

Package ‘tidyBF’

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Type Package

Title Tidy Wrapper for 'BayesFactor' Package

Version 0.2.1

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Description Provides helper functions that make it easy to run 'BayesFactor' package tests on a data which is in a tidy format. Additionally, it provides a more consistent syntax and by default returns a dataframe with rich details. These functions can also return expressions containing results from Bayes Factor tests that can then be displayed on custom plots.

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URL <https://indrajeetpatil.github.io/tidyBF/>,
<https://github.com/IndrajeetPatil/tidyBF>

BugReports <https://github.com/IndrajeetPatil/tidyBF/issues>

Depends R (>= 3.6.0)

Imports BayesFactor, dplyr, ipmisc (>= 3.1.0), metaBMA, rlang, tidyr

Suggests ggplot2, knitr, rmarkdown, spelling, testthat

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NeedsCompilation no

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bf_contingency_tab	<i>Bayesian contingency table analysis</i>
--------------------	--

Description

Bayesian contingency table analysis

Usage

```
bf_contingency_tab(
  data,
  x,
  y = NULL,
  counts = NULL,
  ratio = NULL,
  sampling.plan = "indepMulti",
  fixed.margin = "rows",
  prior.concentration = 1,
  caption = NULL,
  output = "results",
  k = 2L,
  ...
)
```

```
bf_onesample_proptest(
  data,
  x,
  y = NULL,
  counts = NULL,
  ratio = NULL,
  sampling.plan = "indepMulti",
  fixed.margin = "rows",
  prior.concentration = 1,
  caption = NULL,
```

```

    output = "results",
    k = 2L,
    ...
)

```

Arguments

data	for use with formula, a data frame containing all the data
x	The variable to use as the rows in the contingency table.
y	The variable to use as the columns in the contingency table. Default is NULL. If NULL, one-sample proportion test (a goodness of fit test) will be run for the main variable. Otherwise an appropriate association test will be run.
counts	A string naming a variable in data containing counts, or NULL if each row represents a single observation (Default).
ratio	A vector of proportions: the expected proportions for the proportion test (should sum to 1). Default is NULL, which means the null is equal theoretical proportions across the levels of the nominal variable. This means if there are two levels this will be <code>ratio = c(0.5, 0.5)</code> or if there are four levels this will be <code>ratio = c(0.25, 0.25, 0.25, 0.25)</code> , etc.
sampling.plan	Character describing the sampling plan. Possible options are "indepMulti" (independent multinomial; default), "poisson", "jointMulti" (joint multinomial), "hypergeom" (hypergeometric). For more, see <code>?BayesFactor::contingencyTableBF()</code> .
fixed.margin	For the independent multinomial sampling plan, which margin is fixed ("rows" or "cols"). Defaults to "rows".
prior.concentration	Specifies the prior concentration parameter, set to 1 by default. It indexes the expected deviation from the null hypothesis under the alternative, and corresponds to Gunel and Dickey's (1974) "a" parameter.
caption	Text to display as caption (will be displayed on top of the Bayes Factor caption/message).
output	Can either be "null" (or "caption" or "H0" or "h0"), which will return expression with evidence in favor of the null hypothesis, or "alternative" (or "title" or "H1" or "h1"), which will return expression with evidence in favor of the alternative hypothesis, or "results", which will return a dataframe with results all the details).
k	Number of digits after decimal point (should be an integer) (Default: k = 2).
...	further arguments to be passed to or from methods.

Note

Bayes Factor for goodness of fit test is based on gist provided by Richard Morey: <https://gist.github.com/richardmorey/a4cd3a2051f373db917550d67131dba4>.

See Also

[bf_corr_test](#), [bf_oneway_anova](#), [bf_ttest](#)

Examples

```
# for reproducibility
set.seed(123)
library(tidyBF)

# ----- association tests -----

# to get caption (in favor of null)
bf_contingency_tab(
  data = mtcars,
  x = am,
  y = cyl,
  fixed.margin = "cols"
)

# to see results
bf_contingency_tab(
  data = mtcars,
  x = am,
  y = cyl,
  sampling.plan = "jointMulti",
  fixed.margin = "rows",
  prior.concentration = 1
)

# ----- goodness of fit tests -----

bf_contingency_tab(
  data = mtcars,
  x = am,
  prior.concentration = 10
)
```

bf_corr_test

Bayesian correlation test.

Description

Bayesian correlation test.

Usage

```
bf_corr_test(
  data,
  x,
  y,
  bf.prior = 0.707,
  caption = NULL,
  output = "results",
```

```

    hypothesis.text = TRUE,
    k = 2L,
    ...
)

```

Arguments

data	for use with formula, a data frame containing all the data
x	The column in data containing the explanatory variable to be plotted on the x-axis. Can be entered either as a character string (e.g., "x") or as a bare expression (e.g, x).
y	The column in data containing the response (outcome) variable to be plotted on the y-axis. Can be entered either as a character string (e.g., "y") or as a bare expression (e.g, y).
bf.prior	A number between 0.5 and 2 (default 0.707), the prior width to use in calculating Bayes factors.
caption	Text to display as caption (will be displayed on top of the Bayes Factor caption/message).
output	Can either be "null" (or "caption" or "H0" or "h0"), which will return expression with evidence in favor of the null hypothesis, or "alternative" (or "title" or "H1" or "h1"), which will return expression with evidence in favor of the alternative hypothesis, or "results", which will return a dataframe with results all the details).
hypothesis.text	Logical that decides whether the expression containing result should have text to describe the hypothesis test being described. For output = "null", this is "In favor of null: ", otherwise "In favor of alternative: ".
k	Number of digits after decimal point (should be an integer) (Default: k = 2).
...	Additional arguments (ignored).

See Also

[bf_contingency_tab](#), [bf_oneway_anova](#), [bf_ttest](#)

Examples

```

# for reproducibility
set.seed(123)

# to see results
bf_corr_test(
  data = anscombe,
  x = x1,
  y = y4,
  bf.prior = 1
)

# to get caption

```

```
bf_corr_test(
  data = anscombe,
  x = x1,
  y = y4,
  bf.prior = 0.8,
  output = "null"
)
```

bf_expr

Prepare caption with expression for Bayes Factor results

Description

Convenience function to create an expression with Bayes Factor results.

Usage

```
bf_expr(
  bf.df,
  k = 2L,
  output = "null",
  hypothesis.text = TRUE,
  caption = NULL,
  ...
)
```

Arguments

bf.df	A dataframe containing two columns <code>log_e_bf01</code> (for evidence in favor of null hypothesis) and <code>bf.prior</code> . If dataframe contains more than two rows, only the first row will be used.
k	Number of digits after decimal point (should be an integer) (Default: <code>k = 2</code>).
output	Can either be "null" (or "caption" or "H0" or "h0"), which will return expression with evidence in favor of the null hypothesis, or "alternative" (or "title" or "H1" or "h1"), which will return expression with evidence in favor of the alternative hypothesis, or "results", which will return a dataframe with results all the details).
hypothesis.text	Logical that decides whether the expression containing result should have text to describe the hypothesis test being described. For <code>output = "null"</code> , this is "In favor of null: ", otherwise "In favor of alternative: ".
caption	Text to display as caption (will be displayed on top of the Bayes Factor caption/message).
...	Additional arguments (ignored).

Examples

```
# for reproducibility
set.seed(123)
library(tidyBF)

# dataframe containing results
bf.df <-
  bf_extractor(BayesFactor::correlationBF(
    x = iris$Sepal.Length,
    y = iris$Petal.Length
  )) %>%
  dplyr::mutate(.data = ., bf.prior = 0.707)

# creating caption (for null)
bf_expr(
  bf.df,
  output = "null",
  k = 3,
  caption = "Note: Iris dataset"
)

# creating caption (for alternative)
bf_expr(bf.df, output = "alternative")
```

bf_extractor

Extract Bayes Factors from BayesFactor model object.

Description

Extract Bayes Factors from BayesFactor model object.

Usage

```
bf_extractor(bf.object, ...)
```

Arguments

bf.object	An object from BayesFactor package.
...	Currently ignored.

Note

Important: don't enter `1/bf_obj` to extract results for null hypothesis; doing so will return wrong results.

Examples

```

set.seed(123)

# creating a `BayesFactor` object
bf_obj <-
  BayesFactor::anovaBF(
    formula = Sepal.Length ~ Species,
    data = iris,
    progress = FALSE
  )

# extracting Bayes Factors in a dataframe
bf_extractor(bf_obj)

```

bf_meta

*Bayes factor for random-effects meta-analysis***Description**

Bayes factor for random-effects meta-analysis

Usage

```

bf_meta(
  data,
  d = prior("norm", c(mean = 0, sd = 0.3)),
  tau = prior("invgamma", c(shape = 1, scale = 0.15)),
  k = 2L,
  output = "results",
  caption = NULL,
  messages = TRUE,
  ...
)

```

Arguments

data	A dataframe. It must contain columns named estimate (effect sizes or outcomes) and std.error (corresponding standard errors). These two columns will be used for yi and sei arguments in metafor::rma (for parametric analysis) or metaplus::metaplus (for robust analysis).
d	prior distribution on the average effect size d. The prior probability density function is defined via prior .
tau	prior distribution on the between-study heterogeneity tau (i.e., the standard deviation of the study effect sizes dstudy in a random-effects meta-analysis. A (nonnegative) prior probability density function is defined via prior .
k	Number of digits after decimal point (should be an integer) (Default: k = 2).

output	Can either be "null" (or "caption" or "H0" or "h0"), which will return expression with evidence in favor of the null hypothesis, or "alternative" (or "title" or "H1" or "h1"), which will return expression with evidence in favor of the alternative hypothesis, or "results", which will return a dataframe with results all the details).
caption	Text to display as caption (will be displayed on top of the Bayes Factor caption/message).
messages	Deprecated. Retained only for backward compatibility.
...	Arguments passed on to <code>metaBMA::meta_random</code> labels optional: character values with study labels. Can be a character vector or the quoted or unquoted name of the variable in data rscale_contin scale parameter of the JZS prior for the continuous covariates. rscale_discrete scale parameter of the JZS prior for discrete moderators. centering whether continuous moderators are centered. logml how to estimate the log-marginal likelihood: either by numerical integration ("integrate") or by bridge sampling using MCMC/Stan samples ("stan"). To obtain high precision with logml="stan", many MCMC samples are required (e.g., logml_iter=10000, warmup=1000). summarize how to estimate parameter summaries (mean, median, SD, etc.): Either by numerical integration (summarize = "integrate") or based on MCMC/Stan samples (summarize = "stan"). ci probability for the credibility/highest-density intervals. rel.tol relative tolerance used for numerical integration using <code>integrate</code> . Use rel.tol=.Machine\$double.eps for maximal precision (however, this might be slow). logml_iter number of iterations (per chain) from the posterior distribution of d and tau. The samples are used for computing the marginal likelihood of the random-effects model with bridge sampling (if logml="stan") and for obtaining parameter estimates (if summarize="stan"). Note that the argument iter=2000 controls the number of iterations for estimation of the random-effect parameters per study in random-effects meta-analysis. silent_stan whether to suppress the Stan progress bar.

Examples

```
# setup
set.seed(123)
library(metaBMA)

# creating a dataframe
(df <-
  structure(
    .Data = list(
      study = c("1", "2", "3", "4", "5"),
      estimate = c(
```

```

      0.382047603321706,
      0.780783111514665,
      0.425607573765058,
      0.558365541235078,
      0.956473848429961
    ),
    std.error = c(
      0.0465576338644502,
      0.0330218199731529,
      0.0362834986178494,
      0.0480571500648261,
      0.062215818388157
    )
  ),
  row.names = c(NA, -5L),
  class = c("tbl_df", "tbl", "data.frame")
))

# getting Bayes factor in favor of null hypothesis
bf_meta(
  data = df,
  k = 3,
  iter = 1500,
  messages = TRUE,
  # customizing analysis with additional arguments
  control = list(max_treedepth = 15)
)

```

bf_oneway_anova

Bayesian one-way analysis of variance

Description

Bayesian one-way analysis of variance

Usage

```

bf_oneway_anova(
  data,
  x,
  y,
  bf.prior = 0.707,
  caption = NULL,
  output = "results",
  hypothesis.text = TRUE,
  paired = FALSE,
  k = 2L,
  ...
)

```

Arguments

data	A dataframe (or a tibble) from which variables specified are to be taken. A matrix or tables will not be accepted.
x	The grouping variable from the dataframe data.
y	The response (a.k.a. outcome or dependent) variable from the dataframe data.
bf.prior	A number between 0.5 and 2 (default 0.707), the prior width to use in calculating Bayes factors.
caption	Text to display as caption (will be displayed on top of the Bayes Factor caption/message).
output	Can either be "null" (or "caption" or "H0" or "h0"), which will return expression with evidence in favor of the null hypothesis, or "alternative" (or "title" or "H1" or "h1"), which will return expression with evidence in favor of the alternative hypothesis, or "results", which will return a dataframe with results all the details).
hypothesis.text	Logical that decides whether the expression containing result should have text to describe the hypothesis test being described. For output = "null", this is "In favor of null: ", otherwise "In favor of alternative: ".
paired	if TRUE, observations are paired
k	Number of digits after decimal point (should be an integer) (Default: k = 2).
...	Additional arguments.

See Also

[bf_contingency_tab](#), [bf_corr_test](#), [bf_ttest](#)

Examples

```
# setup
set.seed(123)

# between-subjects -----
bf_oneway_anova(
  data = iris,
  x = Species,
  y = Sepal.Length,
  bf.prior = 0.8
)

# within-subjects -----
bf_oneway_anova(
  data = bugs_long,
  x = condition,
  y = desire,
  paired = TRUE
)
```

`bf_ttest`*Bayes Factor for t-test*

DescriptionBayes Factor for *t*-test**Usage**

```
bf_ttest(  
  data,  
  x,  
  y = NULL,  
  test.value = 0,  
  paired = FALSE,  
  bf.prior = 0.707,  
  caption = NULL,  
  output = "results",  
  hypothesis.text = TRUE,  
  k = 2L,  
  ...  
)
```

```
bf_one_sample_ttest(  
  data,  
  x,  
  y = NULL,  
  test.value = 0,  
  paired = FALSE,  
  bf.prior = 0.707,  
  caption = NULL,  
  output = "results",  
  hypothesis.text = TRUE,  
  k = 2L,  
  ...  
)
```

```
bf_two_sample_ttest(  
  data,  
  x,  
  y = NULL,  
  test.value = 0,  
  paired = FALSE,  
  bf.prior = 0.707,  
  caption = NULL,  
  output = "results",  
  hypothesis.text = TRUE,  
  k = 2L,  
  ...  
)
```

```

    k = 2L,
    ...
  )

```

Arguments

data	for use with formula, a data frame containing all the data
x	Either the grouping variable from the dataframe data if it's a two-sample <i>t</i> -test or a numeric variable if it's a one-sample <i>t</i> -test.
y	The column in data containing the response (outcome) variable to be plotted on the y-axis. Can be entered either as a character string (e.g., "y") or as a bare expression (e.g, y).
test.value	A number specifying the value of the null hypothesis (Default: 0).
paired	if TRUE, observations are paired
bf.prior	A number between 0.5 and 2 (default 0.707), the prior width to use in calculating Bayes factors.
caption	Text to display as caption (will be displayed on top of the Bayes Factor caption/message).
output	Can either be "null" (or "caption" or "H0" or "h0"), which will return expression with evidence in favor of the null hypothesis, or "alternative" (or "title" or "H1" or "h1"), which will return expression with evidence in favor of the alternative hypothesis, or "results", which will return a dataframe with results all the details).
hypothesis.text	Logical that decides whether the expression containing result should have text to describe the hypothesis test being described. For output = "null", this is "In favor of null: ", otherwise "In favor of alternative: ".
k	Number of digits after decimal point (should be an integer) (Default: k = 2).
...	Additional arguments (ignored).

Details

If y is NULL, a one-sample *t*-test will be carried out, otherwise a two-sample *t*-test will be carried out.

See Also

[bf_contingency_tab](#), [bf_corr_test](#), [bf_oneway_anova](#)

Examples

```

# ----- two-samples tests -----

# for reproducibility
set.seed(123)
library(tidyBF)

```

```

# to get dataframe
bf_ttest(
  data = mtcars,
  x = am,
  y = wt,
  paired = FALSE,
  bf.prior = 0.880
)

# ----- one-samples test -----

# to get dataframe
bf_ttest(
  data = iris,
  x = Sepal.Length,
  test.value = 5.85
)

```

 bugs_long

Tidy version of the "Bugs" dataset.

Description

Tidy version of the "Bugs" dataset.

Usage

bugs_long

Format

A data frame with 372 rows and 6 variables

- subject. Dummy identity number for each participant.
- gender. Participant's gender (Female, Male).
- region. Region of the world the participant was from.
- education. Level of education.
- condition. Condition of the experiment the participant gave rating for (**LDLF**: low frighteningness and low disgustingness; **LFHD**: low frighteningness and high disgustingness; **HFHD**: high frighteningness and low disgustingness; **HFHD**: high frighteningness and high disgustingness).
- desire. The desire to kill an arthropod was indicated on a scale from 0 to 10.

Details

This data set, "Bugs", provides the extent to which men and women want to kill arthropods that vary in frighteningness (low, high) and disgustingness (low, high). Each participant rates their attitudes towards all anthrropods. Subset of the data reported by Ryan et al. (2013).

Source

<https://www.sciencedirect.com/science/article/pii/S0747563213000277>

Examples

```
dim(bugs_long)
head(bugs_long)
dplyr::glimpse(bugs_long)
```

meta_data_check	<i>Helper function to check column names for meta-analysis.</i>
-----------------	---

Description

Helper function to check column names for meta-analysis.

Usage

```
meta_data_check(data)
```

Arguments

data	A dataframe. It must contain columns named estimate (effect sizes or outcomes) and std.error (corresponding standard errors). These two columns will be used for yi and sei arguments in metafor::rma (for parametric analysis) or metaplan::metaplan (for robust analysis).
------	---

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