Package 'WRS2'

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Type Package

Title A Collection of Robust Statistical Methods

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Description
A collection of robust statistical methods based on Wilcox' WRS functions. It implements t-tests (independent and dependent samples), ANOVA (including between-within subject designs) and nonparametric ANCOVA models based on robust location measures.

License GPL-3

URL https://r-forge.r-project.org/projects/psychor/

Imports MASS, reshape, plyr, stats, graphics, grDevices, utils

Depends R (>= 3.0.0)

Suggests knitr, beanplot, car, colorspace, ez

VignetteBuilder knitr

LazyData yes

LazyLoad yes

ByteCompile yes

NeedsCompilation yes

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R topics documented:

`WRS2-package` *Wilcox Robust Estimation and Testing*

Description

A user-friendly version of Wilcox' robust statistics functions (WRS package). It implements the most important robust tests as described in Rand Wilcox book "Introduction to Robust Estimation and Hypothesis Testing".

Details

Package:	WRS2
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The **WRS2** package provides wrapper functions for the **WRS** package such that these functions can be applied in a user-friendly manner. It interfaces various functions in the **WRS** package in terms of easy-to-use input arguments and corresponding S3 methods for presenting the output. Several robust ANOVA and ANCOVA functions have been implemented so far. Additional functions will be added subsequently.

Author(s)

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References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

`ancova` *Robust ANCOVA*

Description

This function computes robust ANCOVA for 2 independent groups and one covariate. It compares trimmed means. No parametric assumption (e.g. homogeneity) is made about the form of the regression lines. A running interval smoother is used. A bootstrap version which computes confidence intervals using a percentile t-bootstrap is provided as well.

Usage

```
ancova(formula, data, tr = 0.2, fr1 = 1, fr2 = 1, pts = NA)

ancboot(formula, data, tr = 0.2, nboot = 599, fr1 = 1, fr2 = 1, pts = NA)
```

Arguments

`formula`	an object of class formula.
`data`	an optional data frame for the input data.
`tr`	trim level for the mean.
`fr1`	values of the span for the first group (1 means unspecified)
`fr2`	values of the span for the second group (1 means unspecified)
`pts`	can be used to specify the design points where the regression lines are to be compared; if `NA` design points are chosen.
`nboot`	number of bootstrap samples

Value

Returns an object of class ancova containing:

evalpts	covariate values (including points close to these values) where the test statistic is evaluated
n1	number of subjects at evaluation point (first group)
n2	number of subjects at evaluation point (first group)
trDiff	trimmed mean differences
se	standard errors for trimmed mean differences
ci.low	lower confidence limit for trimmed mean differences
ci.hi	upper confidence limit for trimmed mean differences
test	values of the test statistic
crit.vals	critical values
p.vals	p-values
fitted.values	fitted values from interval smoothing
call	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t2way

Examples

```
head(invisibility)
ancova(mischief2 ~ cloak + mischief1, data = invisibility)

## specifying covariate evaluation points
ancova(mischief2 ~ cloak + mischief1, data = invisibility, pts = c(3, 4, 8, 1))

## bootstrap version
ancboot(mischief2 ~ cloak + mischief1, data = invisibility)
```

bush *Bushtucker Foods*

Description

In the TV show "I'm a celebrity, get me out of here" the celebrities had to eat things like stick insects, fish eyes, etc. This dataset records the time taken to retch when eating these things.

Usage

```
bush
```

Format

A data frame with 5 variables and 8 observations:

`participant` participant ID

`stick_insect` time taken to retch when eating a stick insect

`kangaroo_testicle` time taken to retch when eating a kangaroo testicle

`fish_eye` time taken to retch when eating a fish eye

`witchetty_grub` time taken to retch when eating a witchetty grub

Details

Dataset from Field et al. book (p. 557).

References

Field, A., Miles, J, \& Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
bush
summary(bush)
```

bwtrim *A robust two-way mixed ANOVA using trimmed means.*

Description

The bwtrim function computes a two-way between-within subjects ANOVA on the trimmed means. It allows for one between subjects variable and one within subjects variable. The functions sppba, sppbb, and sppbi compute the main fixed effect, the main within-subjects effect, and the interaction effect only, respectively, using bootstrap. For these 3 functions the user can choose an M-estimator for group comparisons.

Usage

```
bwtrim(formula, id, data, tr = 0.2)
tsplit(formula, id, data, tr = 0.2)
sppba(formula, id, data, est = "mom", avg = TRUE, nboot = 500, MDIS = FALSE)
sppbb(formula, id, data, est = "mom", nboot = 500)
sppbi(formula, id, data, est = "mom", nboot = 500)
```

Arguments

formula	an object of class formula.
id	subject ID.
data	an optional data frame for the input data.
tr	trim level for the mean.
est	Estimate to be used for the group comparisons: either "onestep" for one-step M-estimator of location using Huber's Psi, "mom" for the modified one-step (MOM) estimator of location based on Huber's Psi, or "median".
avg	If TRUE, the analysis is done by averaging K measures of location for each level of the fixed effect, and then comparing averages by testing the hypothesis that all pairwise differences are equal to zero. If FALSE the analysis is done by testing whether K equalities are simultaneously true.
nboot	number of bootstrap samples.
MDIS	if TRUE the depths of the points in the bootstrap cloud are based on Mahalanobis distance, if FALSE a projection distance is used.

Details

The tsplit function is doing exactly the same as bwtrim. It is kept in the package in order to be consistent with older versions of the Wilcox (2012) book.

For sppba, sppbb, and sppbi the analysis is done based on all pairs of difference scores. The null hypothesis is that all such differences have a typical value of zero. In the formula interface it is required to provide full model.

Value

`bwtrim` returns an object of class `"t2way"` containing:

`Qa`	first main effect
`A.p.value`	p-value first main effect
`Qb`	second main effect
`B.p.value`	p-value second main effect
`Qab`	interaction effect
`AB.p.value`	p-value interaction effect
`call`	function call
`varnames`	variable names

`sppba`, `sppbb`, and `sppbi` returns an object of class `"spp"` containing:

`test`	value of the test statistic
`p.value`	p-value

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

`t2way`

Examples

```
## data need to be on long format
pictureLong <- reshape(picture, direction = "long", varying = list(3:4), idvar = "case",
timevar = c("pictype"), times = c("couple", "alone"))
colnames(pictureLong)[4] <- "friend_requests"

## 2-way within-between subjects ANOVA
bwtrim(friend_requests ~ relationship_status*pictype, id = case, data = pictureLong)

## between groups effect only (MOM estimator)
sppba(friend_requests ~ relationship_status*pictype, case, data = pictureLong)

## within groups effect only (MOM estimator)
sppbb(friend_requests ~ relationship_status*pictype, case, data = pictureLong)

## interaction effect only (MOM estimator)
sppbi(friend_requests ~ relationship_status*pictype, case, data = pictureLong)
```

chile *Chile Heat and Length*

Description

Originally from pepperjoe.com, this dataset contains the name, length, and heat of chiles. Heat is measured on a scale from 0-11. (0-2 ... for sissys, 3-4 ... sort of hot, 5-6 ... fairly hot, 7-8 ... real hot, 9.5-9 ... torrid, 9.5-11 ... nuclear).

Usage

```
chile
```

Format

A data frame with 3 variables and 85 observations:

`name` name of the chile

`length` length in cm

`heat` heat of the chile

References

Wright, D. B., & London, K. (2009). Modern Regression Techniques Using R. Sage.

Examples

```
summary(chile)
```

electric *The Electric Company*

Description

These data are based on an educational TV show for children called "The Electric Company". In each of four grades, the classes were randomized into treated (TV show) and control groups (no TV show). At the beginning and at the end of the school year, students in all the classes were given a reading test. The average test scores per class were recorded.

Usage

```
electric
```

Format

A data frame with 5 variables and 192 observations:

`City` Fresno and Youngstown

`Grade` grade

`Pretest` reading scores at the beginning of the semester

`Posttest` reading scores at the end of the semester

`Group` treatment vs. control

References

Gelman, A., & Hill, J. (2007). Data Analysis Using Regression and Multilevel/Hierarchical Models. Cambridge University Press: New York, NY.

Examples

```
summary(electric)
```

---

eurosoccer *European Soccer Leagues*

Description

Contains various team stats from five European soccer leagues (2008/09 season).

Usage

```
eurosoccer
```

Format

A data frame with 11 variables and 96 teams:

`League` Country

`Team` Team

`Games` Number of games

`Won` Games won

`Tied` Games tied

`Lost` Games lost

`GoalsScored` Goals scored

`GoalsConceded` Goals conceded

`GoalDifference` Goal difference

`Points` Final amount of points

`GoalsGame` Goal scored per game

Examples

```
head(eurosoccer)
```

---

goggles *Beer Goggles Effect*

Description

This dataset is about the effects of alcohol on mate selection in night-clubs. The hypothesis is that after alcohol had been consumed, subjective perceptions of physical attractiveness would become more inaccurate (beer-goggles effect). There are 48 participants: 24 males, 24 females. The reseacher took 3 groups of 8 participants to a night club. One group got no alcohol, one group 2 pints, and one group 4 pints. At the end of the evening the researcher took a photograph of the person the participant was chatting up. The attractiveness of the person on the photo was then evaluated by independent judges.

Usage

```
goggles
```

Format

A data frame with 3 variables and 48 observations:

`gender` 24 male, 24 female students

`alcohol` amount of alcohol consumed

`attractiveness` attractiveness rating (0-100)

Details

Dataset from Field et al. book (p. 501).

References

Field, A., Miles, J, & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
goggles
summary(goggles)
```

hangover *Hangover Symptoms*

Description

In a study on the effect of consuming alcohol, hangover symptoms were measured for two independent groups, with each subject consuming alcohol and being measured on three different occasions. One group consisted of sons of alcoholics and the other was a control group.

Usage

```
chile
```

Format

A data frame with 4 variables and 120 observations:

`symptoms` number of hangover symptoms

`group` son of alcoholic vs. control

`time` measurement occasion

`id` subject ID

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Examples

```
summary(hangover)
```

invisibility *Cloaks of Invisibility*

Description

We are interested in the effect that wearing a cloak of invisibility has on people's tendency to mischief. 80 participants were placed in an enclosed community. Hidden cameras recorded mischievous acts. It was recorded how many mischievous acts were conducted in the first 3 weeks (mischief1). After 3 weeks 34 participants were told that the cameras were switched off so that no one would be able to see what they're getting up to. The remaining 46 subjects were given a cloak of invisibility. These people were told not to tell anyone else about their cloak and they could wear it whenever they liked. The number of mischievous acts were recorded over the next 3 weeks (mischief2).

Usage

```
invisibility
```

Format

A data frame with 3 variables and 80 observations:

`cloak` factor with 34 subjects in the no cloak condition, 46 in the cloak condition

`mischief1` number of mischievous acts during the first 3 weeks

`mischief2` number of mischievous acts during the second 3 weeks

Details

Fictional dataset from Field et al. book (p. 485).

References

Field, A., Miles, J, \& Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
invisibility
summary(invisibility)
```

`med1way` *Heteroscedastic one-way ANOVA for medians.*

Description

This function computes a one-way ANOVA for the medians. Homoscedasticity assumption not required. There shouldn't be too many ties.

Usage

```
med1way(formula, data,iter = 1000)
```

Arguments

`formula`	an object of class formula.
`data`	an optional data frame for the input data.
`iter`	number of iterations.

Value

Returns an object of class `med1way` containing:

`test`	value of the test statistic
`crit.val`	critical value
`p.value`	p-value
`call`	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

`t1way`,`t1waybt`

Examples

```
med1way(libido ~ dose, data = viagra)
```

`med2way` *A two-way ANOVA for medians.*

Description

This function computes a two-way ANOVA medians with interactions effects.

Usage

```
med2way(formula, data)
```

Arguments

`formula`	an object of class formula.
`data`	an optional data frame for the input data.

Value

Returns an object of class `t2way` containing:

`Qa`	first main effect
`A.p.value`	p-value first main effect
`Qb`	second main effect
`B.p.value`	p-value second main effect
`Qab`	interaction effect
`AB.p.value`	p-value interaction effect
`call`	function call
`varnames`	variable names

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t2way, med1way

Examples

```
med2way(attractiveness ~ gender*alcohol, data = goggles)
```

---

movie *Movies and Aggressive Affect*

Description

Participants are randomly assigned to one of two groups. The first group watches a violent film, and the other watches a nonviolent film. Afterwards, the aggressive affect is measured, and it is desired to compare three groups, taking gender and degress into account as well.

Usage

```
movie
```

Format

A data frame with 4 variables and 68 observations:

`degree` no degree vs. degree

`gender` 36 males, 32 females

`type` violend vs. nonviolent

`aggressive` aggressive affect

Details

Artificial dataset from Wilcox book (p. 316).

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Examples

```
movie
summary(movie)
```

`picture` *Profile Pictures*

Description

This dataset examines how the profile pictures on social network platforms affect the number of friend requests when females are in a relationship. The relationship status is a between-subject variable (part of the participants did set their status to relationship). For the first 3 weeks the subjects had a picture of their own in their profiles. For the following 3 weeks they posted a picture with a man.

Usage

```
picture
```

Format

A data frame with 4 variables and 40 observations:

`case` subject id

`relationship_status` Relationship status on social network platform

`couple` amount of friend requests when profile picture as couple

`alone` amount of friend requests when profile picture as single

Details

Dataset from Field et al. book (p. 644).

References

Field, A., Miles, J, \& Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
picture
summary(picture)
```

Pygmalion *Pygmalion Data*

Description

The Pygmalion effect is the phenomenon where higher expectations lead to an increase in performance. For instance, when teachers expect students to do well and show intellectual growth, they do; when teachers do not have such expectations, performance and growth are not so encouraged and may in fact be discouraged in a variety of ways. This dataset contains reasoning IQ scores of children. For the experimental group, positive expectancies had been suggested to teachers after the pretest. For the experimental group, no expectancies had been suggested after the pretest. For both groups we have reasoning IQ posttest scores. The dataset is taken from Elashoff and Snow (1970).

Usage

```
Pygmalion
```

Format

A data frame with 3 variables and 114 observations:

`Pretest` pretest score

`Posttest` posttest score

`Group` treatment vs. control

References

Elashoff, J. D., & Snow, R. E. (1970). A case study in statistical inference: Reconsideration of the Rosenthal-Jacobson data on teacher expectancy. Technical Report No. 15, School of Education, Stanford University.

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Examples

```
summary(Pygmalion)
```

rmanova *A heteroscedastic one-way repeated measures ANOVA for trimmed means.*

Description

The `rmanova` function computes a one-way repeated measures ANOVA for the trimmed means. Homoscedasticity assumption not required. Corresponding post hoc tests can be performed using `rmmcp`.

Usage

```
rmanova(y, groups, blocks, tr = 0.2)
rmmcp(y, groups, blocks, tr = 0.2)
```

Arguments

y	a numeric vector of data values (response).
groups	a vector giving the group of the corresponding elements of y.
blocks	a vector giving the block of the corresponding elements of y.
tr	trim level for the mean.

Value

rmanova an object of class "t1way" containing:

test	value of the test statistic
df1	degrees of freedom
df2	degrees of freedom
p.value	p-value
call	function call

rmmcp returns an object of class "mcp1" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

med1way, t1way

Examples

```
head(WineTasting)
rmanova(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster)

## post hoc
rmmcp(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster)

head(bush)
require(reshape)
bushLong <- melt(bush, id.var = "participant", variable_name = "food")
rmanova(bushLong$value, bushLong$food, bushLong$participant)

## post hoc
```

```
rmmcp(bushLong$value, bushLong$food, bushLong$participant)
```

---

rmanovab *A heteroscedastic one-way repeated measures bootstrap ANOVA for trimmed means.*

Description

The rmanova function computes a bootstrap version of the one-way repeated measures ANOVA for the trimmed means. Homoscedasticity assumption not required. Corresponding post hoc tests can be performed using pairdepb.

Usage

```
rmanovab(y, groups, blocks, tr = 0.2, nboot = 599)
pairdepb(y, groups, blocks, tr = 0.2, nboot = 599)
```

Arguments

y	a numeric vector of data values (response).
groups	a vector giving the group of the corresponding elements of y.
blocks	a vector giving the block of the corresponding elements of y.
tr	trim level for the mean.
nboot	number of bootstrap samples.

Value

rmanovab an object of class "rmanovab" containing:

test	value of the test statistic
crit	critical value
call	function call

pairdepb returns an object of class "mcp2" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

rmanova

Examples

```
head(WineTasting)
rmanovab(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster)

## post hoc
pairdepb(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster)
```

---

runmean *Running Interval Smoother*

Description

The `runmean` implements a running interval smoother on the trimmed mean, `rungen` uses general M-estimators, `runmbo` performs interval smoothing on M-estimators with bagging.

Usage

```
runmean(x, y, fr = 1, tr = 0.2)
rungen(x, y, fr = 1, est = "mom")
runmbo(x, y, fr = 1, est = "mom", nboot = 40)
```

Arguments

`x`	a numeric vector of data values (predictor)
`y`	a numeric vector of data values (response)
`fr`	smoothing factor (see details)
`tr`	trim level for the mean
`est`	type of M-estimator (`"mom"`, `"onestep"`, or `"median"`)
`nboot`	number of bootstrap samples

Details

The larger the smoothing factor, the stronger the smoothing. Often the choice `fr = 1` gives good results; the general strategy is to find the smallest constant so that the plot looks reasonably smooth.

Value

Returns the fitted values.

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

ancova

Examples

```
## trimmed mean smoother
fitmean <- runmean(Pygmalion$Pretest, Pygmalion$Posttest)
## MOM smoother
fitmest <- rungen(Pygmalion$Pretest, Pygmalion$Posttest)
## median smoother
fitmed <- rungen(Pygmalion$Pretest, Pygmalion$Posttest, est = "median")
## bagged onestep smoother
fitbag <- runmbo(Pygmalion$Pretest, Pygmalion$Posttest, est = "onestep")

## plot smoothers
plot(Pygmalion$Pretest, Pygmalion$Posttest, col = "gray", xlab = "Pretest", ylab = "Posttest",
     main = "Pygmalion Smoothing")
orderx <- order(Pygmalion$Pretest)
lines(Pygmalion$Pretest[orderx], fitmean[orderx], lwd = 2)
lines(Pygmalion$Pretest[orderx], fitmest[orderx], lwd = 2, col = 2)
lines(Pygmalion$Pretest[orderx], fitmed[orderx], lwd = 2, col = 3)
lines(Pygmalion$Pretest[orderx], fitbag[orderx], lwd = 2, col = 4)
legend("topleft", legend = c("Trimmed Mean", "MOM", "Median", "Bagged Onestep"), col = 1:4, lty = 1)
```

`spider` *Arachnophobes*

Description

24 arachnophobes were used in all. 12 were asked to play with a big hairy tarantula spider with big fangs and an evil look. Their subsequent anxiety was measured. The remaining 12 were shown only picture of the same hairy tarantula. Again, the anxiety was measured.

Usage

```
spider
```

Format

A data frame with 2 variables and 24 observations:

`Group` picture vs. real spider

`Anxiety` anxiety measure

Details

Dataset from Field et al. book (p. 362).

References

Field, A., Miles, J, \& Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
spider
```

`swimming` *Optimistic and Pessimistic Swimmers*

Description

At a swimming team practice, all participants were asked to swim their best event as far as possible, but in each case the time that was reported was falsified to indicate poorer than expected performance (i.e., each swimmer was disappointed). 30 min later, they did the same performance. The authors predicted that on the second trial more pessimistic swimmers would do worse than on their first trial, whereas optimistic swimmers would do better. The response is ratio = Time1/Time2 (> 1 means that a swimmer did better in trial 2).

Usage

```
swimming
```

Format

A data frame with 4 variables and 58 observations:

`Optim` Optimists and pessimists

`Sex` Gender of the swimmer

`Event` Swimming event: freestyle, breaststroke, backstroke

`Ratio` Ratio between the swimming times

References

Seligman, M. E. P., Nolen-Hoeksema, S., Thornton, N., & Thornton, C. M. (1990). Explanatory style as a mechanism of disappointing athletic performance. Psychological Science, 1, 143-146.

Examples

```
summary(swimming)
```

t1way *A heteroscedastic one-way ANOVA for trimmed means.*

Description

The t1way function computes a one-way ANOVA for the medians. Homoscedasticity assumption not required. It uses a generalization of Welch's method. Corresponding post hoc tests can be performed using lincon.

Usage

```
t1way(formula, data, tr = 0.2)
lincon(formula, data, tr = 0.2)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.

Details

In the post hoc computations, confidence intervals are adjusted to control FWE, but p-values are not adjusted to control FWE.

Value

t1way returns an object of class "t1way" containing:

test	value of the test statistic (F-statistic)
df1	degrees of freedom
df2	degrees of freedom
p.value	p-value
call	function call

lincon returns an object of class "mcp1" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

med1way,t1waybt

Examples

```
t1way(libido ~ dose, data = viagra)

## post hoc tests
lincon(libido ~ dose, data = viagra)
```

`t1waybt` *Bootstrap version of the heteroscedastic one-way ANOVA for trimmed means.*

Description

Test the hypothesis of equal trimmed means using a percentile t bootstrap method. Corresponding post hoc tests are provided in `mcppb20`.

Usage

```
t1waybt(formula, data, tr = 0.2, nboot = 599)
mcppb20(formula, data, tr = 0.2, nboot = 599, crit = NA)
```

Arguments

`formula`	an object of class formula.
`data`	an optional data frame for the input data.
`tr`	trim level for the mean.
`nboot`	number of bootstrap samples.
`crit`	critical significance value.

Value

Returns an object of class `t1waybt` containing:

`test`	value of the test statistic
`p.value`	p-value
`Var.Explained`	explained amount of variance
`Effect.Size`	effect size
`nboot.eff`	effective number of bootstrap samples
`call`	function call

`mcppb20` returns an object of class `"mcp1"` containing:

`comp`	inference for all pairwise comparisons
`fnames`	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way,med1way

Examples

```
t1waybt(libido ~ dose, data = viagra)

## post hoc
mcppb20(libido ~ dose, data = viagra)
```

---

t2way *A two-way ANOVA for trimmed means, M-estimators, and medians.*

Description

The t2way function computes a two-way ANOVA for trimmed means with interactions effects. Corresponding post hoc tests are mcp2atm. pbad2way performs a two-way ANOVA using M-estimators for location with mcp2a for post hoc tests.

Usage

```
t2way(formula, data, tr = 0.2)
pbad2way(formula, data, est = "mom", nboot = 599)
mcp2atm(formula, data, tr = 0.2)
mcp2a(formula, data, est = "mom", nboot = 599)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
est	Estimate to be used for the group comparisons: either "onestep" for one-step M-estimator of location using Huber's Psi, "mom" for the modified one-step (MOM) estimator of location based on Huber's Psi, or "median".
nboot	number of bootstrap samples.

Details

pbad2way returns p-values only.

Value

The functions t2way and pbad2way return an object of class t2way containing:

Qa	first main effect
A.p.value	p-value first main effect
Qb	second main effect
B.p.value	p-value second main effect
Qab	interaction effect
AB.p.value	p-value interaction effect
call	function call
varnames	variable names

The functions mcp2atm and mcp2a return an object of class mcp containing:

effects	list with post hoc comparisons for all effects
contrasts	design matrix

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way, med1way

Examples

```
## 2-way ANOVA on trimmed means
t2way(attractiveness ~ gender*alcohol, data = goggles)

## post hoc tests
mcp2atm(attractiveness ~ gender*alcohol, data = goggles)

## 2-way ANOVA on MOM estimator
pbad2way(attractiveness ~ gender*alcohol, data = goggles)

## post hoc tests
mcp2a(attractiveness ~ gender*alcohol, data = goggles)

## 2-way ANOVA on medians
pbad2way(attractiveness ~ gender*alcohol, data = goggles, est = "median")

## post hoc tests
mcp2a(attractiveness ~ gender*alcohol, data = goggles, est = "median")

## extract design matrix
model.matrix(mcp2a(attractiveness ~ gender*alcohol, data = goggles, est = "median"))
```

t3way *A three-way ANOVA for trimmed means.*

Description

This function computes a three-way ANOVA for trimmed means with all interactions effects.

Usage

```
t3way(formula, data, tr = 0.2)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.

Value

Returns an object of class t3way containing:

Qa	first main effect
A.p.value	p-value first main effect
Qb	second main effect
B.p.value	p-value second main effect
Qc	third main effect
C.p.value	p-value third main effect
Qab	first two-way interaction effect
AB.p.value	p-value first two-way interaction effect
Qac	second two-way interaction effect
AC.p.value	p-value second two-way interaction effect
Qbc	third two-way interaction effect
BC.p.value	p-value third two-way interaction effect
Qabc	three-way interaction effect
ABC.p.value	p-value three-way interaction effect
call	function call
varnames	variable names

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way, t2way

Examples

```
t3way(aggressive ~ degree*gender*type, data = movie)
```

---

trimse *Robust location measures and their standard errors (se).*

Description

The following functions for estimating robust location measures and their standard errors are provided: winmean for the Winsorized mean, winse for its se, trimse for the trimmend mean se, msmedse for the median se, mest for the M-estimator.

Usage

```
winmean(x, tr = 0.2, na.rm = FALSE)
winse(x, tr = 0.2)
trimse(x, tr = 0.2, na.rm = FALSE)
msmedse(x, sewarn = TRUE)
mest(x, bend = 1.28, na.rm = FALSE)
```

Arguments

x	a numeric vector containing the values whose measure is to be computed.
tr	trim lor Winsorizing level.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
sewarn	a logical value indicating whether warnings for ties should be printed.
bend	bending constant for M-estimator.

Details

The standard error for the median is computed according to McKean and Shrader (1984).

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

McKean, J. W., & Schrader, R. M. (1984). A comparison of methods for studentizing the sample median. Communications in Statistics - Simulation and Computation, 13, 751-773.

Dana, E. (1990). Salience of the self and salience of standards: Attempts to match self to standard. Unpublished PhD thesis, Department of Psychology, University of Southern California.

Examples

```
## Self-awareness data (Dana, 1990): Time persons could keep a portion of an
## apparatus in contact with a specified range.
self <- c(77, 87, 88, 114, 151, 210, 219, 246, 253, 262, 296, 299, 306, 376,
          428, 515, 666, 1310, 2611)
mean(self, 0.1)     ## .10 trimmed mean
trimse(self, 0.1)   ## se trimmed mean
winmean(self, 0.1)  ## Winsorized mean (.10 Winsorizing amount)
winse(self, 0.1)    ## se Winsorized mean
median(self)        ## median
msmedse(self)       ## se median
mest(self)          ## Huber M-estimator
```

`viagra` *Effects of Viagra*

Description

Participants were assigned randomly to three viagra dosages (placebo, low dosage, high dosage). The dependent variable was an objective measure of libido.

Usage

```
viagra
```

Format

A data frame with 2 variables and 15 observations:

`dose` viagra dosage

`libido` objective measure of libido

Details

Artificial dataset from Field et al. book (p. 401).

References

Field, A., Miles, J, \& Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
viagra
```

WineTasting *Wine Tasting*

Description

In this hypothetical dataset we have three types of wine (A, B and C). We asked 22 friends to taste each of the three wines (in a blind fold fashion), and then to give a grade of 1 to 7. We asked them to rate the wines 5 times each, and then averaged their results to give a number for a persons preference for each wine.

Usage

```
WineTasting
```

Format

A data frame with 3 variables and 66 observations:

`Taste` Taste Rating

`Wine` Wine (A, B, C)

`Taster` Taster (index)

Examples

```
WineTasting
summary(WineTasting)
```

yuen *Independent samples t-tests on robust location measures.*

Description

The function yuen performs Yuen's test for trimmed means, `yuenbt` is a bootstrap version of it. The `pb2gen` function performs a t-test based on various robust estimators.

Usage

```
yuen(formula, data, tr = 0.2)
yuenbt(formula, data, tr = 0.2, nboot = 599)
pb2gen(formula, data, est = "mom", nboot = 599)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
nboot	number of bootstrap samples.
est	Estimate to be used for the group comparisons: either "onestep" for one-step M-estimator of location using Huber's Psi, "mom" for the modified one-step (MOM) estimator of location based on Huber's Psi, or "median", "mean".

Value

Returns objects of classes "yuen" or "pb2" containing:

test	value of the test statistic (t-statistic)
p.value	p-value
conf.int	confidence interval
df	degress of freedom
diff	trimmed mean difference
call	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Yuen, K. K. (1974). The two sample trimmed t for unequal population variances. Biometrika, 61, 165-170.

See Also

t1way,t1waybt

Examples

```
## Yuen's test
yuen(Anxiety ~ Group, data = spider)

## Bootstrap version of Yuen's test (symmetric CIs)
yuenbt(Anxiety ~ Group, data = spider)

## Using an M-estimator
pb2gen(Anxiety ~ Group, data = spider, est = "mom")
pb2gen(Anxiety ~ Group, data = spider, est = "mean")
pb2gen(Anxiety ~ Group, data = spider, est = "median")
```

yuend *Paired samples t-test on trimmed means.*

Description

The function yuen performs Yuen's test for trimmed means, yuenbt is a bootstrap version of it. The pb2gen function performs a t-test based on various robust estimators.

Usage

```
yuend(x, y, tr = 0.2)
```

Arguments

x	an numeric vector of data values (e.g. for time 1).
y	an numeric vector of data values (e.g. for time 2).
tr	trim level for the means.

Details

The test statistic is a paired samples generalization of Yuen's independent samples t-test on trimmed means.

Value

Returns an object of class "yuen" containing:

test	value of the test statistic (t-statistic)
p.value	p-value
conf.int	confidence interval
df	degress of freedom
diff	trimmed mean difference
call	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

yuen

Examples

```
## Cholesterol data from Wilcox (2012, p. 197)
before <- c(190, 210, 300,240, 280, 170, 280, 250, 240, 220)
after <- c(210, 210, 340, 190, 260, 180, 200, 220, 230, 200)
yuend(before, after)
```

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