mathbf{X}\hat{\beta}\|^2 / (n - r)} \leq F_{q, n-r, 1-\alpha} \right\}$$

where

$$\psi = \begin{pmatrix} \alpha \\ \beta \end{pmatrix}$$

Confidence band for the regression line

Simultaneous band for the entire regression line:

$$\left\{ a + bx \pm s \sqrt{2F_{2,n-2,1-\alpha} \left\{ \frac{1}{n} + \frac{(x - \bar{x})^2}{\sum_i (x_i - \bar{x})^2} \right\}} : x \in \mathbb{R} \right\}$$

Scheffes confidence intervals giving reg line

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