Package 'RI2by2'

October 12, 2022

Type Package

Title Randomization Inference for Treatment Effects on a Binary Outcome

Version 1.3

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Imports compiler, gtools, Rcpp

LinkingTo Rcpp

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

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

```
AE.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-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

Rigdon, J.R. and Hudgens, M.G. (2015). Randomization inference for treatment effects on a binary outcome. *Statistics in Medicine, 34(6), 924-935*.

Examples

```
ex = matrix(c(8,2,3,7),2,2,byrow=TRUE)
AE.CI(ex,0.05)
```

Perm.CI *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

```
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-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 nperm, $\binom{n}{m}$ randomizations are performed, but if $\binom{n}{m}$ is greater than nperm, a random sample with replacement of nperm 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

Rigdon, J.R. and Hudgens, M.G. (2015). Randomization inference for treatment effects on a binary outcome. *Statistics in Medicine, 34(6), 924-935*.

Examples

```
ex = matrix(c(8,2,3,7),2,2,byrow=TRUE)
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-`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 $\geq$ `level` (or `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. and Hudgens, M.G. (2015). Randomization inference for treatment effects on a binary outcome. *Statistics in Medicine, 34(6), 924-935*.

Chiba, Y. (2015). Exact tests for the weak causal null hypothesis on a binary outcome in randomized trials. *Journal of Biometrics & Biostatistics, 6(244)*.

Chiba, Y. (2016). A note on exact confidence interval for causal effects on a binary outcome in randomized trials. *Statistics in Medicine, 35(10), 1739-1741*.

Blaker, H. (2000). Confidence curves and improved exact confidence intervals for discrete distributions. *Canadian Journal of Statistics, 28(4), 783-798*.

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

```
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

```
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-`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

Robins, J.M. (1988). Confidence intervals for causal parameters. *Statistics in Medicine, 7(7), 773-785.*

Examples

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

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