Package ‘sprtt’

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Type Package

Title Sequential Probability Ratio Tests: Using t-Statistic

Version 0.1.0

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Description The seq_ttest() function is the implementation of Abraham Wald’s (1947) Sequential Probability Ratio Test (SPRT) for the test of a normal mean (difference) with unknown variance in R (R Core Team, 2018). It performs sequential t tests developed by Rushton (1950) <doi:10.2307/2332385>, Rush ton (1952) <doi:10.2307/2334026> and Hajnal (1961) <doi:10.2307/2333131>, based on the SPRT. Specifically, seq_ttest() performs one-sample, two-sample, and paired t tests for testing one- and two-sided hypotheses. The test is to be applied to the data during the sampling process, ideally after each observation. At any stage, it will return a decision to either continue sampling or terminate and accept one of the specified hypotheses. For more information on the SPRT t test, see Schnuerch & Erdfelder (2019) <doi:10.1037/met0000234>.

License GPL (>= 3)

URL https://meikesteinhilber.github.io/sprtt/

BugReports https://github.com/MeikeSteinhilber/sprtt/issues

Depends R (>= 3.5.0)

Imports methods, stats

Suggests knitr, rmarkdown, testthat (>= 3.0.0), testthis, dplyr, effsize

VignetteBuilder knitr

Encoding UTF-8

Language en-US

LazyData true

RoxygenNote 7.1.1

NeedsCompilation no
df_cancer

**Description**

A dataset that includes 120 individuals.

**Usage**

df_cancer

**Format**

A data frame with 2 variables:

- treatment_group
- control_group
df_income

Description
A dataset that includes 120 individuals with sex gender and monthly income.

Usage
df_income

Format
A data frame with 2 variables:

monthly_income
sex

df_stress

Description
A dataset that includes 120 individuals.

Usage
df_stress

Format
A data frame with 2 variables:

baseline_stress
one_year_stress
seq_ttest

Sequential Probability Ratio Test using t-statistic

Description
Performs one and two sample sequential t-tests on vectors of data.

Usage
seq_ttest(
  x,  
  y = NULL,  
  data = NULL,  
  mu = 0,  
  d,  
  alpha = 0.05,  
  power = 0.95,  
  alternative = "two.sided",  
  paired = FALSE,  
  na.rm = TRUE,  
  verbose = TRUE
)

Arguments

x  Works with two classes: numeric and formula. Therefore you can write "x" or "x~y".
  • "numeric input": a (non-empty) numeric vector of data values.
  • "formula input": a formula of the form lhs ~ rhs where lhs is a numeric variable giving the data values and rhs either 1 for a one-sample test or a factor with two levels giving the corresponding groups.

y  an optional (non-empty) numeric vector of data values.

data  an optional data.frame, which you can use only in combination with a "formula input" in argument x.

mu  a number indicating the true value of the mean (or difference in means if you are performing a two sample test).

d  a number indicating the specified effect size (Cohen’s d)

alpha  the type I error. A number between 0 and 1.

power  1 - beta (beta is the type II error probability). A number between 0 and 1.

alternative  a character string specifying the alternative hypothesis, must be one of two.sided (default), greater or less. You can specify just the initial letter.

paired  a logical indicating whether you want a paired t-test.

na.rm  a logical value indicating whether NA values should be stripped before the computation proceeds.

verbose  a logical value whether you want a verbose output or not.
seq_ttest_results-class

An S4 class to represent the results of a sequential t-test.

Value

An object of the S4 class seq_ttest_results. Click on the class link to see the full description of the slots. To get access to the object use the @-operator or []-brackets instead of $. See the examples below.

Examples

# set seed --------------------------------------------------------------------
set.seed(333)

# load library ---------------------------------------------------------------
library(sprt)

# one sample: numeric input ---------------------------------------------------
treatment_group <- rnorm(20, mean = 0, sd = 1)
results <- seq_ttest(treatment_group, mu = 1, d = 0.8)

# get access to the slots -----------------------------------------------------
# @ Operator
results@likelihood_ratio

# [] Operator
results["likelihood_ratio"]

# two sample: numeric input ---------------------------------------------------
treatment_group <- stats::rnorm(20, mean = 0, sd = 1)
control_group <- stats::rnorm(20, mean = 1, sd = 1)
seq_ttest(treatment_group, control_group, d = 0.8)

# two sample: formula input ---------------------------------------------------
stress_level <- stats::rnorm(20, mean = 0, sd = 1)
sex <- as.factor(c(rep(1, 10), rep(2, 10)))
seq_ttest(stress_level ~ sex, d = 0.8)

# NA in the data --------------------------------------------------------------
stress_level <- c(NA, stats::rnorm(20, mean = 0, sd = 2), NA)
sex <- as.factor(c(rep(1, 11), rep(2, 11)))
seq_ttest(stress_level ~ sex, d = 0.8, na.rm = TRUE)

# work with dataset (data are in the package included) ------------------------
seq_ttest(monthly_income ~ sex, data = df_income, d = 0.8)
Slots

likelihood_ratio_log  the logarithmic test statistic.
decision  the test decision: "accept H1", "accept H0", or "continue sampling".
A_boundary_log  the lower logarithmic boundary of the test.
B_boundary_log  the upper logarithmic boundary of the test.
d  a number indicating the specified effect size (Cohen's d).
mu  a number indicating the true value of the mean (or difference in means if you are performing a
two sample test).
alpha  the type I error. A number between 0 and 1.
power  1 - beta (beta is the type II error probability). A number between 0 and 1.
likelihood_ratio  the likelihood ratio of the test without logarithm.
likelihood_1  the likelihood of the alternative Hypothesis (H1).
likelihood_0  the likelihood of the null Hypothesis (H0).
likelihood_1_log  the logarithmic likelihood of the alternative Hypothesis (H1).
likelihood_0_log  the logarithmic likelihood of the null Hypothesis (H0).
non_centrality_parameter  parameter to calculate the likelihoods
t_value  the t-value of the t-statistic.
p_value  the p-value of the t-test.
df  degrees of freedom.
mean_estimate  the estimated mean or difference in means depending on whether it was a one-
sample test or a two-sample test.
alternative  a character string specifying the alternative hypothesis: "two.sided" (default), "greater"
or "less".
one_sample  "true" if it is a one-sample test, "false" if it is a two-sample test.
ttest_method  a character string indicating what type of t-test was performed.
data_name  a character string giving the name(s) of the data.
verbose  a logical value whether you want a verbose output or not.

sprtt

Description

This package provides the implementation of sequential probability ratio tests using t-statistic.

detailed help pages

For detailed instructions on the sprtt package, see: vignette("sprtt") or https://meikesteinhilber.github.io/sprtt/

sprtt functions

• seq_ttest  Performs one and two sample sequential t-tests on vectors of data.
[,seq_ttest_arguments-method

Method to retrieve the contents of a slot of an object of the seq_ttest_arguments class.

Description
This method is only used internally to process the input arguments of the seq_ttest function. As a normal user, you can ignore this specific documentation.

Usage
## S4 method for signature 'seq_ttest_arguments'
x[i, j, drop]

Arguments
x
  the seq_ttest_arguments object.
i
  indices indicating elements to extract.
j
  not used.
drop
  not used.
seq_ttest_arguments
  the corresponding class to this method.

Value
Returns the contents of the specified slot of an seq_ttest_arguments object. For more information, see the arguments of the seq_ttest function.

[,seq_ttest_results-method

Method to retrieve the contents of a slot of an object of the seq_ttest_results class.

Description
Method to retrieve the contents of a slot of an object of the seq_ttest_results class.

Usage
## S4 method for signature 'seq_ttest_results'
x[i, j, drop]
Arguments

- `x` the `seq_ttest_results` object.
- `i` indices indicating elements to extract.
- `j` not used.
- `drop` not used.
- `seq_ttest_results` the corresponding class to this method.

Value

Returns the contents of the specified slot. For more information, see the documentation for the `seq_ttest_results` class.
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