Package ‘crossReg’

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Type Package

Title Confidence intervals for crossover points of two simple regression lines

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Description This package provides functions to calculate confidence intervals for crossover points of two simple linear regression lines using the non-linear regression, the delta method, the Fieller method, and the bootstrap methods.

Suggests boot, MASS

License GPL-2

NeedsCompilation no

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R topics documented:

crossReg-package — *Confidence intervals for crossover points*

Description

Given the linear regression model y = b0 + b1*x1 + b2*x2 + b3*x1*x2, the crossover point of the two simple regression lines implied by the linear regression model can be expressed as C = -b2/b3 (Aiken and West, 1991). This package provides functions to calculate confidence intervals for crossover points of two simple linear regression lines using the non-linear regression, the delta method, the Fieller method, and the bootstrap methods.

Details

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License:	GPL-2

Author(s)

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BootC — *Confidence intervals for crossover points using the bootstrap methods*

Description

Calculate confidence intervals for crossover points of two simple linear regression lines using the bootstrap

Usage

```
BootC(Data)
```

Arguments

`Data`	a dataframe containing data values for y, x1, and x2

Details

The function BootC() calculates confidence intervals for the crossover point C using the boot package in R. Bootstrap confidence intervals include Normal, Basic, Percentile, and BCa confidence intervals.

Author(s)

Sunbok Lee

References

Bollen, K. A., & Stine, R. (1990). Direct and indirect effects: Classical and bootstrap estimate of variability. Sociological Methodology, 20, 115-140.

Examples

```
# example data
library(MASS)
out <- mvrnorm(1000, mu = c(0,0), Sigma = matrix(c(1,0.2,0.2,1), ncol = 2),empirical = TRUE)
x1 <- out[,1]
x2 <- out[,2]
epsilon <-rnorm(1000,0,1)
y <- 1 + 1*x1 + 0.5*x2 + 1*x1*x2 + epsilon  # true C = -0.5/1 = -0.5
simData <- data.frame(y=y,x1=x1,x2=x2)

# run BootC()
library(boot)
BootC(simData)
```

DeltaC *Confidence intervals for crossover points using the delta method*

Description

Calculate confidence intervals for crossover points of two simple linear regression lines using the delta method.

Usage

```
DeltaC(Data, order)
```

Arguments

Data	a dataframe containing data values for y, x1, and x2
order	a scalar number representing the order of Delta method. 1=1st order delta method and 2=2nd order delta method

Details

Given a linear regression model y = b0 + b1*x1 + b2*x2 + b3*x1*x2, the crossover point of two simple regression lines can be directly calculated based on C=-b2/b3. The Delta method can be used to estimate the standard error of C = -b2/b3 based on the standard errors of b2 and b3 which can be obtained from a linear regression. The function DeltaC() calculates the confidence intervals for C based on the standard error of C obtained from the delta method.

Value

`LowCI`	lower bound of confidence intervals for C based on the delta method
`UpperCI`	upper bound of confidence intervals for C based on the delta method

Author(s)

Sunbok Lee

References

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Assessing moderated mediation hypotheses: Theory, methods, and prescriptions. Multivariate Behavioral Research, 42, 185-227.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. Sociological Methodology, 13, 290-312.

Examples

```
# example data
library(MASS)
out <- mvrnorm(1000, mu = c(0,0), Sigma = matrix(c(1,0.2,0.2,1), ncol = 2),empirical = TRUE)
x1 <- out[,1]
x2 <- out[,2]
epsilon <-rnorm(1000,0,1)
y <- 1 + 1*x1 + 0.5*x2 + 1*x1*x2 + epsilon  # true C = -0.5/1 = -0.5
simData <- data.frame(y=y,x1=x1,x2=x2)

# run DeltaC()
DeltaC(simData,2)
```

`FiellerC` *Confidence intervals for crossover points using the Fieller method*

Description

Calculate confidence intervals for crossover points of two simple linear regression lines using the Fieller method.

Usage

```
FiellerC(Data)
```

Arguments

Data — a dataframe containing data values for y, x1, and x2

Details

Fieller (1954) proposed a method for calculating the confidence interval for the ratio of two normally distributed random variables without assuming any particular form for the sampling distribution of the ratio itself. The function FiellerC() calculates confidence intervals for the crossover points of two simple regression lines using the Fieller method.

Value

LowCI — lower bound of confidence intervals for C based on the Fieller method

UpperCI — upper bound of confidence intervals for C based on the Fieller method

Author(s)

Sunbok Lee

References

Fieller, E. C. (1954). Some problems in interval estimation. Journal of the Royal Statistical Society, Series B: Methodological, 16, 175-185.

Examples

```
# example data
library(MASS)
out <- mvrnorm(1000, mu = c(0,0), Sigma = matrix(c(1,0.2,0.2,1), ncol = 2),empirical = TRUE)
x1 <- out[,1]
x2 <- out[,2]
epsilon <-rnorm(1000,0,1)
y <- 1 + 1*x1 + 0.5*x2 + 1*x1*x2 + epsilon  # true C = -0.5/1 = -0.5
simData <- data.frame(y=y,x1=x1,x2=x2)

# run FiellerC()
FiellerC(simData)
```

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nonLinearC — *Confidence intervals for crossover points using non-linear regression*

Description

Calculate confidence intervals for crossover points of two simple linear regression lines using non-linear regression.

Usage

```
nonLinearC(Data, startingValue)
```

Arguments

- `Data` — a dataframe containing data values for y, x1, and x2
- `startingValue` — a list containing starting values for estimating parameters in non-linear regression

Details

For a crossover point C = -b2/b3 of the two simple regression lines, Widaman et al. (2012) proposed to estimate C using the non-linear regression of the form y = A0 + A1*(x1-C) + A2*(x1-C)*x2. The function nonLinearC() estimates C using the non-linear regression and calculates the confidence intervals for C based on the standard error of C obtained from a non-linear regression.

Value

- `C_Hat` — estimate of C from a non-linear regression
- `SE` — standard error of C from a non-linear regression
- `LowCI` — lower bound of confidence intervals for C based on a non-linear regression
- `UpperCI` — upper bound of confidence intervals for C based on a non-linear regression

Author(s)

Sunbok Lee

References

Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. Newbury Park, CA: Sage

Widaman, K. F., Helm, J. L., Castro-Schilo, L., Pluess, M., Stallings, M. C., & Belsky, J. (2012). Distinguishing ordinal and disordinal interactions. Psychological Methods, 17, 615-622

Examples

```
# set initial values for non-linear regression
startingValue <- list(A0 = 1, B1 = 1, B2 = 1, C = 1)

# example data
library(MASS)
out <- mvrnorm(1000, mu = c(0,0), Sigma = matrix(c(1,0.2,0.2,1), ncol = 2),empirical = TRUE)
x1 <- out[,1]
x2 <- out[,2]
epsilon <-rnorm(1000,0,1)
y <- 1 + 1*x1 + 0.5*x2 + 1*x1*x2 + epsilon  # true C = -0.5/1 = -0.5
simData <- data.frame(y=y,x1=x1,x2=x2)

# run nonLinearC()
nonLinearC(simData, startingValue)
```

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