Package ‘brunnermunzel’

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Type Package

Title (Permuted) Brunner-Munzel Test

Version 1.4.1

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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 7.0.2

Suggests testthat, knitr, markdown, dplyr, ggplot2

VignetteBuilder knitr

NeedsCompilation yes

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R topics documented:

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

Index 11
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.
**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")`.

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**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

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**Note**

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

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**References**


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**See Also**

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

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**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)+.5*P(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)
## permuted Brunner-Munzel Test
## data: value by group
## p-value = 0.158
## 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.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

## Brunner-Munzel Test
##
## data: Group1 and Group2
## p-value = 0.1593
## sample estimates:
## P(X<Y)+.5*P(X=Y)
## 0.68

brunnermunzel.permutation.test(dat2) # table

## 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
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 \sim 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 togetOption("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
```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)
```

\begin{verbatim}
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).
\end{verbatim}
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