

Package ‘autotestR’

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Title Automated Functions for Basic Statistical Tests

Version 1.2.17

Description Provides simple and intuitive functions for basic statistical analyses.

Methods include the t-test (Student 1908 <[doi:10.1093/biomet/6.1.1](https://doi.org/10.1093/biomet/6.1.1)>),
the Mann-Whitney U test (Mann and Whitney 1947 <[doi:10.1214/aoms/1177730491](https://doi.org/10.1214/aoms/1177730491)>),
Pearson's correlation (Pearson 1895 <[doi:10.1098/rspl.1895.0041](https://doi.org/10.1098/rspl.1895.0041)>),
and analysis of variance (Fisher 1925, <[doi:10.1007/978-1-4612-4380-9_5](https://doi.org/10.1007/978-1-4612-4380-9_5)>).
Functions are compatible with 'ggplot2' and 'dplyr'.

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autotestR	<i>autotestR</i>
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Description

designed to simplify the execution of the main statistical tests commonly used in the life sciences. It provides user-friendly functions that automatically generate plots and clear explanations, making statistical analysis more accessible for researchers and students.

Main features

- t test (independent and paired)
- Mann–Whitney test (Wilcoxon rank-sum)
- Multiple group comparison (t test or Mann–Whitney)
- Chi-squared test and Fisher’s exact test
- One-way ANOVA with Tukey HSD post hoc test
- Kruskal–Wallis test with Dunn post hoc test
- Pearson, Spearman, and Kendall correlation tests with automatic plots
- Diagnostic function that suggests the most appropriate statistical test
- Intuitive plots fully integrated into the functions

Basic usage:

```
library(autotestR)
```

Independent t test

```
group1 <- rnorm(30, 10, 2) group2 <- rnorm(30, 12, 2) test.t(group1, group2)
```

Chi-squared test

```
var1 <- sample(c("A", "B"), 100, replace = TRUE) var2 <- sample(c("Yes", "No"), 100, replace = TRUE) test.chi(var1, var2)
```

Multiple test (t test or Mann–Whitney)

```
df <- data.frame( control = rnorm(30, 10), treatment = rnorm(30, 12), test1 = rnorm(30, 11), test2 = rnorm(30, 15) ) test.tmulti(df)
```

ANOVA with post hoc test

```
g1 <- rnorm(20, 5) g2 <- rnorm(20, 7) g3 <- rnorm(20, 6) test.anova(g1, g2, g3)
```

Correlation test

```
x <- rnorm(30) y <- x + rnorm(30, 0, 1) test.correlation(x, y)
```

Author(s)

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```
pre.test
```

```
pre.test() — Automatic statistical test suggestion
```

Description

Automatically identifies whether the input data are numeric or categorical and suggests the most appropriate statistical test.

Usage

```
pre.test(..., alpha = 0.05, help = FALSE, verbose = TRUE)
```

Arguments

...	Two or more vectors (numeric or categorical), or a data.frame with ≥ 2 columns
alpha	Significance level. Default = 0.05
help	Logical. If TRUE, shows detailed help
verbose	Logical. If TRUE, prints informative messages

Value

Invisible list with normality results, homogeneity or contingency table, and test recommendation

```
test.anova
```

```
ANOVA test with automated assumption checking
```

Description

Performs ANOVA (and Tukey HSD) if data meet normality and homogeneity assumptions. Otherwise, automatically recommends Kruskal-Wallis/Dunn.

Usage

```
test.anova(
  ...,
  title = "ANOVA/Tukey HSD",
  xlab = "Group",
  ylab = "Value",
  style = c("boxplot", "violin", "mono", "halfeye"),
  help = FALSE,
  verbose = TRUE
)
```

Arguments

...	Vectors or a data.frame with ≥ 2 columns.
title	Plot title.
xlab	X-axis label.
ylab	Y-axis label.
style	Aesthetic style of the generated plot.
help	If TRUE, shows help.
verbose	If TRUE, shows detailed messages.

Value

An aov object or a recommendation message.

Examples

```
df <- data.frame(
  control = rnorm(30, 10),
  treatment = rnorm(30, 12),
  test = rnorm(30, 11)
)
test.anova(df)
```

test.chi

Chi-square test

Description

Applies the Pearson chi-square test or Fisher's exact test to assess association between two categorical variables.

Usage

```
test.chi(  
  x,  
  y = NULL,  
  title = "Chi-square Test",  
  xlab = NULL,  
  ylab = "Proportion",  
  style = c("stacked", "barplot", "mosaic", "pie"),  
  show_table = TRUE,  
  help = FALSE,  
  verbose = TRUE  
)
```

Arguments

x	Categorical vector or data frame with two columns (group 1 and group 2).
y	Categorical vector (group 2). Required if x is a vector.
title	Plot title (string). Default: "Chi-square Test".
xlab	X-axis label in the plot (string). Default: NULL (uses variable name).
ylab	Y-axis label in the plot (string). Default: "Proportion".
style	Plot style generated by the function.
show_table	Logical. If TRUE, prints the contingency table to the console. Default: TRUE.
help	Logical. If TRUE, displays a detailed explanation of the function. Default: FALSE.
verbose	Logical. If TRUE, prints messages about the test and expected frequencies. Default: TRUE.

Value

Test result and contingency table.

Examples

```
data <- data.frame(  
  control = c(rep("healthy", 50), rep("sick", 150)),  
  treatment = c(rep("healthy", 100), rep("sick", 100))  
)  
test.chi(data)
```

test.correlation

*Correlation Analysis with Automatic Method Selection***Description**

Performs correlation analysis between two numeric variables using Pearson, Spearman, or Kendall methods. When method = "auto", the function automatically selects the most appropriate method based on normality, presence of ties, and proportion of outliers.

Usage

```
test.correlation(
  x,
  y = NULL,
  method = "auto",
  main = NULL,
  xlab = NULL,
  ylab = NULL,
  style = c("simple", "inference", "structure", "density", "distribution"),
  plot_normality = FALSE,
  help = FALSE,
  verbose = TRUE
)

## S3 method for class 'test.correlation'
print(x, ...)
```

Arguments

x	Numeric vector or data frame with exactly two numeric columns.
y	Numeric vector (optional if x is a data frame).
method	Correlation method: "auto" (default), "pearson", "spearman", or "kendall".
main	Plot title. If NULL, an automatic title is generated. If FALSE, no title is displayed.
xlab	Label for the x-axis. If NULL, a label is inferred from the input. If FALSE, no label is shown.
ylab	Label for the y-axis. If NULL, a label is inferred from the input. If FALSE, no label is shown.
style	Plot style: "simple" (default), "inference", "structure", "density", or "distribution".
plot_normality	Logical. If TRUE, displays QQ-plots for normality assessment.
help	Logical. If TRUE, displays a detailed usage guide.
verbose	Logical. If TRUE, prints information about method selection and diagnostics.
...	Additional arguments passed to other print methods (currently ignored)

Details

In addition to hypothesis testing, the function provides diagnostic information, effect size interpretation, and publication-ready visualizations.

Method selection in automatic mode follows these rules:

- If more than 5\ Kendall's tau is used.
- If both variables are normally distributed and no ties are present, Pearson's correlation is used.
- Otherwise, Spearman's rank correlation is applied.

Normality is assessed using Shapiro-Wilk ($n \leq 50$), Anderson-Darling ($50 < n \leq 300$), or Kolmogorov-Smirnov ($n > 300$) tests.

Value

An object of class "test.correlation" containing:

- call: Matched function call.
- data: Input data (if $n \leq 5000$).
- n: Sample size.
- method: Selected correlation method.
- estimate: Correlation coefficient.
- effect: Effect size information (r, rho, or tau, and r^2 when applicable).
- conf.int: Confidence interval.
- p.value: P-value of the test.
- interpretation: Qualitative interpretation of effect size.
- diagnostics: Normality, ties, and outlier diagnostics.
- decision: Automatic selection rationale.
- htest: Underlying stats::cor.test object.
- plot: ggplot2 object.

See Also

[cor.test](#), [ggplot](#)

Examples

```
# Pearson (approximately normal data)
set.seed(123)
x <- rnorm(50, sd = 0.1)
y <- x + rnorm(50, sd = 0.1)
test.correlation(x, y)

# Spearman (non-normal data)
set.seed(123)
x <- runif(300)
y <- log(x + 0.1) + rnorm(300, sd = 0.5)
```

```
test.correlation(x, y)

# Kendall (ties and outliers)
set.seed(123)
x <- runif(1000, 1, 100)
y <- sin(x) * 30 + rnorm(1000, 0, 10)
x[sample(1:500, 50)] <- 50
y[sample(1:500, 50)] <- 0
x_out <- runif(100, 10, 20)
y_out <- runif(100, 80, 120)
x <- c(x, x_out)
y <- c(y, y_out)
test.correlation(x, y)
```

test.fisher	<i>Fisher's Exact Test</i>
-------------	----------------------------

Description

Performs Fisher's Exact Test using two categorical vectors or a data frame with two columns, constructing a contingency table and optionally generating graphical visualizations.

Usage

```
test.fisher(
  x,
  y = NULL,
  title = "Fisher's Exact Test",
  xlab = NULL,
  ylab = "Proportion",
  style = c("stacked", "barplot", "mosaic", "pie"),
  show_table = TRUE,
  help = FALSE,
  verbose = TRUE
)
```

Arguments

x	Categorical vector or data frame with two columns.
y	Categorical vector (required if x_var is a vector).
title	Plot title (string). Default: "Fisher's Exact Test"
xlab	Name of the x-axis in the plot (string). Default: NULL (uses variable name)
ylab	Name of the y-axis in the plot (string). Default: "Proportion"
style	Plot style. Controls the visualization type
show_table	Logical. If TRUE, prints the contingency table to the console. Default: TRUE
help	Logical. If TRUE, shows detailed function explanation. Default: FALSE
verbose	Logical. If TRUE, prints detailed test messages. Default: TRUE

Value

Invisible object containing the Fisher test result.

Examples

```
data <- data.frame(control = c("healthy", "healthy", "sick", "sick", "sick"),
                  treatment = c("healthy", "healthy", "healthy", "healthy", "sick"))
test.fisher(data)
```

test.interaction	<i>Test for interaction between a continuous predictor and a grouping variable</i>
------------------	--

Description

Fits a linear model of the form $y \sim x * by$ to evaluate whether the association between a continuous predictor and an outcome differs across groups. Optionally produces a publication-ready visualization of group-specific regression lines.

Usage

```
test.interaction(
  y,
  x,
  by,
  title = NULL,
  xlab = NULL,
  ylab = NULL,
  plot = TRUE,
  style = c("clean", "CI", "facet"),
  conf.level = 0.95,
  verbose = TRUE,
  help = FALSE
)

## S3 method for class 'test.interaction'
print(x, ...)
```

Arguments

y	Numeric vector representing the continuous predictor.
x	Numeric vector representing the continuous outcome.
by	Grouping variable defining the interaction. Must be coercible to a factor with at least two levels.
title	Optional title title for the plot.
xlab	Optional x-axis label.

ylab	Optional y-axis label.
plot	Logical. Should a plot be generated?
style	Plot style. One of "clean", "CI" or "facet".
conf.level	Confidence level for the interaction interval (default: 0.95).
verbose	Logical. If TRUE, prints detailed messages. Default: TRUE.
help	Logical. If TRUE, shows a detailed explanation of the function. Default: FALSE.
...	Additional arguments passed to other print methods (currently ignored)

Details

The interaction coefficient (β) represents the difference in regression slopes between groups, conditional on the reference level of by. The sign and magnitude of this coefficient depend on the chosen reference group.

Confidence intervals are emphasized as the primary inferential quantity.

Value

An object of class "test.interaction" containing:

- model: the fitted linear model,
- interaction: estimated interaction effects with confidence intervals,
- plot: a ggplot object (if plot = TRUE).

Examples

```
# Simple example: different trends between groups

set.seed(125)

n <- 60
df_bio <- data.frame(
  response = rnorm(n, mean = 10, sd = 2),
  group    = rep(c('Control', 'Treatment'), each = n / 2)
)

df_bio$marker <- with(
  df_bio,
  ifelse(
    group == 'Control',
    2 + 1.3 * response + rnorm(n, 0, 2),
    2 + 1.2 * response + rnorm(n, 0, 1)
  )
)

test.interaction(
  x = df_bio$marker,
  y = df_bio$response,
  by = df_bio$group
)
```

test.kruskal	<i>Kruskal-Wallis Test with Dunn Post-hoc</i>
--------------	---

Description

Performs the Kruskal-Wallis rank-sum test for comparing three or more independent groups, followed by Dunn's post-hoc test with multiple comparison adjustment.

Usage

```
test.kruskal(
  ...,
  title = "Kruskal-Wallis + Dunn",
  xlab = "Group",
  ylab = "Value",
  style = c("boxplot", "violin", "mono", "halfeye"),
  adjust = c("bonferroni", "holm", "BH"),
  help = FALSE,
  verbose = TRUE
)
```

Arguments

...	Numeric vectors representing groups, or a data frame with two or more columns (each column is treated as a group).
title	Character. Plot title.
xlab	Character. X-axis label.
ylab	Character. Y-axis label.
style	Character. Plot style. One of: "boxplot", "violin", "mono", or "halfeye".
adjust	Character. Method for p-value adjustment in Dunn's test. One of "bonferroni", "holm", or "BH".
help	Logical. If TRUE, displays a short help message and exits.
verbose	Logical. If TRUE, prints formatted statistical results to the console.

Details

This function is a non-parametric alternative to one-way ANOVA and is recommended when normality or homoscedasticity assumptions are violated.

Value

Invisibly returns a list with the following components:

type Test type.

H Kruskal-Wallis H statistic.

df Degrees of freedom.
p Global test p-value.
epsilon_sq Epsilon-squared effect size.
epsilon_ci Bootstrap confidence interval for effect size.
means_sd Group means and standard deviations.
dunn Dunn post-hoc results.
significant_pairs Significant pairwise comparisons.
data Long-format data used in the analysis.

Examples

```
set.seed(123)

n <- 25

df <- data.frame(
  control    = rexp(n, rate = 1),
  treatment1 = rexp(n, rate = 0.6),
  treatment2 = rgamma(n, shape = 2, scale = 1)
)

test.kruskal(df)
```

test.t	<i>Student's t-test (with automatic diagnostics)</i>
--------	--

Description

Performs Student's t-test to compare means between two independent groups, with automatic checks for normality and homogeneity of variances. If assumptions are violated, the Mann-Whitney test is automatically applied (without generating a plot).

Usage

```
test.t(
  ...,
  title = TRUE,
  title_text = "t-test",
  xlab = "Group",
  ylab = "Value",
  style = c("boxplot", "violin", "mono", "halfeye"),
  help = FALSE,
  verbose = TRUE
)
```

Arguments

...	Two numeric vectors or a data frame with exactly two columns.
title	Logical. If true, return a plot entitled.
title_text	Plot title (string). Default: "t-test".
xlab	X-axis label in the plot (string). Default: "Group".
ylab	Y-axis label in the plot (string). Default: "Value".
style	Plot aesthetic generated by the function.
help	Logical. If TRUE, shows a detailed explanation of the function. Default: FALSE.
verbose	Logical. If TRUE, prints detailed messages. Default: TRUE.

Value

Invisible list with summary, test test_result, method and (optionally) plot.

Examples

```
set.seed(123)
df <- data.frame(
  control = rnorm(30, 10),
  treatment = rnorm(30, 15)
)
test.t(df)
```

test.tmulti

Multiple pairwise comparisons with diagnostics

Description

Performs multiple pairwise comparisons using Student's t-test or Mann-Whitney test, with automatic diagnostics, effect sizes, confidence intervals, multiple testing correction and visualization.

Usage

```
test.tmulti(
  ...,
  comparisons = NULL,
  title = "Multiple comparisons (t / MW)",
  xlab = "",
  ylab = "Value",
  style = c("boxplot", "violin", "mono", "halfeye"),
  p_adjust = c("none", "holm", "BH", "bonferroni"),
  help = FALSE,
  verbose = TRUE
)
```

Arguments

<code>...</code>	Numeric vectors or a data.frame with groups in columns.
<code>comparisons</code>	List of character vectors specifying pairwise comparisons (e.g. <code>list(c("A","B"), c("B","C"))</code>). If NULL, all pairwise combinations are used.
<code>title</code>	Plot title.
<code>xlab</code>	X-axis label.
<code>ylab</code>	Y-axis label.
<code>style</code>	Plot style. One of "boxplot", "violin", "mono", or "halfeye".
<code>p_adjust</code>	Method for multiple testing correction. One of "none", "holm", "BH", "bonferroni".
<code>help</code>	Logical. If TRUE, prints usage examples.
<code>verbose</code>	Logical. If TRUE, prints results and plots.

Details

Normality is assessed using Shapiro-Wilk tests and homogeneity of variances using Levene's test. If assumptions are met, a pooled-variance t-test is used. Otherwise, the Mann-Whitney test is applied with bootstrap confidence intervals.

Effect sizes:

- Cohen's d for t-tests
- Rank-biserial correlation for Mann-Whitney

Value

A list with:

results A tibble with test results.

plot A ggplot object.

data_long Long-format data used for plotting.

Examples

```
df <- data.frame(
  control = rnorm(30, 10),
  treatment = rnorm(30, 12),
  test1 = rnorm(30, 11),
  test2 = rnorm(30, 15)
)

test.tmulti(
  df,
  comparisons = list(
    c("control", "treatment"),
    c("treatment", "test1")
  )
)
```

test.tpaired	<i>Paired t-test with advanced visualizations</i>
--------------	---

Description

Performs a paired t-test between two numeric vectors (e.g., before vs after) or between two numeric columns of a data frame. Includes four visualization styles (boxplot, violin, mono, and half-eye).

Usage

```
test.tpaired(
  ...,
  title = "Paired t-test",
  xlab = "",
  ylab = "Value",
  style = c("boxplot", "violin", "mono", "halfeye"),
  connect = TRUE,
  help = FALSE,
  verbose = TRUE
)
```

Arguments

...	Two numeric vectors of equal length, or a data frame with exactly two numeric columns.
title	Plot title.
xlab	X-axis label.
ylab	Y-axis label.
style	Plot style: • 1 Premium boxplot • 2 Violin + minimal boxplot • 3 mono • 4 Half-eye (ggdist)
connect	Logical. If TRUE, connects paired observations.
help	If TRUE, displays detailed help.
verbose	If TRUE, prints progress messages.

Value

An invisible list containing:

summary_table Group means and standard deviations

test_result t-test result object (stats::t.test)

data Data frame used for plotting

plot ggplot2 object

Examples

```
before <- c(13, 12, 15, 14)
after  <- c(9, 11, 10, 10)
test.tpaired(before, after)
```

test.u	<i>Mann-Whitney U Test</i>
--------	----------------------------

Description

Performs the Mann-Whitney (Wilcoxon rank-sum) test for comparing two independent groups, with statistical summary and graphical visualization.

Usage

```
test.u(
  ...,
  title = "Mann-Whitney Test",
  xlab = "Group",
  ylab = "Value",
  style = c("boxplot", "violin", "mono", "halfeye"),
  help = FALSE,
  verbose = TRUE
)
```

Arguments

...	Two numeric vectors or a data.frame with two numeric columns.
title	Plot title. Default: "Mann-Whitney Test".
xlab	Label for x-axis. Default: "Group".
ylab	Label for y-axis. Default: "Value".
style	Plot aesthetic style.
help	Logical. If TRUE, prints a detailed explanation. Default: FALSE.
verbose	Logical. If TRUE, prints detailed messages. Default: TRUE.

Value

Invisible list with:

- summary** Group-wise statistical summary
- test** Test result (htest object)
- plot** ggplot2 visualization object

Examples

```
x <- c(1, 3, 5, 6)
y <- c(7, 8, 9, 12)
data <- data.frame(groupA = x, groupB = y)
test.u(data)
```

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