Package 'litteR'

July 4, 2025

Title Litter Analysis

Version 1.0.1

Date 2025-07-04

Description Data sets on various litter types like beach litter, riverain litter, floating litter, and seafloor litter are rapidly growing. This package offers a simple user interface to analyse these litter data in a consistent and reproducible way. It also provides functions to facilitate several kinds of litter analysis, e.g., trend analysis, power analysis, and baseline analysis. Under the hood, these functions are also used by the user interface. See Schulz et al. (2019) <doi:10.1016/j.envpol.2019.02.030> for details. MS-Windows users are advised to run 'litteR' in 'RStudio'. See our vignette: Installation manual for 'RStudio' and 'litteR'.

Depends R (>= 4.0.0)

Imports readr (>= 1.3.1), stringr (>= 1.4.0), dplyr (>= 1.0.0), tidyselect (>= 1.1.0), tidyr (>= 1.1.0), fs (>= 1.4.1), ggplot2 (>= 3.3.1), purrr (>= 0.3.4), rlang (>= 0.4.6), yaml (>= 2.2.1), rmarkdown (>= 2.2), tcltk

Suggests knitr, kableExtra, testthat (>= 2.3.2)

License GPL (>= 3)

Encoding UTF-8

VignetteBuilder knitr

RoxygenNote 7.3.2

NeedsCompilation no

Author Dennis Walvoort [aut, cre, cph], Willem van Loon [aut, cph], Rijkswaterstaat - The Netherlands [cph, fnd, dtc]

Maintainer Dennis Walvoort <dennis.Walvoort@wur.nl>

Repository CRAN

Date/Publication 2025-07-04 10:30:02 UTC

Contents

`litteR-package` *Litter Analysis*

Description

A tool for the analysis of various litter types, e.g., beach litter, riverain litter, floating litter, and seafloor litter.

Details

The easiest way to get convenient with **litteR** is to create an empty project directory and fill it with example files by calling the function `create_litter_project`. The workhorse function in **litteR** is called `litter`. This function will start a simple user interface and lets you select an input file (*.csv) and a settings file (*.yaml). It will produce an HTML-report with litter analysis results according to the selected options in the settings file. See the package vignette for more details.

Author(s)

Maintainer: Dennis Walvoort <dennis.Walvoort@wur.nl> [copyright holder]

Authors:

- Willem van Loon <willem.van.loon@rws.nl> [copyright holder]

Other contributors:

- Rijkswaterstaat - The Netherlands [copyright holder, funder, data contributor]

References

Schulz, Marcus, Dennis J.J. Walvoort, Jon Barry, David M. Fleet & Willem M.G.M. van Loon, 2019. Baseline and power analyses for the assessment of beach litter reductions in the European OSPAR region. Environmental Pollution 248:555-564 <doi:10.1016/j.envpol.2019.02.030>

`adj_boxplot_stats` *Adjusted Boxplot Statistics*

Description

Adjusted boxplot statistics according to Hubert & Vandervieren (2008). The upper whisker extends from the hinge to the largest value no further than the upper fence. Similarly, the lower whisker extends from the hinge to the smallest value no further than the lower fence. See Hubert & Vandervieren (2008, p.5191, Eq.5).

Usage

```
adj_boxplot_stats(x, ...)

## Default S3 method:
adj_boxplot_stats(x, ...)
```

Arguments

`x`	numeric vector
`...`	further arguments passed to or from other methods.

Value

Numeric vector consisting of respectively the lower whisker/fence, the first quartile/hinge, the median, the third quartile/hinge, and the upper whisker/fence.

Methods (by class)

- `adj_boxplot_stats(default)`: Adjusted Boxplot Statistics

References

Hubert, M., and E. Vandervieren, 2008. An adjusted boxplot for skewed distributions. Computational Statistics and Data Analysis 52:5186-5201 doi:10.1016/j.csda.2007.11.008

See Also

`stat_adj_boxplot`

Examples

```
adj_boxplot_stats(rlnorm(100))
```

create_litter_project *Create Project Directory*

Description

Fills an empty directory (path) with example files. If the path' argument is missing or NULL, a Tcl/Tk dialogue will be started.

Usage

```
create_litter_project(path = NULL)
```

Arguments

path	(Existing) directory name

create_logger *Simple Logger*

Description

Logger, in the spirit of loggers like log4j. Implemented logging levels are DEBUG, INFO, WARN, ERROR (in increasing order of specificity. Logging events can be filtered to show only events with a minimum specificity.

Usage

```
create_logger(con = stdout(), level = c("DEBUG", "INFO", "WARN", "ERROR"))
```

Arguments

con	connection to write logging data to
level	log only events of this level and those that are more specific (see details)

Value

Anonymous logging functions

Examples

```
logger <- create_logger(level = "INFO")
logger$info("starting specific computation")
logger$info("Today is {Sys.Date()}")
```

cv *Coefficient of Variation*

Description

Coefficient of Variation

Usage

```
cv(x, na.rm = FALSE)
```

Arguments

x	a numeric vector
na.rm	logical. Should missing values be removed?

Value

coefficient of variation (numeric vector of length 1).

References

https://en.wikipedia.org/wiki/Coefficient_of_variation

enumerate *Enumerate Objects*

Description

Generic function for enumerating objects

Usage

```
enumerate(x, ...)

## S3 method for class 'numeric'
enumerate(x, ...)
```

Arguments

x	object to enumerate
...	further arguments passed to or from other methods.

Methods (by class)

- `enumerate(numeric)`: enumerate `numeric` vector.

See Also

enumerate.character

---

enumerate.character *Enumerate Character Vector*

Description

Collapsing a character vector of length n, to a character vector of length 1.

Usage

```
## S3 method for class 'character'
enumerate(x, ...)
```

Arguments

x	character vector
...	further arguments passed to or from other methods.

Value

character vector of length 1, with elements separated by a comma except for the last element which is prepended by "and".

Examples

```
enumerate("apples")
enumerate(c("apples", "oranges"))
enumerate(c("apples", "oranges", "pears"))
```

---

enumerate.sequenized *Convert Sequenized Output to Character String*

Description

Convert Sequenized Output to Character String

Usage

```
## S3 method for class 'sequenized'
enumerate(x, ...)
```

Arguments

x	object of class sequenized.
...	further arguments passed to or from other methods.

Value

string representation (character vector of length 1) of a sequenized object

See Also

sequenize.integer

`has_write_access` *Check Write Permission*

Description

Simple wrapper for `file.access` with `mode=2`

Usage

```
has_write_access(path)
```

Arguments

`path`	filename

Value

`TRUE` if write access, `FALSE` if not

`intercept` *Intercept*

Description

Extract the intercept from object `x`.

Usage

```
intercept(x, ...)
```

Arguments

`x`	object
`...`	further arguments passed to or from other methods.

Value

estimate of the intercept (numeric vector of length 1).

iod *Index of Dispersion*

Description

A normalized measure of the dispersion of a probability distribution.

Usage

```
iod(x, na.rm = FALSE)
```

Arguments

x	a numeric vector
na.rm	logical. Should missing values be removed?

Value

index of dispersion (numeric vector of length 1).

References

https://en.wikipedia.org/wiki/Index_of_dispersion

is_date_format *Check Date Format*

Description

Checks if the data format x complies with format.

Usage

```
is_date_format(x, format = "%Y-%m-%d")
```

Arguments

x	object of class character or Date
format	required date format (see strptime)

Value

TRUE if x complies with format, and FALSE otherwise.

Examples

```
is_date_format("2019-05-14", "%Y-%m-%d")
```

is_natural_number *Test for Natural Numbers*

Description

Test for natural numbers according to ISO 80000-2, that is the set {0, 1, 2, ...}

Usage

```
is_natural_number(x)
```

Arguments

x	numeric vector

Value

TRUE in case x is a natural number, FALSE otherwise.

Examples

```
stopifnot(!is_natural_number(3.1))
stopifnot(!is_natural_number(2.99))
stopifnot(is_natural_number(3))
stopifnot(all(is_natural_number(0:9)))
stopifnot(sum(is_natural_number(c(1, 2.5, 3))) == 2)
```

kendall_s *Mann-Kendall S Statistic*

Description

Mann-Kendall S Statistic

Usage

```
kendall_s(x, t = seq_along(x))
```

Arguments

x	observations
t	time index

References

Gilbert, R.O., 1987. Statistical methods for environmental pollution monitoring.

See Also

kendall_var_s

---

kendall_var_s *Mann-Kendall Variance of S Statistic*

Description

Mann-Kendall Variance of S Statistic

Usage

```
kendall_var_s(x, t = seq_along(x))
```

Arguments

x	observations
t	time index

References

Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring.

Van Belle and Hughes, 1984, Nonparametric Tests for Trend in Water Quality. Water Resources Research 20:127-136

---

list_duplicates *List Duplicates*

Description

Lists all duplicates as a list of tuples.

Usage

```
list_duplicates(x, ...)

## S3 method for class 'character'
list_duplicates(x, ...)

## S3 method for class 'tbl'
list_duplicates(x, ...)

## S3 method for class 'data.frame'
list_duplicates(x, ...)
```

Arguments

x	object of class character, tibble or data.frame.
...	further arguments passed to or from other methods.

Value

list of row numbers with duplicates

Methods (by class)

- list_duplicates(character): list duplicates for a character vector.
- list_duplicates(tbl): lists duplicates for a tibble.
- list_duplicates(data.frame): lists duplicates for a data.frame.

Examples

```
list_duplicates(c("a", "b", "c")) # list()
list_duplicates(c("a", "b", "a", "c")) # list(c(1, 3))
```

---

litter *Graphical User Interface to the litteR-package*

Description

Starts a graphical user interface for analysing litter data. A Tcl/Tk-dialogue will be started if one or more arguments are missing.

Usage

```
litter(filename = NULL)
```

Arguments

filename	name of file containing settings (see vignette for details)

Details

For details, see our vignette by typing: vignette("litter-manual")

Value

directory name (invisibly) where all results are stored.

mann_kendall *Mann Kendall*

Description

Performs Mann-Kendall non-parametric test for trend.

Usage

```
mann_kendall(x, t = seq_along(x), type = c("both", "increasing", "decreasing"))

## S3 method for class 'mann_kendall'
test_statistic(x, ...)

## S3 method for class 'mann_kendall'
p_value(x, ...)
```

Arguments

x	numeric vector representing a time-series.
t	time index (a numeric vector, or a vector of class Date).
type	direction to test (both, increasing, or decreasing).
...	further arguments passed to or from other methods.

Value

object of class Mann-Kendall.

Methods (by generic)

- test_statistic(mann_kendall): Extracts Mann Kendall tau
- p_value(mann_kendall): Extract p-value

See Also

test_statistic, p_value, cor.test, regional_kendall

Examples

```
# create mann_kendall object
mk <- mann_kendall(c(9, 4, 7, 5, 3), type = "decreasing")
mk <- mann_kendall(
  x = c(9, 4, 7, 5, 3),
  t = c(1, 3, 2, 5, 9),
  type = "decreasing")

# get test statistic tau
```

```
test_statistic(mk)

# get p-value
p_value(mk)
```

`medcouple` *Medcouple*

Description

Robust statistic that quantifies the skewness of univariate distributions.

Usage

```
medcouple(x, ...)

## Default S3 method:
medcouple(x, ...)
```

Arguments

`x`	numeric vector
`...`	further arguments passed to or from other methods.

Value

medcouple (numeric vector of length 1).

Methods (by class)

- `medcouple(default)`: default method

Note

This is a naive, but robust en simple implementation. For a more efficient implementation see package robustbase and the references section below.

References

Brys, G., M. Hubert, A. Struyf, 2004. A Robust Measure of Skewness. Journal of Computational and Graphical Statistics 13: 996-1017. doi:10.1198/106186004X12632.

p_value *p-value*

Description

Extract p-value.

Usage

```
p_value(x, ...)
```

Arguments

x	object
...	further arguments passed to or from other methods.

Value

p-value of a test (numeric vector of length 1).

read_litter *Read Litter Data*

Description

Reads litter data from various formats. Currently only the OSPAR data snapshot format, and a wide format are supported. See the package vignette for more details.

Usage

```
read_litter(filename, logger = create_logger(level = "INFO"), type_names)
```

Arguments

filename	name of litter file
logger	optional logger object (see create_logger)
type_names	character vector of allowed type_names

Value

tibble with litter data in long format

read_litter_types *Read Type Names*

Description

Read the file that links type names to group codes See the package vignette for more details.

Usage

```
read_litter_types(filename, logger = create_logger(level = "INFO"))
```

Arguments

filename	name of type file
logger	optional logger object (see create_logger)

Value

tibble with look-up-table of type names and group codes

read_settings *Read Settings File*

Description

Reads settings file. See tutorial for its format.

Usage

```
read_settings(filename, logger = create_logger(level = "INFO"))
```

Arguments

filename	name of litter file
logger	optional logger object (see create_logger)

Value

validated settings file

recdf *Sample From an ECDF*

Description

Type stable implementation of an Empirical Cumulative Distribution Function (ECDF) sampler.

Usage

```
recdf(x, n)
```

Arguments

x	numeric vector
n	number of draws

Value

vector of n elements of the same type as x

See Also

ecdf

Examples

```
recdf(1:5, 10)
```

regional_kendall *Regional Kendall Test for Trend*

Description

Performs Regional Kendall non-parametric test for trend.

Usage

```
regional_kendall(
  x,
  t = seq_along(x),
  r = rep.int(1, length(x)),
  type = c("both", "increasing", "decreasing")
)

## S3 method for class 'regional_kendall'
test_statistic(x, ...)
```

```
## S3 method for class 'regional_kendall'
p_value(x, ...)
```

Arguments

x	observations
t	time index
r	region index
type	direction to test (both, increasing, or decreasing).
...	further arguments passed to or from other methods.

Methods (by generic)

- `test_statistic(regional_kendall)`: Extracts Regional Kendall Z
- `p_value(regional_kendall)`: Extract Regional Kendall p-value

References

Gilbert, R.O., 1987. Statistical methods for environmental pollution monitoring.

See Also

`mann_kendall`

---

rmad *Relative Median Absolute Deviation*

Description

This is the Median Absolute Deviation divided by the median and is similar to the coefficient of variation.

Usage

```
rmad(x, na.rm = FALSE)
```

Arguments

x	a numeric vector
na.rm	logical. Should missing values be removed?

Value

Relative median absolute deviation (numeric vector of length 1).

References

https://en.wikipedia.org/wiki/Median_absolute_deviation

roll *Rolling Statistics*

Description

Applies function `fun` within a rolling (moving) window of size `w` to vector numeric vector `x`.

Usage

```
roll(x, w = 3, fun = mean)
```

Arguments

`x`	numeric vector (time-series)
`w`	width of moving window
`fun`	function to be applied

Value

vector of length length(x)-w

sequenize *Sequenize Objects*

Description

Generic function for sequenizing objects

Usage

```
sequenize(x, ...)
```

Arguments

`x`	object to sequenize
`...`	further arguments passed to or from other methods.

See Also

`sequenize.integer`

sequenize.integer *Sequenize Integer Sequence*

Description

Compression of integer sequences to 'start-end' notation. For instance `c(1:5, 8:9)` becomes `"1-5, 8-9"`.

Usage

```
## S3 method for class 'integer'
sequenize(x, ...)
```

Arguments

`x`	vector of integers.
`...`	further arguments passed to or from other methods.

Value

object of class `sequenized`

Note

The elements of `x` should be unique and in ascending order.

Examples

```
sequenize(c(1:4, 8:9))
```

slope *Slope*

Description

Extract slope.

Usage

```
slope(x, ...)
```

Arguments

`x`	object
`...`	further arguments passed to or from other methods.

Value

estimate of the slope (numeric vector of length 1).

`stat_adj_boxplot` *Adjusted Boxplot Statistics for ggplot2*

Description

Computes adjusted boxplot statistics to be used by `ggplot2`. See Hubert & Vandervieren (2008, p.5191, Eq.5).

Usage

```
stat_adj_boxplot()

stat_adj_boxplot_outlier()
```

Functions

- `stat_adj_boxplot_outlier()`: add outliers to adjusted boxplot

References

Hubert, M., and E. Vandervieren, 2008. An adjusted boxplot for skewed distributions. Computational Statistics and Data Analysis 52:5186-5201 doi:10.1016/j.csda.2007.11.008

See Also

`adj_boxplot_stats`, `stat_adj_boxplot_outlier`

Examples

```
library(ggplot2)

d <- data.frame(x = gl(2, 50), y = rnorm(100))
ggplot(data = d, mapping = aes(x = x, y = y)) +
   stat_adj_boxplot()
```

test_statistic *Test Statistic*

Description

Extract test_statistic.

Usage

```
test_statistic(x, ...)
```

Arguments

x	object
...	further arguments passed to or from other methods.

Value

test statistic of a test (numeric vector of length 1).

See Also

test_statistic.wilcoxon, test_statistic.mann_kendall

theil_sen *Theil Sen Slope Estimator*

Description

Theil Sen Slope Estimator

Usage

```
theil_sen(x, y, ...)

## S3 method for class 'theil_sen'
slope(x, ...)

## S3 method for class 'theil_sen'
intercept(x, ...)
```

Arguments

x	time vector (numeric, or Date).
y	numeric value.
...	further arguments passed to or from other methods.

Value

object of class `Theil_Sen`.

Methods (by generic)

- `slope(theil_sen)`: Extract slope.
- `intercept(theil_sen)`: Extract intercept.

References

https://en.wikipedia.org/wiki/Theil-Sen_estimator

Examples

```
# create theil_sen object
ts <- theil_sen(1:5, c(1, 2, 3, 5, 9))

# get slope
slope(ts)

# get intercept
intercept(ts)
```

`trimean` *Tukey's Trimean*

Description

Robust centrality measure estimated as the weighted average of the three quartiles: $(Q_1 + 2Q_2 + Q_3)/4$, where Q_1, Q_2 and Q_3 are the first, second and third quartiles respectively.

Usage

```
trimean(x, ...)

## Default S3 method:
trimean(x, ...)
```

Arguments

`x`	numeric vector
`...`	further arguments passed to or from other methods.

Value

trimean (numeric value of length 1).

Methods (by class)

- `trimean(default)`: Tukey's trimean

References

https://en.wikipedia.org/wiki/Trimean

Examples

```
stopifnot(trimean(0:100) == mean(0:100))
stopifnot(trimean(0:100) == median(0:100))
```

---

validate *Validation of LitteR File Formats*

Description

Generic function for validation of file formats.

Usage

```
validate(x, ...)

## S3 method for class 'litter'
validate(x, type_names, logger = create_logger(level = "INFO"), ...)

## S3 method for class 'litter_types'
validate(x, logger = create_logger(level = "INFO"), ...)

## S3 method for class 'settings'
validate(x, logger = create_logger(level = "INFO"), ...)
```

Arguments

`x`	object to validate
`...`	further arguments passed to or from other methods.
`type_names`	character vector of permissible types
`logger`	optional logger object (see `create_logger`)

Value

validated object of class `wide`

validated object of class `litter_types`

validated settings (`list`)

Methods (by class)

- validate(litter): validate litter data.
- validate(litter_types): validate litter_types file
- validate(settings): validate settings file

---

wilcoxon *Wilcoxon Test*

Description

Constructor for a Wilcoxon test (simple wrapper for wilcox.test).

Usage

```
wilcoxon(x, type = c("both", "greater", "less"), mu = 0)

## S3 method for class 'wilcoxon'
test_statistic(x, ...)

## S3 method for class 'wilcoxon'
p_value(x, ...)
```

Arguments

x	numeric vector representing a time-series.
type	direction to test (both, increasing, or decreasing).
mu	baseline value (null hypothesis)
...	further arguments passed to or from other methods.

Value

object of class wilcoxon.

Methods (by generic)

- test_statistic(wilcoxon): Extract test statistic V
- p_value(wilcoxon): Extract p-value

See Also

wilcox.test, p_value, test_statistic

Examples

```
# create wilcoxon object
w <- wilcoxon(c(9, 4, 7, 5, 3), type = "less")

# get test statistic V
test_statistic(w)

# get p-value
p_value(w)
```

Index