Package ‘retrodesign’

March 8, 2019

Type  Package
Title  Tools for Type S (Sign) and Type M (Magnitude) Errors
Version  0.1.0
Description  Provides tools for working with Type S (Sign) and Type M (Magnitude) errors, as proposed in Gelman and Tuerlinckx (2000) <doi.org/10.1007/s001800000040> and Gelman & Carlin (2014) <doi.org/10.1177/1745691614551642>. In addition to simply calculating the probability of Type S/M error, the package includes functions for calculating these errors across a variety of effect sizes for comparison, and recommended sample size given “tolerances” for Type S/M errors. To improve the speed of these calculations, closed forms solutions for the probability of a Type S/M error from Lu, Qiu, and Deng (2018) <doi.org/10.1111/bmsp.12132> are implemented. As of 1.0.0, this includes support only for simple research designs. See the package vignette for a fuller exposition on how Type S/M errors arise in research, and how to analyze them using the type of design analysis proposed in the above papers.

Depends  R (>= 3.1.0)
License  MIT + file LICENSE
URL  https://github.com/andytimm/retrodesign
BugReports  https://github.com/andytimm/retrodesign/issues
Encoding  UTF-8
LazyData  true
RoxygenNote  6.1.1
Imports  graphics
Suggests  ggpplot2, knitr, rmarkdown, gridExtra, testthat
VignetteBuilder  knitr
NeedsCompilation  no
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**Description**

Calculates Power, Type S, and Type M error and returns them in a list or df, depending on whether a single true effect size or range is provided. `retro_design()` is faster as it uses the closed form solution from Lu et al. (2018), but this function can be used for t distributions, whereas `retro_design()` cannot. Function originally provided in Gelman and Carlin (2014), reused with permission.

**Usage**

```r
testretrodesign(A, s, alpha = 0.05, df = Inf, n.sims = 10000)
```

**Arguments**

- `A` a numeric or list, an estimate of the true effect size
- `s` a numeric, standard error of the estimate
- `alpha` a numeric, the statistical significance threshold
- `df` a numeric, the degrees of freedom. `df=Inf` is equivalent to a normal distribution.
- `n.sims` a numeric, how many times to simulate when calculating Type M error.
Value

either a list of length 3 containing the power, type s, and type M error, or if A is a list, a df that is 4 by length(A), with an effect size and it’s corresponding power, type s, and type m errors in each row.

Examples

```r
retrodesign(1, 3.28)
retrodesign(list(.2, .2, .2), 8.1)
retrodesign(.5, 1, df = 10)
```

Description

retrodesign.list is the S3 method of the generic retrodesign() function, used when a list is passed for A.

Usage

```r
## S3 method for class 'list'
retrodesign(A, s, alpha = 0.05, df = Inf, n.sims = 10000)
```

Arguments

- `A`: a list, estimates of the true effect size
- `s`: a numeric, standard error of the estimate
- `alpha`: a numeric, the statistical significance threshold
- `df`: a numeric, the degrees of freedom. df=Inf is equivalent to a normal distribution. df=Inf is equivalent to a normal distribution.
- `n.sims`: a numeric, how many times to simulate when calculating Type M error

Value

A df that is 4 by length(A), with an effect size and it’s corresponding power, type s, and type m errors in each row.

Examples

```r
retrodesign(list(.2, .2, .2), 8.1)
retrodesign(list(.2, .2, .2), 8.1, df = 10)
```
Description

retrodesign.numeric is the S3 method of the generic retrodesign() function, used when a single numeric is passed for A.

Usage

```r
## S3 method for class 'numeric'
retrodesign(A, s, alpha = 0.05, df = Inf,
             n.sims = 10000)
```

Arguments

- `A`: a numeric, an estimate of the true effect size
- `s`: a numeric, standard error of the estimate
- `alpha`: a numeric, the statistical significance threshold
- `df`: a numeric, the degrees of freedom. `df=Inf` is equivalent to a normal distribution.
- `n.sims`: a numeric, how many times to simulate when calculating Type M error

Value

A list of length 3 containing the power, type s, and type M error.

Examples

```r
retrodesign(1, .28)
retrodesign(2, 8.1)
retrodesign(.5, 1, df=10)
```

Description

Calculates Power, Type S, and Type M error and returns them in a list or df, depending on whether a single true effect size or range is provided. Uses the closed form solution found for the Type-M error found by Lu et al. (2018), and thus is faster than retrodesign. For t distributions, use retrodesign() instead; the closed form solution only applies in the normal case.

Usage

```r
retro_design(A, s, alpha = 0.05)
```
Arguments

- **A**: a numeric or list, an estimate of the true effect size
- **s**: a numeric, standard error of the estimate
- **alpha**: a numeric, the statistical significance threshold

Value

either a list of length 3 containing the power, type s, and type M error, or if A is a list, a df that is 4 by length(A), with an effect size and it's corresponding power, type s, and type m errors in each row.

Examples

```r
retrodesign(1,3.28)
retrodesign(list(.2,2,20),8.1)
```

---

**retro_design.list**  
*List retro_design*

Description

retro_design.list is the S3 method of the generic retro_design() function, used when a list is passed for A.

Usage

```r
## S3 method for class 'list'
retro_design(A, s, alpha = 0.05)
```

Arguments

- **A**: a list, estimates of the true effect size
- **s**: a numeric, standard error of the estimate
- **alpha**: a numeric, the statistical significance threshold

Value

A df that is 4 by length(A), with an effect size and it's corresponding power, type s, and type m errors in each row.

Examples

```r
retro_design(list(.2,2,20),8.1)
```
retro_design.numeric  Numeric retro_design

Description

retro_design.numeric is the S3 method of the generic retro_design() function, used when a single numeric is passed for A.

Usage

```r
## S3 method for class 'numeric'
retro_design(a, s, alpha = 0.05)
```

Arguments

- `a` : a numeric, an estimate of the true effect size
- `s` : a numeric, standard error of the estimate
- `alpha` : a numeric, the statistical significance threshold

Value

A list of length 3 containing the power, type s, and type M error.

Examples

```r
retrodesign(1,4.28)
retrodesign(2,8.1)
```

sim_plot  sim_plot: visualize type S/M errors

Description

Graphs type S/M errors resulting from a simulation using the provided parameters (using the same simulation method as retrodesign()). Can optionally display using ggplot.

Usage

```r
sim_plot(A, s, alpha = 0.05, df = Inf, n.sims = 5000, gg = TRUE)
```
**type_m**

**Arguments**
- `A` a numeric, an estimate of the true effect size
- `s` a numeric, standard error of the estimate
- `alpha` a numeric, the statistical significance threshold
- `df` a numeric, the degrees of freedom
- `n.sims` a numeric, how many times to simulate when calculating Type M error
- `gg` If TRUE and ggplot2 is installed, uses ggplot2 for graphic

**Value**
A list of length 3 containing the power, type s, and type M error.

**Examples**
```r
sim_plot(1, 3.28)
sim_plot(0.5, 1)
```

---

**Description**
Calculates type m error. Is calculated using simulation, and thus supports t distributions through the df parameter.

**Usage**
```r
type_m(A, s, alpha = 0.05, df = Inf, n.sims = 10000)
```

**Arguments**
- `A` a numeric or list, estimate(s) of the true effect size
- `s` a numeric, standard error of the estimate
- `alpha` a numeric, the statistical significance threshold
- `df` a numeric, the number of degrees of freedom. df=Inf is equivalent to a normal distribution.
- `n.sims` a numeric, how many times to simulate when calculating Type M error

**Value**
either the type m error, a numeric if a single A is provided, or a df of length 2 by A, with the effect size and corresponding type m error in each row.

**Examples**
```r
type_m(1, 3.28)
type_m(list(.2, .2, .20), 8.1)
```
type_m.list

**Description**

type_m.list is the S3 method of the generic type_m() function, used when a list is passed for A.

**Usage**

```r
## S3 method for class 'list'
type_m(A, s, alpha = 0.05, df = Inf, n.sims = 10000)
```

**Arguments**

- `A`: a list, estimates of the true effect size
- `s`: a numeric, standard error of the estimate
- `alpha`: a numeric, the statistical significance threshold
- `df`: a numeric, the number of degrees of freedom. df=Inf is equivalent to a normal distribution.
- `n.sims`: a numeric, how many times to simulate when calculating Type M error

**Value**

A df that is 2 by length(A), with an effect size and its corresponding type m errors in each row.

**Examples**

```r
type_s(list(.R,R,R0I,8.1I
```

---

type_m.numeric

**Description**

this is the S3 method of the generic type_m() function, used when a numeric is passed for A.

**Usage**

```r
## S3 method for class 'numeric'
type_m(A, s, alpha = 0.05, df = Inf, n.sims = 10000)
```

**Description**

this is the S3 method of the generic type_m() function, used when a numeric is passed for A.
**Arguments**

- **A**: a numeric, estimate of the true effect size
- **s**: a numeric, standard error of the estimate
- **alpha**: a numeric, the statistical significance threshold
- **df**: a numeric, the number of degrees of freedom. df=Inf is equivalent to a normal distribution.
- **n.sims**: a numeric, how many times to simulate when calculating Type M error

**Value**

either the type m, a numeric if a single A is provided, or a df of length 2 by A, with the effect size and corresponding type m error in each row.

**Examples**

```r
type_m(1, S.R8I
```

---

**Description**

Calculates type s error.

**Usage**

```r
type_s(A, s, alpha = 0.05)
```

**Arguments**

- **A**: a numeric or list, estimate(s) of the true effect size
- **s**: a numeric, standard error of the estimate
- **alpha**: a numeric, the statistical significance threshold

**Value**

either the type S, a numeric if a single A is provided, or a df of length 2 by A, with the effect size and corresponding type S error in each row.

**Examples**

```r
type_s(1,3.28)

type_s(list(.R,R,R0I,8.1I
```
Description

type_s.list is the S3 method of the generic type_s() function, used when a list is passed for A.

Usage

## S3 method for class 'list'
type_s(A, s, alpha = 0.05)

Arguments

A  a list, estimates of the true effect size
s  a numeric, standard error of the estimate
alpha  a numeric, the statistical significance threshold

Value

A df that is 2 by length(A), with an effect size and it’s corresponding type_s errors in each row.

Examples

type_s(list(.2,2,20),8.1)

Description

this is the S3 method of the generic type_s() function, used when a numeric is passed for A.

Usage

## S3 method for class 'numeric'
type_s(A, s, alpha = 0.05)

Arguments

A  a numeric, estimate of the true effect size
s  a numeric, standard error of the estimate
alpha  a numeric, the statistical significance threshold
type_s.numeric

Value

either the type S, a numeric if a single A is provided, or a df of length 2 by A, with the effect size and corresponding type S error in each row.

Examples

type_s(1, 3.28)
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