

Package ‘BayesPower’

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Title Sample Size and Power Calculation for Bayesian Testing with Bayes Factor

Version 1.0.3

Description The goal of 'BayesPower' is to provide tools for Bayesian sample size determination and power analysis across a range of common hypothesis testing scenarios using Bayes factors. The main function, `BayesPower_BayesFactor()`, launches an interactive 'shiny' application for performing these analyses. The application also provides command-line code for reproducibility. Details of the methods are described in the tutorial by Wong, Pawel, and Tendeiro (2025) <[doi:10.31234/osf.io/pgdac_v3](https://doi.org/10.31234/osf.io/pgdac_v3)>.

BugReports <https://github.com/tkWong3004/BayesPower/issues>

License GPL (>= 3)

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BayesPower_BayesFactor

Launch the BayesPower Shiny Application

Description

This function starts the interactive Shiny application for Bayesian power analysis using Bayes factors. The app provides a graphical user interface built with **shiny**.

Usage

```
BayesPower_BayesFactor()
```

Details

The application includes both the UI and server components, which are defined internally in the package. When run, a browser window or RStudio viewer pane will open to display the interface.

Value

No return value, called for its side effects.

Examples

```
if (interactive()) {
  # Launch the Shiny application
  BayesPower_BayesFactor()
}
```

BF10.bin.test

Bayes Factor for a Bayesian One-Proportion Test

Description

Calculate the Bayes factor (BF10) for a single-proportion test, either against a point null or an interval null hypothesis.

Usage

```
BF10.bin.test(
  x,
  n,
  alpha,
  beta,
  h0,
  scale,
  prior_analysis,
  alternative,
  ROPE = NULL
)
```

Arguments

x	Numeric integer. Observed number of successes (non-negative integer scalar, must be $\leq n$).
n	Numeric integer. Sample size (positive integer scalar).
alpha	Numeric scalar. Shape parameter of the analysis beta prior under the alternative hypothesis (required if <code>prior_analysis = "beta"</code>).
beta	Numeric scalar. Shape parameter of the analysis beta prior under the alternative hypothesis (required if <code>prior_analysis = "beta"</code>).
h0	Numeric scalar. Null proportion value (numeric scalar between 0.1 and 0.9).
scale	Numeric scalar. Scale parameter for the analysis prior (only used if <code>prior_analysis = "Moment"</code>).
prior_analysis	Character. the analysis prior under the alternative hypothesis: "beta" (stretched beta) or "Moment" (normal-moment prior).
alternative	Character. Hypothesis being tested: two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0 ; and for "less" a numeric scalar < 0 .

Value

An object of class "BFvalue_bin" containing:

- `bf10`: Bayes factor in favor of the alternative hypothesis.
- `type`: Test type ("One-proportion").
- `x`: Number of successes.
- `n`: Sample size.
- `h0`: Null proportion value.
- `analysis_h1`: List describing the analysis prior, containing prior (prior distribution), alpha (alpha parameter), beta (beta parameter), and scale (scale parameter).
- `alternative`: the direction of the alternative hypothesis.
- `ROPE`: interval null bounds (if specified).
- `p.value`: p-value.

Examples

```
BF10.bin.test(  
  x = 42,  
  n = 52,  
  h0 = 0.5,  
  prior_analysis = "beta",  
  alternative = "greater",  
  alpha = 1,  
  beta = 1)
```

BF10.cor

Bayes Factor for a Bayesian Correlation Test

Description

Calculate the Bayes factor (BF10) for a correlation coefficient, either against a point null or an interval null hypothesis. Supports default beta ("d_beta"), stretched beta ("beta"), and normal-moment ("Moment") priors for the alternative hypothesis.

Usage

```
BF10.cor(  
  r,  
  n,  
  k,  
  alpha,  
  beta,  
  h0,  
  alternative,
```

```

    scale,
    prior_analysis,
    ROPE = NULL
  )

```

Arguments

<code>r</code>	Numeric scalar. Observed correlation coefficient. Must be a numeric scalar between -1 and 1.
<code>n</code>	Numeric integer. Sample size. Must be a numeric scalar greater than 3.
<code>k</code>	Numeric scalar. Parameter for the analysis default beta prior ("d_beta") under the alternative hypothesis.
<code>alpha</code>	Numeric scalar. Parameter for the analysis beta prior ("beta") under the alternative hypothesis.
<code>beta</code>	Numeric scalar. Parameter for the analysis beta prior ("beta") under the alternative hypothesis.
<code>h0</code>	Numeric scalar. Null value of the correlation. Must be a numeric scalar between -0.8 and 0.8.
<code>alternative</code>	Character. The direction of the alternative hypothesis being tested: two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
<code>scale</code>	Numeric scalar. Scale parameter for the analysis normal-moment prior ("Moment"). Must be > 0.
<code>prior_analysis</code>	Character. Analysis prior: default beta ("d_beta"), beta ("beta"), or normal-moment ("Moment").
<code>ROPE</code>	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0; and for "less" a numeric scalar < 0.

Value

A list with class "BFvalue_r" containing:

- `type`: "correlation"
- `bf10`: Calculated Bayes factor BF10
- `h0`: Null value of the correlation
- `r`: Observed correlation coefficient
- `n`: Sample size
- `analysis_h1`: List with the analysis prior parameters: `prior_analysis`, `k`, `alpha`, `beta`, and `scale`.
- `alternative`: the direction of the alternative hypothesis
- `ROPE`: Interval bounds if specified
- `p.value`: Numeric, p.value.

Examples

```
BF10.cor(
  r = 0.3930924,
  n = 46,
  prior_analysis = "d_beta",
  k = 1,
  h0 = 0,
  alternative = "two.sided")
```

BF10.f.test

Bayes Factor for a Bayesian F-Test

Description

Computes the Bayes factor (BF10) for an F-test, comparing a full model to a reduced model under either an effect-size prior or a Moment prior. Optionally, an interval null hypothesis can be specified.

Usage

```
BF10.f.test(fval, df1, df2, dff, rscale, f_m, prior_analysis, ROPE = NULL)
```

Arguments

fval	Numeric scalar. Observed F statistic (must be at least 0).
df1	Numeric scalar. Numerator degrees of freedom (must be > 0).
df2	Numeric scalar. Denominator degrees of freedom (must be > 0).
dff	Numeric scalar. Degrees of freedom for the analysis prior under the alternative hypothesis. For the Moment prior, this must be ≥ 3 .
rscale	Numeric scalar. Scale parameter for the effect-size prior (only used when prior_analysis = "effectsize").
f_m	Numeric scalar. Cohen's f effect-size parameter for the analysis prior.
prior_analysis	Character. Analysis prior under the alternative hypothesis. Must be either "effectsize" or "Moment".
ROPE	Numeric scalar. Optional numeric scalar specifying an upper bound for an interval null hypothesis. If provided, must be > 0.

Value

A list of class "BFvalue_f" containing:

- fval: Input F-value.
- df1, df2: Degrees of freedom.
- ROPE: Interval bound (if specified).
- analysis_h1: List containing the analysis prior specification, including the prior distribution, the scale rscale, f_m, and degrees of freedom dff.
- bf10: The computed Bayes factor.
- p.value: p-value.

Examples

```
BF10.f.test(  
  fval = 4.5,  
  df1 = 2,  
  df2 = 12,  
  dff = 12,  
  rscale = 0.707,  
  f_m = 0.1,  
  prior_analysis = "effectsize"  
)
```

BF10.props

Bayes Factor for Comparing Two Proportions

Description

Compute the Bayes factor (BF10) for a Bayesian test of two proportions.

Usage

```
BF10.props(a0, b0, a1, b1, a2, b2, N1, N2, x1, x2)
```

Arguments

a0	Numeric scalar. Alpha parameter of the Beta prior under the null hypothesis.
b0	Numeric scalar. Beta parameter of the Beta prior under the null hypothesis.
a1	Numeric scalar. Alpha parameter of the Beta prior for group 1 under the alternative hypothesis.
b1	Numeric scalar. Beta parameter of the Beta prior for group 1 under the alternative hypothesis.
a2	Numeric scalar. Alpha parameter of the Beta prior for group 2 under the alternative hypothesis.
b2	Numeric scalar. Beta parameter of the Beta prior for group 2 under the alternative hypothesis.
N1	Numeric integer. Sample size for group 1.
N2	Numeric integer. Sample size for group 2.
x1	Numeric integer. Number of successes observed in group 1.
x2	Numeric integer. Number of successes observed in group 2.

Value

A list of class BFvalue_2p containing:

- type: the string "Two-proportions".
- analysis_h0: list with a and b for the null prior.
- analysis_h1_theta_1: list with a and b for group 1 prior under H1.
- analysis_h1_theta_2: list with a and b for group 2 prior under H1.
- bf10: the computed Bayes factor (BF10).
- N1, x1, N2, x2: the input sample sizes and observed successes.
- OddRatio: observed odd ratio.
- p.value: p.value.

Examples

```
BF10.props(  
  a0 = 1,  
  b0 = 1,  
  a1 = 1,  
  b1 = 1,  
  a2 = 1,  
  b2 = 1,  
  N1 = 493,  
  N2 = 488,  
  x1 = 155,  
  x2 = 150)
```

BF10.ttest.OneSample *Bayes Factor for a One-Sample Bayesian t-Test*

Description

Computes the Bayes factor (BF10) for a one-sample t-test, comparing an observed t-value against either a point null hypothesis or an interval null hypothesis.

Usage

```
BF10.ttest.OneSample(  
  tval,  
  df,  
  prior_analysis,  
  location,  
  scale,  
  dff,  
  alternative,  
  ROPE = NULL  
)
```

Arguments

tval	Numeric scalar. Observed t-value from the one-sample t-test.
df	Numeric scalar. Degrees of freedom of the t-test (must be ≥ 1).
prior_analysis	Character. Analysis prior under the alternative hypothesis. Must be either "Normal" (normal distribution), "Moment" (normal-moment prior), or "t-distribution" (t-distribution).
location	Numeric scalar. Location parameter for the analysis prior under the alternative hypothesis.
scale	Numeric scalar. Scale parameter for the analysis prior under the alternative hypothesis (must be > 0).
dff	Numeric scalar. Degrees of freedom for the t-distribution prior (only required if prior_analysis = "t-distribution"; must be > 0). Ignored otherwise.
alternative	Character. The direction of the alternative hypothesis two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0 ; and for "less" a numeric scalar < 0 .

Value

An object of class "BFvalue_t" containing:

- type: Character indicating "One-sample t-test".
- bf10: Numeric, the Bayes factor (BF10).
- tval: Observed t-value.
- df: Degrees of freedom.
- analysis_h1: List with the analysis prior parameters: prior_analysis, location, scale, and optionally dff.
- alternative: Character, the direction of the alternative hypothesis.
- ROPE: Optional numeric vector of interval null bounds.
- d: Numeric, observed Cohen's d.
- p.value: Numeric, p-value.

Examples

```
BF10.ttest.OneSample(
  tval = 2,
  df = 50,
  prior_analysis = "t-distribution",
  location = 0,
  scale = 0.707,
  dff = 1,
  alternative = "two.sided")
```

BF10.ttest.TwoSample *Bayes Factor for a Two-Sample Bayesian t-Test*

Description

Compute the Bayes factor (BF10) for a two-sample independent-samples t-test. Supports both point-null and interval-null hypotheses.

Usage

```
BF10.ttest.TwoSample(
  tval,
  N1,
  N2,
  prior_analysis,
  location,
  scale,
  dff,
  alternative,
  ROPE = NULL
)
```

Arguments

tval	Numeric scalar. Observed t-value from the two-sample t-test.
N1	Numeric integer. Sample size of group 1 (must be > 2, will be rounded to nearest integer).
N2	Numeric integer. Sample size of group 2 (must be > 2, will be rounded to nearest integer).
prior_analysis	Character. Analysis prior under the alternative hypothesis: "Normal", "Moment" (normal-moment prior), or "t-distribution".
location	Numeric scalar. Location parameter of the analysis prior.
scale	Numeric scalar > 0. Scale parameter of the analysis prior.
dff	Numeric scalar. Degrees of freedom for the analysis prior (required if prior_analysis = "t-distribution"; ignored otherwise).
alternative	Character. The direction of the alternative hypothesis two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0; and for "less" a numeric scalar < 0.

Value

A list of class BFvalue_t containing:

- type: Character string describing the test type.
- bf10: Computed Bayes factor BF10.
- tval: Observed t-value.
- df: Degrees of freedom.
- analysis_h1: List with the analysis prior parameters: prior_analysis, location, scale, and optionally dff.
- alternative: Hypothesis tested ("two.sided", "greater", or "less").
- ROPE: Interval bounds used, if any.
- N1: Sample size of group 1.
- N2: Sample size of group 2.
- d: Numeric, observed Cohen's d.
- p.value: Numeric, p-value.

Examples

```
BF10.ttest.TwoSample(  
  tval = -1.148,  
  N1 = 53,  
  N2 = 48,  
  prior_analysis = "t-distribution",  
  location = 0,  
  scale = 0.707,  
  dff = 1,  
  alternative = "two.sided",  
  ROPE = c(-0.36,0.36))
```

BFpower.bin

Sample Size Determination for the Bayesian One-Proportion Test

Description

Perform sample size determination or the calculation of compelling and misleading evidence for a Bayesian test of a single proportion.

Usage

```
BFpower.bin(  
  alternative,  
  threshold,  
  h0,  
  true_rate,
```

```

false_rate,
prior_analysis,
alpha,
beta,
scale,
prior_design = NULL,
alpha_d,
beta_d,
location_d,
scale_d,
N = NULL,
ROPE = NULL,
type_rate = "positive"
)

```

Arguments

alternative	Character. The direction of the alternative hypothesis : two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
threshold	Numeric scalar. Threshold for compelling evidence (must be > 1).
h0	Numeric scalar. Null proportion value for the test (numeric scalar between 0.1 and 0.9).
true_rate	Numeric scalar. Targeted true positive rate or true negative rate .
false_rate	Numeric scalar. Targeted false positive rate or false negative rate .
prior_analysis	Character. Analysis prior under the alternative hypothesis: "beta" or "Moment" (normal-moment prior).
alpha	Numeric scalar. Parameter for the analysis beta prior (used when prior_analysis = "beta").
beta	Numeric scalar. Parameter for the analysis beta prior (used when prior_analysis = "beta").
scale	Numeric scalar. Scale parameter for the analysis moment prior (used when prior_analysis = "Moment").
prior_design	Character. Design prior under the alternative hypothesis: "beta", "Moment" (normal-moment prior), or "Point".
alpha_d	Numeric scalar. Parameter for the design beta prior (used when prior_design = "beta").
beta_d	Numeric scalar. Parameter for the design beta prior (used when prior_design = "beta").
location_d	Numeric scalar. Proportion value for the design point prior (prior_design = "Point"). Represents the true proportion under the alternative hypothesis.
scale_d	Numeric scalar. Scale parameter for the design moment prior (used when prior_design = "Moment").
N	Numeric integer. Sample size. If NULL, sample size determination is performed.

ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0; and for "less" a numeric scalar < 0.
type_rate	Character. Either "positive" (controls true/false positive rates) or "negative" (controls true/false negative rates).

Details

1. Sample size determination mode (when N = NULL):

If no sample size is provided, the function calculates the minimum sample size needed to achieve the desired configuration below. The user must provide:

- type_rate - either "positive" to control true/false positive rates or "negative" to control true/false negative rates.
- true_rate - the targeted true positive or true negative rate (between 0.6 and 0.999).
- false_rate - the acceptable false positive or false negative rate (between 0.001 and 0.1).
- threshold - the Bayes factor threshold for compelling evidence (must be > 1).

The function iteratively finds the smallest sample size for which the probability of obtaining compelling evidence meets or exceeds true_rate, while the probability of misleading evidence does not exceed false_rate.

2. Fixed-sample analysis mode (when N is supplied):

If a positive numeric sample size N is provided, the function computes the probabilities of obtaining compelling or misleading evidence for that fixed sample size. In this mode, type_rate, true_rate, and false_rate are ignored; only the Bayes factor threshold threshold is used.

Model specification:

The user must specify the analysis prior under the alternative hypothesis using prior_analysis:

- prior_analysis = "beta": requires alpha and beta parameters (shape parameters of the beta distribution).
- prior_analysis = "Moment": requires scale parameter (scale of the moment prior).

The design prior under the alternative hypothesis can optionally be specified using prior_design:

- "beta": requires alpha_d and beta_d.
- "Moment": requires scale_d.
- "Point": requires location_d, representing the true proportion under the alternative hypothesis.

If prior_design is NULL, no design prior is used.

Interval Null Hypothesis:

If ROPE is provided, the function evaluates the Bayes factor for an interval null. Otherwise, a point-null hypothesis is assumed.

Hypothesis:

The function supports one-sided ("greater" or "less") and two-sided ("two.sided") tests. Design prior and interval null bounds must be consistent with the directionality of the hypothesis.

Value

A list of class "BFpower" containing:

- type: Test type ("One proportion").
- alternative: alternative hypothesis.
- h0: The proportion under the null hypothesis.
- analysis_h1: List describing the analysis prior, containing prior (prior distribution), alpha (alpha parameter), beta (beta parameter), and scale (scale parameter).
- design_h1: List describing the design prior (if provided), containing prior (prior distribution), alpha (alpha parameter), beta (beta parameter), and scale (scale parameter).
- results: Data frame of probabilities of compelling/misleading evidence and the required or supplied sample size.
- threshold: Compelling-evidence threshold.

If sample size determination fails, the function returns NaN and prints a message.

Examples

```
BFpower.bin(  
  alternative = "greater",  
  threshold = 3,  
  true_rate = 0.8,  
  false_rate = 0.05,  
  h0 = 0.5,  
  prior_analysis = "beta",  
  alpha = 1,  
  beta = 1)
```

BFpower.cor

Sample Size Determination for the Bayesian Correlation Test

Description

Perform sample size determination or the probability of obtaining compelling or misleading evidence for a Bayesian correlation test. Can handle both point-null and interval-null hypothesis, and allows specifying analysis and design priors.

Usage

```
BFpower.cor(  
  alternative,  
  h0,  
  ROPE = NULL,  
  threshold,  
  true_rate,
```

```

    false_rate,
    prior_analysis,
    k,
    alpha,
    beta,
    scale,
    prior_design = NULL,
    alpha_d,
    beta_d,
    location_d,
    k_d,
    scale_d,
    N = NULL,
    type_rate = "positive"
)

```

Arguments

alternative	Character. The direction of the alternative hypothesis being tested: two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
h0	Numeric scalar. Null rho correlation value. Must be between -0.8 and 0.8.
ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0; and for "less" a numeric scalar < 0.
threshold	Numeric scalar. Threshold of compelling evidence (numeric scalar > 1).
true_rate	Numeric scalar. Targeted true positive rate (if positive = "positive") or true negative rate (if positive = "negative").
false_rate	Numeric scalar. Targeted false positive rate (if positive = "positive") or false negative rate (if positive = "negative").
prior_analysis	Character. Analysis prior under the alternative hypothesis: default beta ("d_beta"), beta ("beta"), or normal-moment prior ("Moment").
k	Numeric scalar. Parameter for the default beta prior ("d_beta").
alpha	Numeric scalar. Parameter for the beta prior ("beta").
beta	Numeric scalar. Parameter for the beta prior ("beta").
scale	Numeric scalar. Scale parameter for the normal-moment prior ("Moment").
prior_design	Character. Design prior under the alternative hypothesis: default beta ("d_beta"), beta ("beta"), normal-moment prior ("Moment"), or point ("Point").
alpha_d	Numeric scalar. Parameter for the design beta prior ("beta").
beta_d	Numeric scalar. Parameter for the design beta prior ("beta").
location_d	Numeric scalar. Location parameter for the design point prior ("Point").
k_d	Numeric scalar. Parameter for the design default beta prior ("d_beta").
scale_d	Numeric scalar. Scale parameter for the design normal-moment prior ("Moment").

N	Numeric integer. Sample size. Only required if the goal is not sample size determination, but rather to calculate the probability of obtaining compelling or misleading evidence for a given sample size.
type_rate	Character. Character indicating which rate to control: "positive" (true/false positive rates) or "negative" (true/false negative rates).

Details

1. Sample size determination mode (when N = NULL):

If no sample size is provided, the function determines the minimum sample size required to meet the desired requirements. In this mode, the user must supply the following arguments:

- type_rate - either "positive" to control true/false positive rates, or "negative" to control true/false negative rates.
- true_rate - the targeted true positive or true negative rate (between 0.6 and 0.999).
- false_rate - the acceptable false positive or false negative rate (between 0.001 and 0.1).
- threshold - the Bayes factor threshold for compelling evidence (must be > 1).

The function iteratively finds the smallest sample size for which the probability of obtaining compelling evidence meets or exceeds true_rate, while the probability of misleading evidence does not exceed false_rate.

2. Fixed-sample analysis mode (when N is supplied):

If a positive numeric sample size N is provided, the function computes the probabilities of obtaining compelling or misleading evidence for that fixed sample size. In this mode, the arguments type_rate, true_rate, and false_rate are ignored; only the Bayes factor threshold threshold is used.

Hypothesis specification:

The alternative argument defines the direction of the alternative hypothesis : "two.sided" for two-sided, "greater" for right-sided, or "less" for left-sided tests. The optional ROPE argument specifies bounds for an interval null hypothesis. If ROPE = NULL, a point-null test is assumed.

Analysis Priors:

The analysis prior specifies the prior distribution of the correlation under the alternative hypothesis. Depending on prior_analysis, the user must supply:

- d_beta (default beta): $k > 0$.
- beta (stretched beta): α and $\beta > 0$.
- Moment (normal-moment prior): $scale > 0$.

Design Priors (optional):

A design prior can be supplied to reflect uncertainty about the correlation during study planning. If provided, prior_design must be one of "d_beta", "beta", "Moment", or "Point", and the corresponding parameters must be supplied:

- d_beta: $k_d > 0$.
- beta: α_d and $\beta_d > 0$.

- Moment: `scale_d > 0`.
- Point: `location_d` numeric scalar.

Interval Null Hypothesis:

If ROPE is provided, the function evaluates the Bayes factor for an interval null. Otherwise, a point-null hypothesis is assumed.

Value

A list of class `BFpower_r` containing:

- `type`: Test type (always "Correlation").
- `alternative`: the direction of the alternative hypothesis.
- `h0`: the value of correlation under the null hypothesis.
- `ROPE`: Bounds for interval null (if used).
- `analysis_h1`: List with the analysis prior parameters: `prior_analysis`, `k`, `alpha`, `beta`, and `scale`.
- `design_h1`: List with the design prior parameters: `prior_design`, `k`, `alpha`, `beta`, `scale`, and `location`.
- `results`: Data frame with the probabilities of compelling/misleading evidence, and with the required sample size.
- `threshold`: Threshold of compelling evidence.

Examples

```
BFpower.cor(
  alternative = "greater",
  h0 = 0,
  threshold = 3,
  true_rate = 0.8,
  false_rate = 0.05,
  prior_analysis = "d_beta",
  k = 1,
  prior_design = "Point",
  location_d = 0.3
)
```

Description

This function performs sample size determination (when `N = NULL`) or calculates the probability of compelling/misleading evidence for a fixed sample size.

Usage

```
BFpower.f.test(
  threshold,
  true_rate,
  false_rate,
  p,
  k,
  prior_analysis,
  dff,
  rscale,
  f_m,
  prior_design = NULL,
  dff_d,
  rscale_d,
  f_m_d,
  N = NULL,
  type_rate = "positive",
  ROPE = NULL
)
```

Arguments

threshold	Numeric scalar. Threshold for compelling evidence (must be > 1).
true_rate	Numeric scalar. Targeted true positive or true negative rate (used only when sample size determination is requested; N = NULL).
false_rate	Numeric scalar. Targeted false positive or false negative rate (used only when sample size determination is requested; N = NULL).
p	Numeric integer. Number of predictors in the reduced model.
k	Numeric integer. Number of predictors in the full model (must satisfy $k > p$).
prior_analysis	Character. Analysis prior model under the alternative hypothesis: "effectsize" or "Moment".
dff	Numeric scalar. Degrees of freedom for the analysis prior under the alternative hypothesis. Must be a positive scalar, and must be at least 3 if prior_analysis = "Moment".
rscale	Numeric scalar. Scale parameter for the analysis effect-size prior (only used when prior_analysis = "effectsize").
f_m	Numeric scalar. Cohen's f effect-size parameter for the analysis prior (must be > 0).
prior_design	Character. Design prior model under the alternative hypothesis: "effectsize", "Moment", or "Point".
dff_d	Numeric scalar. Degrees of freedom for the design prior. Must be a positive scalar, and at least 3 if prior_design = "Moment".
rscale_d	Numeric scalar. Scale parameter for the design effect-size prior (only used when prior_design = "effectsize").

f_m_d	Numeric scalar. Cohen's f value for the design prior or the effect-size of the point design prior.
N	Numeric integer. Sample size. If NULL, sample size determination is performed.
type_rate	Character. Either "positive" (control true/false positive rates) or "negative" (control true/false negative rates).
ROPE	Numeric vector. Numeric bounds for the interval null (only used when interval Bayes factors are required).

Details

Computes required sample size or probabilities of compelling or misleading evidence for a fixed sample size.

1. Sample size determination mode (when N = NULL):

If no sample size is provided, the function calculates the minimum sample size to achieve the desired configuration below. The user must provide:

- type_rate - either "positive" to control true/false positive rates, or "negative" to control true/false negative rates.
- true_rate - the targeted true positive or true negative rate (between 0.6 and 0.999).
- false_rate - the acceptable false positive or false negative rate (between 0.001 and 0.1).
- threshold - the Bayes factor threshold for compelling evidence (must be > 1).

The function iteratively finds the smallest sample size for which the probability of obtaining compelling evidence meets or exceeds true_rate, while the probability of misleading evidence does not exceed false_rate.

2. Fixed-sample analysis mode (when N is supplied):

If a positive numeric sample size N is provided, the function computes the probabilities of obtaining compelling or misleading evidence for that fixed sample size. In this mode, the arguments type_rate, true_rate, and false_rate are ignored; only the Bayes factor threshold threshold is used.

Model specification:

The function requires the user to specify the full model (k predictors) and the reduced model (p predictors, $k > p$), and the analysis prior under the alternative hypothesis. Depending on the chosen prior_analysis, different arguments are required:

- prior_analysis = "effectsize": requires rscale (scale parameter) and f_m (Cohen's f effect-size), and dff (degrees of freedom).
- prior_analysis = "Moment": requires f_m (Cohen's f effect-size) and dff (degrees of freedom, must be ≥ 3); rscale is not used.

The design prior under the alternative hypothesis can optionally be specified using prior_design, which can be:

- "effectsize": requires rscale_d, f_m_d, and dff_d.
- "Moment": requires f_m_d and dff_d (≥ 3); rscale_d is not used.
- "Point": requires f_m_d only; rscale_d and dff_d are not used.

Interval Null Hypothesis:

If ROPE is provided, the function evaluates the Bayes factor for an interval null. Otherwise, a point-null hypothesis is assumed.

Value

A list of class BFpower containing:

- type: Test type (always "Regression/ANOVA").
- k, p: Number of predictors in the full and reduced models.
- ROPE: Bounds for interval null (if used).
- analysis_h1: List containing the analysis prior specification, including the prior distribution, the scale rscale, f_m, and degrees of freedom dff.
- design_h1: List containing the design prior specification, including the prior distribution, the scale rscale, f_m, and degrees of freedom dff (or NULL if not specified).
- results: Data frame of probabilities of compelling/misleading evidence and the required or supplied sample size.
- threshold: Threshold of compelling evidence.

If sample size determination fails, the function returns NaN and prints a message.

Examples

```
BFpower.f.test(  
  threshold = 3,  
  true_rate = 0.8,  
  false_rate = 0.05,  
  p = 3,  
  k = 4,  
  prior_analysis = "effectsize",  
  dff = 3,  
  rscale = 0.18,  
  f_m = 0.1,  
  prior_design = "Point",  
  f_m_d = 0.1)
```

Description

Perform sample size determination or calculate probabilities of compelling and misleading evidence for a Bayesian comparison of two proportions.

Usage

```

BFpower.props(
  threshold,
  true_rate,
  a0,
  b0,
  a1,
  b1,
  a2,
  b2,
  prior_design_1 = "same",
  a1d,
  b1d,
  dp1,
  prior_design_2 = "same",
  a2d,
  b2d,
  dp2,
  N1 = NULL,
  N2 = NULL,
  type_rate = "positive"
)

```

Arguments

threshold	Numeric scalar. Threshold of compelling evidence.
true_rate	Numeric scalar. Targeted true positive rate (if positive = "positive") or true negative rate (if positive = "negative").
a0	Numeric scalar. Alpha parameter of the Beta prior under the null hypothesis.
b0	Numeric scalar. Beta parameter of the Beta prior under the null hypothesis.
a1	Numeric scalar. Alpha parameter of the Beta analysis prior for group 1 under the alternative hypothesis.
b1	Numeric scalar. Beta parameter of the Beta analysis prior for group 1 under the alternative hypothesis.
a2	Numeric scalar. Alpha parameter of the Beta analysis prior for group 2 under the alternative hypothesis.
b2	Numeric scalar. Beta parameter of the Beta analysis prior for group 2 under the alternative hypothesis.
prior_design_1	Character. The design prior of group 1: "beta", "Point", or "same" (if "same", the design prior is identical to the analysis prior).
a1d	Numeric scalar. Alpha parameter of the design prior for group 1 (used if model1 = "beta").
b1d	Numeric scalar. Beta parameter of the design prior for group 1 (used if model1 = "beta").

dp1	Numeric scalar. True proportion for group 1 in the design prior (used if model1 = "Point").
prior_design_2	Character. The design prior of group 2: "beta", "Point", or "same" (if "same", the design prior is identical to the analysis prior).
a2d	Numeric scalar. Alpha parameter of the design prior for group 2 (used if model2 = "beta").
b2d	Numeric scalar. Beta parameter of the design prior for group 2 (used if model2 = "beta").
dp2	Numeric scalar. True proportion for group 2 in the design prior (used if model2 = "Point").
N1	Numeric integer. Sample size for group 1.
N2	Numeric integer. Sample size for group 2.
type_rate	Character. Choose "positive" to control true/false positive rates or "negative" to control true/false negative rates.

Details

1. Sample size determination mode (when N1 = NULL and N2 = NULL):

If no sample sizes are provided for the two groups, the function calculates the minimum sample sizes needed to achieve the desired configuration. The user must provide:

- type_rate - either "positive" to control true/false positive rates or "negative" to control true/false negative rates.
- true_rate - the targeted true positive or true negative rate (between 0.6 and 0.999).
- threshold - the Bayes factor threshold for compelling evidence (must be > 1).

The function iteratively finds the smallest sample sizes for which the probability of obtaining compelling evidence meets or exceeds true_rate.

2. Fixed-sample analysis mode (when N1 and N2 are supplied):

If positive numeric sample sizes N1 and N2 are provided, the function computes the probabilities of obtaining compelling or misleading evidence for these fixed sample sizes. In this mode, type_rate and true_rate are ignored; only the Bayes factor threshold threshold is used.

Model specification:

The user must specify the analysis priors under the null and alternative hypotheses using Beta parameters:

- a0, b0 - Beta parameters for the null hypothesis prior.
- a1, b1 - Beta parameters for the analysis prior of group 1 under the alternative hypothesis.
- a2, b2 - Beta parameters for the analysis prior of group 2 under the alternative hypothesis.

Design priors for the alternative hypothesis can optionally be specified:

- prior_design_1, a1d, b1d, dp1 - design prior for group 1 ("same" uses the analysis prior, "beta" requires Beta parameters, "Point" uses a fixed proportion).
- prior_design_2, a2d, b2d, dp2 - design prior for group 2.

Value

An object of class BFpower (a list) containing:

- type: Character, always "Two-proportions".
- analysis_h0: List of analysis prior parameters under the null, containing a and b.
- analysis_h1_theta_1: List of analysis prior parameters for group 1 under the alternative, containing a and b.
- analysis_h1_theta_2: List of analysis prior parameters for group 2 under the alternative, containing a and b.
- design_h1_theta_1: List of design prior parameters for group 1 under the alternative, containing prior, a, b, and p.
- design_h1_theta_2: List of design prior parameters for group 2 under the alternative, containing prior, a, b, and p.
- results: Data frame of probabilities of compelling and misleading evidence.
- grid: Grid used for computation.
- threshold: Threshold of compelling evidence.
- mode_bf: Character string specifying the mode (sample size determination or power calculation).

Examples

```
BFpower.props(  
  threshold = 3,  
  true_rate = 0.8,  
  a0 = 1,  
  b0 = 1,  
  a1 = 156,  
  b1 = 339,  
  a2 = 151,  
  b2 = 339)
```

BFpower.ttest.OneSample

Sample Size Determination for the One-Sample Bayesian t-Test

Description

Perform sample size determination or calculate the probability of obtaining compelling or misleading evidence for a one-sample Bayesian t-test. Can handle both point-null and interval-null hypothesis, and allows specifying analysis and design priors.

Usage

```
BFpower.ttest.OneSample(
  alternative,
  ROPE = NULL,
  prior_analysis,
  location,
  scale,
  dff,
  prior_design = NULL,
  location_d,
  scale_d,
  dff_d,
  N = NULL,
  type_rate = "positive",
  true_rate,
  false_rate,
  threshold
)
```

Arguments

alternative	Character. The direction of the alternative hypothesis : two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0; and for "less" a numeric scalar < 0.
prior_analysis	Character. The analysis prior under the alternative hypothesis: "Normal", "Moment" (normal-moment prior), or "t-distribution".
location	Numeric scalar. Location parameter for the analysis prior under the alternative hypothesis.
scale	Numeric scalar. Scale parameter for the analysis prior under the alternative hypothesis (must be > 0).
dff	Numeric scalar. Degrees of freedom for the analysis prior under the alternative hypothesis (required if prior_analysis = "t-distribution").
prior_design	Optional Character. The design prior under the alternative hypothesis: "Normal", "Moment" (normal-moment prior), "t-distribution", or "Point".
location_d	Numeric scalar. Location parameter for the design prior under the alternative hypothesis.
scale_d	Numeric scalar. Scale parameter for the design prior under the alternative hypothesis.
dff_d	Numeric scalar. Degrees of freedom for the design prior under the alternative hypothesis (required if prior_design = "t-distribution").
N	Numeric integer. Sample size.

type_rate	Character. Either "positive" (controls true/false positive rates) or "negative" (controls true/false negative rates).
true_rate	Numeric scaler. Target true positive or negative rate (between 0.6 and 0.999).
false_rate	Numeric scaler. Target false positive or false negative rate (between 0.001 and 0.1).
threshold	Numeric scaler. Threshold of compelling evidence (must be > 1).

Details

1. Sample size determination mode (when N = NULL):

If no sample size is provided, the function determines the minimum sample size. In this mode, the user must supply the following arguments:

- type_rate - either "positive" to control true/false positive rates, or "negative" to control true/false negative rates.
- true_rate - the targeted true positive or true negative rate (between 0.6 and 0.999).
- false_rate - the acceptable false positive or false negative rate (between 0.001 and 0.1).
- threshold - the Bayes factor threshold for compelling evidence (must be > 1).

The function iteratively finds the smallest sample size for which the probability of obtaining compelling evidence meets or exceeds true_rate, while the probability of misleading evidence does not exceed false_rate.

2. Fixed-sample analysis mode (when N is supplied):

If a positive numeric sample size N is provided, the function computes the probabilities of obtaining compelling or misleading evidence for that fixed sample size. In this mode, the arguments type_rate, true_rate, and false_rate are ignored; only the Bayes factor threshold threshold is used.

Analysis Priors:

The analysis prior specifies the prior distribution of the effect under the alternative hypothesis. The user must provide:

- prior_analysis - the type of prior: "Normal", "Moment" (normal-moment prior), or "t-distribution".
- location - the mean or location of the prior.
- scale - the standard deviation or scale (must be positive).
- dff - degrees of freedom (required if prior_analysis = "t-distribution").

Design Priors (optional):

A design prior can be supplied to reflect uncertainty about the effect size during study planning. If provided, the following must be supplied:

- prior_design - the type of design prior: "Normal", "Moment", "t-distribution", or "Point".
- location_d - the location of the design prior.
- scale_d - the scale parameter (positive for all models except "Point").
- dff_d - degrees of freedom for "t-distribution" design priors.

Interval Null Hypothesis:

The argument `ROPE` specifies the bounds of an interval null hypothesis. If `ROPE` is provided, the function evaluates the Bayes factor for an interval null hypothesis. For a point-null hypothesis, `ROPE` should be left as `NULL`.

Value

An object of class `BFpower_t` containing:

- `type`: Character, always "One-sample t-test".
- `alternative`: Character, the direction of the alternative hypothesis.
- `ROPE`: Optional numeric vector for interval null bounds.
- `analysis_h1`: List with the analysis prior parameters: `prior_analysis`, `location`, `scale`, and optionally `dff`.
- `design_h1`: List with the design prior parameters: `prior_design`, `location`, `scale`, and optionally `dff` (or `NULL` if not provided).
- `results`: Data frame of probabilities: compelling/misleading evidence, or `NaN` if calculation fails.
- `threshold`: Numeric, threshold of compelling evidence.

Examples

```
BFpower.ttest.OneSample(
  alternative = "two.sided",
  threshold = 3,
  true_rate = 0.8,
  false_rate = 0.05,
  prior_analysis = "t-distribution",
  location = 0,
  scale = 0.707,
  dff = 1
)
```

```
BFpower.ttest.TwoSample
```

Sample Size Determination for the Two-Sample Bayesian t-Test

Description

Perform sample size determination or calculate the probabilities of obtaining compelling or misleading evidence for a two-sample Bayesian t-test. Supports point-null and interval-null hypotheses, and allows specifying analysis and design priors.

Usage

```
BFpower.ttest.TwoSample(
  alternative,
  ROPE = NULL,
  threshold,
  true_rate,
  false_rate,
  prior_analysis,
  location,
  scale,
  dff,
  prior_design = NULL,
  location_d,
  scale_d,
  dff_d,
  N1 = NULL,
  N2 = NULL,
  r = NULL,
  type_rate = "positive"
)
```

Arguments

alternative	Character. The direction of the alternative hypothesis: two-sided ("two.sided"), right-sided ("greater"), or left-sided ("less").
ROPE	Optional numeric vector. Specifies bounds for an interval null hypothesis. For "two.sided" this must be a numeric vector of length 2 with two distinct finite values; for "greater" a numeric scalar > 0; and for "less" a numeric scalar < 0.
threshold	Numeric scalar. Threshold for compelling evidence (must be > 1).
true_rate	Numeric scalar. Target true positive or negative rate .
false_rate	Numeric scalar. Target false positive or negative rate .
prior_analysis	Character. Analysis prior under the alternative hypothesis: "Normal", "Moment" (normal-moment prior), or "t-distribution".
location	Numeric scalar. Location parameter for the analysis prior.
scale	Numeric scalar > 0. Scale parameter for the analysis prior.
dff	Numeric scalar. Degrees of freedom for the analysis prior (required if prior_analysis = "t-distribution"; ignored otherwise).
prior_design	Optional Character. Design prior under the alternative: "Normal", "Moment"(normal-moment prior), "t-distribution", or "Point".
location_d	Numeric scalar. Location parameter for the design prior.
scale_d	Numeric scalar > 0. Scale parameter for the design prior.
dff_d	Numeric scalar. Degrees of freedom for the design prior (required if prior_design = "t-distribution"; ignored otherwise).

N1	Numeric integer. Sample size for group 1 (used if $r = \text{NULL}$).
N2	Numeric integer. Sample size for group 2 (used if $r = \text{NULL}$).
r	Optional numeric scalar. Ratio of sample size N2 / N1 (used if N1 and N2 are NULL).
type_rate	Character, either "positive" or "negative"; determines whether to control true/false positive or true/false negative rates .

Details

1. Sample size determination mode (when N1 = NULL and N2 = NULL, but r is provided):

If no sample sizes are provided, the function calculates the minimum required sample sizes for both groups. In this mode, the user must supply:

- type_rate - either "positive" to control true/false positive rates, or "negative" to control true/false negative rates.
- true_rate - the targeted true positive or true negative rate (between 0.6 and 0.999).
- false_rate - the acceptable false positive or false negative rate (between 0.001 and 0.1).
- threshold - the Bayes factor threshold for compelling evidence (must be > 1).
- r - the allocation ratio of group 2 to group 1 sample sizes (N2/N1).

The function iteratively finds the smallest sample sizes N1 and $N2 = r * N1$ for which the probability of obtaining compelling evidence meets or exceeds true_rate, while the probability of misleading evidence does not exceed false_rate.

2. Fixed-sample analysis mode (when N1 and N2 are supplied):

If positive numeric sample sizes N1 and N2 are provided, the function computes the probabilities of obtaining compelling or misleading evidence for those fixed sample sizes. In this mode, the arguments type_rate, true_rate, and false_rate are ignored; only the Bayes factor threshold is used.

Analysis Priors:

The analysis prior specifies the prior distribution of the effect under the alternative hypothesis. The user must provide:

- prior_analysis - the type of prior: "Normal", "Moment" (normal-moment prior), or "t-distribution".
- location - the mean or location of the prior.
- scale - the standard deviation or scale (must be positive).
- dff - degrees of freedom (required if prior_analysis = "t-distribution").

Design Priors (optional):

A design prior can be supplied to reflect uncertainty about the effect size during study planning. If provided, the following must be supplied:

- prior_design - the type of design prior: "Normal", "Moment", "t-distribution", or "Point".
- location_d - the location of the design prior.
- scale_d - the scale parameter (positive for all models except "Point").
- dff_d - degrees of freedom for "t-distribution" design priors.

Interval Null Hypothesis:

The argument ROPE specifies the bounds of an interval null hypothesis. If ROPE is provided, the function evaluates the Bayes factor for an interval null hypothesis. For a point-null hypothesis, ROPE should be left as NULL.

Value

An object of class BFpower_t containing:

- type: Character string describing the test type.
- alternative: Alternative hypothesis ("two.sided", "greater", or "less").
- ROPE: Interval bounds under the null used, if any.
- analysis_h1: List with the analysis prior parameters: prior_analysis, location, scale, and optionally dff.
- design_h1: List with the design prior parameters: prior_design, location, scale, and optionally dff (or NULL if not provided).
- results: Data frame with probabilities of compelling/misleading evidence.
- threshold: Threshold of compelling evidence.

Examples

```
BFpower.ttest.TwoSample(  
  alternative = "two.sided",  
  ROPE = c(-0.36, 0.36),  
  threshold = 3,  
  true_rate = 0.8,  
  false_rate = 0.05,  
  prior_analysis = "Normal",  
  location = -0.23,  
  scale = 0.2,  
  dff = 1,  
  type_rate = "negative",  
  r = 1)
```

plot.BFpower

Plot Method for BFpower Objects

Description

Visualizes a "BFpower" object.

Usage

```
## S3 method for class 'BFpower'  
plot(x, plot_power = FALSE, plot_rel = FALSE, ...)
```

Arguments

<code>x</code>	A "BFpower" object returned by one of the BFpower functions listed in the section Details.
<code>plot_power</code>	Logical. If TRUE, the power-related plots are returned.
<code>plot_rel</code>	Logical. If TRUE, the plot showing the relationship between the data and the Bayes factors is returned.
<code>...</code>	Additional arguments (currently unused; included for method consistency).

Details

This plot method can return up to three plots based on the information from the "BFpower" object:

- The first plot displays the analysis prior and the design prior. However, for `BFpower.props`, three plots are returned, corresponding to the three thetas.
- The second plot contains two panels where the left panel shows the true and false positive rates as a function of sample size, and the right panel shows the true and false negative rates.
- The third plot illustrates the relationship between the data and the Bayes factors.

The object can be generated by any of the following functions: `BFpower.ttest.OneSample`, `BFpower.ttest.TwoSample`, `BFpower.f.test`, `BFpower.cor`, `BFpower.bin`, or `BFpower.props`.

Value

A list of up to three ggplot objects.

Examples

```
results <- BFpower.cor(
  alternative = "greater",
  h0 = 0,
  threshold = 3,
  true_rate = 0.8,
  false_rate = 0.05,
  prior_analysis = "beta",
  alpha = 1,
  beta = 1,
  prior_design = "Point",
  location_d = 0.3
)
print(results)
plot(results, plot_power = TRUE, plot_rel = TRUE)
```

`print.BFpower`*Print Method for BFpower Objects*

Description

Displays the results of a "BFpower" object.

Usage

```
## S3 method for class 'BFpower'  
print(x, ...)
```

Arguments

<code>x</code>	A "BFpower" object returned by one of the BFpower functions listed in the section Details.
<code>...</code>	Additional arguments (currently unused; included for method consistency).

Details

This method prints key information from the "BFpower" object, including the type of hypothesis specification, priors, true and false rates, and required sample. The object can be generated by any of the following functions: [BFpower.ttest.OneSample](#), [BFpower.ttest.TwoSample](#), [BFpower.f.test](#), [BFpower.cor](#), [BFpower.bin](#), or [BFpower.props](#).

Value

Invisibly returns the input "BFpower" object.

Examples

```
results <- BFpower.ttest.OneSample(  
  alternative = "two.sided",  
  threshold = 3,  
  true_rate = 0.8,  
  false_rate = 0.05,  
  prior_analysis = "t-distribution",  
  location = 0,  
  scale = 0.707,  
  dff = 1  
)  
print(results)
```

print.BFvalue *Print Method for BFvalue Objects*

Description

Displays the results of a "BFvalue" object.

Usage

```
## S3 method for class 'BFvalue'  
print(x, ...)
```

Arguments

x	A "BFvalue" object returned by one of the BF10 testing functions listed in Details.
...	Additional arguments (currently unused; included for method consistency).

Details

This method prints key results from a Bayesian test, including the Bayes factor and relevant test statistics with frequentist test result. The object can be generated by any of the following functions: [BF10.ttest.OneSample](#), [BF10.ttest.TwoSample](#), [BF10.cor](#), [BF10.bin.test](#), or [BF10.props](#).

Value

Invisibly returns the input "BFvalue" object.

Examples

```
result <- BF10.ttest.OneSample(  
  tval = 2,  
  df = 50,  
  prior_analysis = "t-distribution",  
  location = 0,  
  scale = 0.707,  
  dff = 1,  
  alternative = "two.sided")  
print(result)
```

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