Package ‘brunnermunzel’

October 12, 2022

Type Package

Title (Permuted) Brunner-Munzel Test

Version 2.0

Date 2022-8-7

License GPL-2 | GPL-3

Description Provides the functions for Brunner-Munzel test and permuted Brunner-Munzel test, which enable to use formula, matrix, and table as argument. These functions are based on Brunner and Munzel (2000) <doi:10.1002/(SICI)1521-4036(200001)42:1%3c17::AID-BIMJ17%3E3.0.CO;2-U> and Neubert and Brunner (2007) <doi:10.1016/j.csda.2006.05.024>, and are written with FORTRAN.

URL https://github.com/toshi-ara/brunnermunzel

BugReports https://github.com/toshi-ara/brunnermunzel/issues/

RoxygenNote 7.2.1

Suggests testthat, knitr, rmarkdown, dplyr, ggplot2

VignetteBuilder knitr

NeedsCompilation yes

Author Toshiaki Ara [aut, cre]

Maintainer Toshiaki Ara <toshiaki.ara@gmail.com>

Repository CRAN

Date/Publication 2022-08-07 15:40:11 UTC

R topics documented:

  brunnermunzel.permutation.test .................................................. 2
  brunnermunzel.test ................................................................. 6

Index 11
brunnermunzel.permutation.test

_permuted Brunner-Munzel test_

Description

This function performs the permuted Brunner-Munzel test.

Usage

brunnermunzel.permutation.test(x, ...)

## Default S3 method:
brunnermunzel.permutation.test(
  x,
  y,
  alternative = c("two.sided", "greater", "less"),
  force = FALSE,
  est = c("original", "difference"),
  ...
)

## S3 method for class 'formula'
brunnermunzel.permutation.test(formula, data, subset = NULL, na.action, ...)

## S3 method for class 'matrix'
brunnermunzel.permutation.test(x, ...)

## S3 method for class 'table'
brunnermunzel.permutation.test(x, ...)

Arguments

x the numeric vector of data values from the sample 1, or 2 x n matrix of table (number of row must be 2 and column is ordinal variables).

... further arguments to be passed to or from methods (This argument is for only formula).

y the numeric vector of data values from the sample 2. If x is matrix or table, y must be missing.

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

force FALSE (default): If sample size is too large [number of combinations > 40116600 = choose(28, 14)], use brunnermunzel.test.

TRUE : perform permuted Brunner-Munzel test regardless sample size.

est a method to calculate estimate and confidence interval, must be either original (default) or difference.
brunnermunzel.permutation.test

original (default): return \( p = P(X < Y) + 0.5 \cdot P(X = Y) \)
difference : return mean difference. i.e. \( P(X < Y) - P(X > Y) = 2 \cdot p - 1 \)

This change is proposed by Dr. Julian D. Karch.

formula a formula of the form \( \text{ lhs ~ rhs } \) where \( \text{ lhs } \) is a numeric variable giving the data
values and \( \text{ rhs } \) a factor with two levels giving the corresponding groups.
data an optional matrix or data frame (or similar: see \text{ model.frame } \) containing
the variables in the formula \text{ formula } \. By default the variables are taken from
environment(formula).
subset an optional vector specifying a subset of observations to be used.
na.action a function which indicates what should happen when the data contain NAs. De-
defaults to getOption("na.action").

Value

A list containing the following components:

method the characters “permuted Brunner-Munzel Test”
data.name a character string giving the name of the data.
p.value the \( p \)-value of the test.
estimate an estimate of the effect size

Note

FORTRAN subroutine ‘combination’ in combination.f is derived from the program by shikino
(\url{http://slpr.sakura.ne.jp/qp/combination}) (CC-BY-4.0). Thanks to shikono for your useful
subroutine.

References

Karin Neubert and Edgar Brunner, “A studentized permutation test for the non-parametric Behrens-

See Also

This function is made in reference to following cite (in Japanese): Prof. Haruhiko Okumura (\url{https: //oku.edu.mie-u.ac.jp/~okumura/stat/brunner-munzel.html}).

Examples

```r
## Hollander & Wolfe (1973), 29f.
## Hamilton depression scale factor measurements in 9 patients with
## mixed anxiety and depression, taken at the first (x) and second
## (y) visit after initiation of a therapy (administration of a
## tranquilizer).
x <- c(1.83, 0.50, 1.62, 2.48, 1.68, 1.88, 1.55, 3.06, 1.30)
y <- c(0.878, 0.647, 0.598, 2.05, 1.06, 1.29, 1.06, 3.14, 1.29)

brunnermunzel.permutation.test(x, y)
```
## permuted Brunner-Munzel Test

## data: x and y
## p-value = 0.158
## sample estimates:
## \( P(X<Y) + 0.5P(X=Y) \)
## 0.2839506

```

'est' option
if 'est = "difference"' return \( P(X<Y) - P(X>Y) \)
```

```
brunnermunzel.permutation.test(x, y, est = "difference")
```

## permuted Brunner-Munzel Test

## data: x and y
## p-value = 0.158
## sample estimates:
## \( P(X<Y) - P(X>Y) \)
## -0.4320988

```

Formula interface.
dat <- data.frame(
  value = c(x, y),
  group = factor(rep(c("x", "y"), c(length(x), length(y))),
                  levels = c("x", "y"))
)
```

```
brunnermunzel.permutation.test(value ~ group, data = dat)
```

## Pain score on the third day after surgery for 14 patients under
## the treatment Y and 11 patients under the treatment N
## (see Brunner and Munzel, 2000; Neubert and Brunner, 2007).

```
Y <- c(1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 4, 1, 1)
N <- c(3, 3, 4, 3, 1, 2, 3, 1, 1, 5, 4)
```

```
brunnermunzel.permutation.test(Y, N)
```

## permuted Brunner-Munzel Test
## data: Y and N
## p-value = 0.008038
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.788961

## Formula interface.
dat <- data.frame(
  value = c(Y, N),
  group = factor(rep(c("Y", "N"), c(length(Y), length(N))),
                levels = c("Y", "N"))
)

brunnermunzel.permutation.test(value ~ group, data = dat)

## matrix or table interface.
##
dat1 <- matrix(c(4, 4, 2, 1, 5, 4), nr = 2, byrow = TRUE)
dat2 <- as.table(dat1)

brunnermunzel.permutation.test(dat1) # matrix

brunnermunzel.permutation.test(dat2) # table

brunnermunzel.permutation.test(data) # matrix

brunnermunzel.permutation.test(data) # table

### Brunner-Munzel Test
### permuted Brunner-Munzel Test
###
### data: A and B
### p-value = 0.1593
### sample estimates:
### P(X<Y)+.5*P(X=Y)
### 0.68
Description

This function performs the Brunner–Munzel test for stochastic equality of two samples, which is also known as the Generalized Wilcoxon Test. NAs from the data are omitted. This function enables to use formula as argument.

Usage

brunnermunzel.test(x, ...)

## Default S3 method:
brunnermunzel.test(
  x,
  y,
  alternative = c("two.sided", "greater", "less"),
  alpha = 0.05,
  perm = FALSE,
  est = c("original", "difference"),
  ...
)

## S3 method for class 'formula'
brunnermunzel.test(formula, data, subset = NULL, na.action, ...)

## S3 method for class 'matrix'
brunnermunzel.test(x, ...)

## S3 method for class 'table'
brunnermunzel.test(x, ...)

Arguments

x the numeric vector of data values from the sample 1, or 2 x n matrix of table (number of row must be 2 and column is ordinal variables).

... further arguments to be passed to or from methods (This argument is for only formula).

y the numeric vector of data values from the sample 2. If x is matrix or table, y must be missing.

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

alpha significance level, default is 0.05 for 95% confidence interval.

perm logical
brunnermunzel.test

TRUE : perform permuted Brunner-Munzel test.
est 
a method to calculate estimate and confidence interval, must be either original (default) or difference.
original (default): return \( p = P(X < Y) + 0.5 \times P(X = Y) \)
difference : return mean difference, i.e. \( P(X < Y) - P(X > Y) = 2 \times p - 1 \)
This change is proposed by Dr. Julian D. Karch.

formula 
a formula of the form lhs ~ rhs where lhs is a numeric variable giving the data values and rhs a factor with two levels giving the corresponding groups.
data 
an optional matrix or data frame (or similar: see model.frame) containing the variables in the formula formula. By default the variables are taken from environment(formula).
subset 
an optional vector specifying a subset of observations to be used.
na.action 
a function which indicates what should happen when the data contain NAs. Defaults to getOption("na.action").

Value
A list containing the following components:
data.name 
a character string giving the name of the data.
statistic 
the Brunner–Munzel test statistic.
parameter 
the degrees of freedom.
p.value 
the \( p \)-value of the test.
conf.int 
the confidence interval.
estimate 
an estimate of the effect size

Note
There exist discrepancies with Brunner and Munzel (2000) because there is a typo in the paper. The corrected version is in Neubert and Brunner (2007) (e.g., compare the estimates for the case study on pain scores). The current R function follows Neubert and Brunner (2007).

See Also
The R script of brunnermunzel.test.default is derived from that of brunner.munzel.test in lawstat package, and is rewritten with FORTRAN. Thanks to authors of lawstat package.

Examples
## Hollander & Wolfe (1973), 29f.
## Hamilton depression scale factor measurements in 9 patients with
## mixed anxiety and depression, taken at the first (x) and second
## (y) visit after initiation of a therapy (administration of a
## tranquilizer).
x <- c(1.83, 0.50, 1.62, 2.48, 1.68, 1.88, 1.55, 3.06, 1.30)
```
y <- c(0.878, 0.647, 0.598, 2.05, 1.06, 1.29, 1.06, 3.14, 1.29)
brunnermunzel.test(x, y)
##
## Brunner-Munzel Test
##
## data: x and y
## Brunner-Munzel Test Statistic = -1.4673, df = 15.147, p-value = 0.1628
## 95 percent confidence interval:
## -0.02962941 0.59753064
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.2839506
##
## 'est' option
## if 'est = "difference"' return P(X<Y) - P(X>Y)
brunnermunzel.test(x, y, est = "difference")
##
## Brunner-Munzel Test
##
## data: x and y
## Brunner-Munzel Test Statistic = -1.4673, df = 15.147, p-value = 0.1628
## 95 percent confidence interval:
## -1.0592588 0.1950613
## sample estimates:
## P(X<Y)-P(X>Y)
## -0.4320988
##
## Formula interface.
dat <- data.frame(
  value = c(x, y),
  group = factor(rep(c("x", "y"), c(length(x), length(y))),
                   levels = c("x", "y"))
)
brunnermunzel.test(value ~ group, data = dat)
##
## Brunner-Munzel Test
##
## data: value by group
## Brunner-Munzel Test Statistic = -1.4673, df = 15.147, p-value = 0.1628
## 95 percent confidence interval:
## -0.02962941 0.59753064
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.2839506
##
## Pain score on the third day after surgery for 14 patients under
## the treatment Y and 11 patients under the treatment N
## (see Brunner and Munzel, 2000; Neubert and Brunner, 2007).
```
Y <- c(1, 2, 1, 1, 1, 1, 1, 1, 2, 4, 1, 1)
N <- c(3, 3, 4, 3, 1, 2, 3, 1, 1, 5, 4)

brunnermunzel.test(Y, N)
##
## Brunner-Munzel Test
##
## data: Y and N
## Brunner-Munzel Test Statistic = 3.1375, df = 17.683, p-value = 0.005786
## 95 percent confidence interval:
## 0.5952169 0.9827052
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.788961

## Formula interface.
dat <- data.frame(
   value = c(Y, N),
   group = factor(rep(c("Y", "N"), c(length(Y), length(N))),
                  levels = c("Y", "N"))
)

brunnermunzel.test(value ~ group, data = dat)
##
## Brunner-Munzel Test
##
## data: value by group
## Brunner-Munzel Test Statistic = 3.1375, df = 17.683, p-value =
## 0.005786
## 95 percent confidence interval:
## 0.5952169 0.9827052
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.788961

## Matrix or Table interface.
##
dat1 <- matrix(c(4, 4, 2, 1, 5, 4), nr = 2, byrow = TRUE)
dat2 <- as.table(dat1)

brunnermunzel.test(dat1)  # matrix
##
## Brunner-Munzel Test
##
## data: Group1 and Group2
## Brunner-Munzel Test Statistic = 1.5511, df = 16.961, p-value =
## 0.1393
## 95 percent confidence interval:
## 0.4351213 0.9248787
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.68
brunnermunzel.test(dat2) # table
##
## Brunner-Munzel Test
##
## data:  A and B
## Brunner-Munzel Test Statistic = 1.5511, df = 16.961, p-value = 0.1393
## 95 percent confidence interval: 0.4351213 0.9248787
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.68
Index

brunnermunzel.permutation.test, 2
brunnermunzel.test, 6

model.frame, 3, 7