Package ‘RI2by2’

October 21, 2016

Type Package

Title Randomization Inference for Treatment Effects on a Binary Outcome

Version 1.3

Author Joseph Rigdon, Wen Wei Loh, Michael G. Hudgens

Maintainer Wen Wei Loh <wwloh@email.unc.edu>

Imports compiler, gtools, Rcpp

LinkingTo Rcpp

Description Computes attributable effects based confidence interval, permutation test confidence interval, or asymptotic confidence interval for the average treatment effect on a binary outcome.

License GPL (>= 3)

Suggests testthat

NeedsCompilation yes

Repository CRAN

Date/Publication 2016-10-21 10:42:34

R topics documented:

AE.CI ................................................................. 2
Perm.CI ................................................................. 3
Perm.CI.RLH ......................................................... 4
Robins.CI ............................................................. 5

Index 7
Description

Computes the attributable effects based confidence interval for the average treatment effect on a binary outcome in an experiment where \( m \) of \( n \) individuals are randomized to treatment by design.

Usage

\[
\text{AE.CI}(\text{data}, \text{level})
\]

Arguments

- **data**: observed 2 by 2 table in matrix form where row 1 is the treatment assignment \( Z=1 \) and column 1 is the binary outcome \( Y=1 \)
- **level**: significance level of hypothesis tests, i.e., method yields a \( 100(1-\text{level})\% \) confidence interval

Details

The attributable effects based confidence interval from inverting \( n + 2 \) hypothesis tests.

Value

- **tau.hat**: estimated average treatment effect
- **lower**: lower bound of confidence interval
- **upper**: upper bound of confidence interval

Author(s)

Joseph Rigdon <jrigdon@stanford.edu>

References


Examples

\[
\text{ex} = \text{matrix}(c(8,2,3,7), 2, 2, \text{byrow=TRUE})
\]

\[
\text{AE.CI(}\text{ex}, 0.05)\]
Permutation test confidence interval for a treatment effect on a binary outcome

Description
Computes permutation-based confidence intervals for the average treatment effect on a binary outcome in an experiment where \( m \) of \( n \) individuals are randomized to treatment by design.

Usage

\[
\text{Perm.CI(data, level, nperm)}
\]

Arguments

data | observed 2 by 2 table in matrix form where row 1 is the treatment assignment \( Z=1 \) and column 1 is the binary outcome \( Y=1 \)

level | significance level of hypothesis tests, i.e., method yields a \( 100(1-\text{level})\% \) confidence interval

nperm | number of randomizations to perform for each hypothesis test

Details
The permutation confidence interval results from inverting \( O(n^4) \) hypothesis tests where \( n \) is the total number of observations in the observed 2 by 2 table. For each hypothesis test, if \( \binom{n}{m} \) is less than or equal to \( n \text{perm} \), \( \binom{n}{m} \) randomizations are performed, but if \( \binom{n}{m} \) is greater than \( n \text{perm} \), a random sample with replacement of \( n \text{perm} \) randomizations are performed.

Value

tau.hat | estimated average treatment effect

lower | lower bound of confidence interval

upper | upper bound of confidence interval

Author(s)
Joseph Rigdon <jrigdon@stanford.edu>

References


Examples

\[
\text{ex = matrix(c(8,2,3,7),2,2,byrow=TRUE)}
\]

\[
\text{Perm.CI(ex,0.05,100)}
\]
Perm.CI.RLH

Permutation test confidence interval for a treatment effect on a binary outcome

Description

Computes permutation-based confidence intervals for the average treatment effect on a binary outcome in an experiment where \( m \) of \( n \) individuals are randomized to treatment by design. This function is based on the modified approach (RLH) in Rigdon, Loh and Hudgens (forthcoming). The Chiba (2015) and Blaker (2000) intervals are also returned. There is an additional option of specifying the maximum number of hypothesis tests to be carried out.

Usage

Perm.CI.RLH(data, level, verbose=FALSE, total_tests=NA)

Arguments

data: observed 2 by 2 table in matrix form where row 1 is the treatment assignment \( Z=1 \) and column 1 is the binary outcome \( Y=1 \)
level: significance level of hypothesis tests, i.e., method yields a \( 100(1-\text{level})\% \) confidence interval
verbose: If TRUE, returns an additional data frame listing all the values of \( (n_{11}, n_{10}, n_{01}, n_{00}) \) tested, and the corresponding p-values; default = FALSE.
total_tests: maximum number of hypotheses to be tested in total, with a minimum of two for each possible value of \( (n_{10} - n_{01})/n \); default = NA. By default, all hypotheses are evaluated until the minimum and maximum values of \( (n_{10} - n_{01})/n \) with p-values \( \geq \text{level} \) (or \( \text{level}/2 \) for the Chiba intervals) are found.

Value

A list with the following items:

Chiba: Chiba confidence interval
RLH: RLH confidence interval
Blaker: Blaker confidence interval
tau.hat: estimated average treatment effect
p_values: if verbose=TRUE, a data frame with all the p-values from the hypothesis tests; default=FALSE

Author(s)

Wen Wei Loh <wwloh@email.unc.edu>
References


Rigdon, J.R., Loh W.W. and Hudgens, M.G. (forthcoming). Response to comment on "Randomization inference for treatment effects on a binary outcome."

Examples

```r
ex = matrix(c(11,1,7,21),2,2,byrow=TRUE)
Perm.CI.RLH(ex, 0.05)

ex = matrix(c(7,5,1,27),2,2,byrow=TRUE)
Perm.CI.RLH(ex, 0.05)
Perm.CI.RLH(ex, 0.05, verbose=TRUE)

ex = matrix(c(33,15,11,37),2,2,byrow=TRUE)
Perm.CI.RLH(ex, 0.05, total_tests=1000)
Perm.CI.RLH(ex, 0.05)

ex = matrix(c(40,60,15,85),2,2,byrow=TRUE)
Perm.CI.RLH(ex, 0.05, total_tests=1000)
## Not run: Perm.CI.RLH(ex, 0.05)
```

**Robins.CI**

*Asymptotic confidence interval for a treatment effect on a binary outcome*

**Description**

Computes the Robins (1988) confidence interval for the average treatment effect on a binary outcome in an experiment where \( m \) of \( n \) individuals are randomized to treatment by design.

**Usage**

```r
Robins.CI(data, level)
```

**Arguments**

- `data` observed 2 by 2 table in matrix form where row 1 is the treatment assignment \( Z=1 \) and column 1 is the binary outcome \( Y=1 \)
- `level` significance level of hypothesis tests, i.e., method yields a \( 100(1\text{-level}) \)% confidence interval
Details

The Robins (1988) confidence interval is similar in form to the well known Wald confidence interval for a difference in proportions, but is guaranteed to have smaller width.

Value

tau.hat estimated average treatment effect
lower lower bound of confidence interval
upper upper bound of confidence interval

Author(s)

Joseph Rigdon <jrigdon@stanford.edu>

References


Examples

```r
#Example 1 from Robins (1988)
ex = matrix(c(40,60,15,85),2,2,byrow=TRUE)
Robins.CI(ex,0.05)
```
Index

*Topic attributable effects
  AE.CI, 2
*Topic permutation test
  Perm.CI, 3
*Topic randomization inference
  AE.CI, 2
  Perm.CI, 3
  Robins.CI, 5

AE.CI, 2
Perm.CI, 3
Perm.CI.RLH, 4
Robins.CI, 5