

Package ‘rtrend’

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Title Trend Estimating Tools

Description The traditional linear regression trend, Modified Mann-Kendall (MK) non-parameter trend and bootstrap trend are included in this package. Linear regression trend is rewritten by '.lm.fit'. MK trend is rewritten by 'Rcpp'. Finally, those functions are about 10 times faster than previous version in R.

Reference:

Hamed, K. H., & Rao, A. R. (1998). A modified Mann-Kendall trend test for autocorrelated data. *Journal of hydrology*, 204(1-4), 182-196.

<[doi:10.1016/S0022-1694\(97\)00125-X](https://doi.org/10.1016/S0022-1694(97)00125-X)>.

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LinkingTo Rcpp, RcppArmadillo

Imports Rcpp, fftwtools, boot, magrittr, matrixStats, lubridate, terra, plyr

Suggests covr, knitr, rmarkdown, testthat (>= 3.0.0)

URL <https://github.com/rpkgs/rtrend>

BugReports <https://github.com/rpkgs/rtrend/issues>

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mkTrend_r	<i>Modified Mann Kendall</i>
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Description

If valid observations ≤ 5 , NA will be returned.

Usage

```
mkTrend_r(y, ci = 0.95, IsPlot = FALSE)
```

```
mkTrend(y, x = seq_along(y), ci = 0.95, IsPlot = FALSE)
```

Arguments

y	numeric vector
ci	critical value of autocorrelation
IsPlot	boolean
x	(optional) numeric vector

Details

mkTrend is 4-fold faster with `.lm.fit`.

Value

- `Z0` : The original (non corrected) Mann-Kendall test Z statistic.
- `pval0`: The original (non corrected) Mann-Kendall test p-value
- `Z` : The new Z statistic after applying the correction
- `pval` : Corrected p-value after accounting for serial autocorrelation $N/n*s$ Value of the correction factor, representing the quotient of the number of samples N divided by the effective sample size $n*s$
- `slp` : Sen slope, The slope of the (linear) trend according to Sen test

Note

slp is significant, if $pval < \alpha$.

Author(s)

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References

Hipel, K.W. and McLeod, A.I. (1994), *Time Series Modelling of Water Resources and Environmental Systems*. New York: Elsevier Science.

Libiseller, C. and Grimvall, A., (2002), Performance of partial Mann-Kendall tests for trend detection in the presence of covariates. *Environmetrics* 13, 71–84, [doi:10.1002/env.507](https://doi.org/10.1002/env.507).

See Also

fume::mktrend and trend::mk.test

Examples

```
x <- c(4.81, 4.17, 4.41, 3.59, 5.87, 3.83, 6.03, 4.89, 4.32, 4.69)
r <- mkTrend(x)
r_cpp <- mkTrend(x, IsPlot = TRUE)
```

 movmean

movmean

Description

NA and Inf values in the y will be ignored automatically.

Usage

```
movmean(y, halfwin = 1L, SG_style = FALSE, w = NULL)
```

```
movmean2(y, win_left = 1L, win_right = 0L, w = NULL)
```

```
movmean_2d(mat, win_left = 3L, win_right = 0L)
```

Arguments

y	A numeric vector.
halfwin	Integer, half of moving window size
SG_style	If true, head and tail values will be in the style of SG (more weights on the center point), else traditional moving mean style.
w	Corresponding weights of y, with the same length.
win_left, win_right	windows size in the left and right
mat	numeric matrix

Examples

```
x <- 1:100
x[50] <- NA; x[80] <- Inf
s1 <- movmean(x, 2, SG_style = TRUE)
s2 <- movmean(x, 2, SG_style = FALSE)
movmean2(c(4, 8, 6, -1, -2, -3, -1), 2, 0)
movmean2(c(4, 8, NA, -1, -2, Inf, -1), 2, 0)
```

set_dim	<i>Set dimensions of an Object</i>
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Description

Set dimensions of an Object

Usage

```
set_dim(x, dim)

set_dimnames(x, value)
```

Arguments

x	an R object, for example a matrix, array or data frame.
dim	integer vector, see also base::dim()
value	For the default method, either NULL or a numeric vector, which is coerced to integer (by truncation).

See Also

[base::dim](#)

Examples

```
x <- 1:12
set_dim(x, c(3, 4))
```

slope_rast	<i>calculate slope of rast object</i>
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Description

calculate slope of rast object

Usage

```
slope_rast(  
  r,  
  period = c(2001, 2020),  
  outfile = NULL,  
  fun = rtrend::slope_mk,  
  ...,  
  overwrite = FALSE,  
  .progress = "text"  
)  
  
rast_filter_time(r, period = c(2001, 2020))
```

Arguments

r	A yearly rast object, which should have time attribute
period	c(year_begin, year_end)
outfile	The path of outputed tiff file. If specified, slope and pvalue will be written into outfile.
fun	the function used to calculate slope, see slope() for details.
...	other parameters ignored
overwrite	logical. If TRUE, outfile is overwritten.
.progress	name of the progress bar to use, see create_progress_bar

Value

A terra rast object, with bands of slope and pvalue.

See Also

[terra::rast\(\)](#)

Examples

```

library(rtrend)
library(terra)

f <- system.file("rast/MOD15A2_LAI_China_G050_2001-2020.tif", package = "rtrend")
r <- rast(f)
r
time(r)

slp <- slope_rast(r,
  period = c(2001, 2020),
  outfile = "LAI_trend.tif", overwrite = TRUE,
  fun = rtrend::slope_mk, .progress = "none"
)
# if you want to show progress, set `.progress = "text"`
slp
plot(slp)

file.remove("LAI_trend.tif")

```

slope_sen

slope

Description

- slope : linear regression slope
- slope_p : linear regression slope and p-value
- slope_mk : mann kendall Sen's slope and p-value
- slope_sen : same as slope_mk, but with no p-value
- slope_boot: bootstrap slope and p-value

Usage

```
slope_sen(y, x = NULL)
```

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

```
slope_p(y, x, fast = TRUE)
```

```
slope_sen_r(y, x = seq_along(y), ...)
```

```
slope_mk(y, x = NULL, ...)
```

```
slope_boot(y, x = NULL, slope_FUN = slope, times = 100, alpha = 0.1, seed, ...)
```

Arguments

y	vector of observations of length n, or a matrix with n rows.
x	vector of predictor of length n, or a matrix with n rows.
...	ignored.
fast	Boolean. If true, <code>stats::lm.fit()</code> will be used, which is 10x faster than <code>stats::lm()</code> .
slope_FUN	one of <code>slope()</code> , <code>slope_p()</code> , <code>slope_mk()</code>
times	The number of bootstrap replicates.
alpha	significant level, default 0.1
seed	a single value, interpreted as an integer, or NULL (see 'Details').

Value

- slope : linear regression coefficient
- pvalue : p-value ≤ 0.05 means that corresponding slope is significant.
- sd : Std. Error

For `slope_boot`, slope is estimated in many times. The lower, mean, upper and standard deviation (sd) are returned.

Examples

```
y <- c(4.81, 4.17, 4.41, 3.59, 5.87, 3.83, 6.03, 4.89, 4.32, 4.69)
r <- slope(y)
r_p <- slope_p(y)
r_mk <- slope_mk(y)
r_boot <- slope_boot(y)
```

smooth_wSG

Weighted Savitzky-Golay

Description

NA and Inf values in the y has been ignored automatically.

Usage

```
smooth_wSG(y, halfwin = 1L, d = 1L, w = NULL)
```

```
smooth_SG(y, halfwin = 1L, d = 1L)
```

Arguments

y	colvec
halfwin	halfwin of Savitzky-Golay
d	polynomial of degree. When $d = 1$, it becomes moving average.
w	colvec of weight

Examples

```
y <- c(1, 3, 2, 5, 6, 8, 10, 1)
w <- seq_along(y)/length(y)

halfwin = 2
d = 2
s1 <- smooth_wSG(y, halfwin, d, w)
s2 <- smooth_SG(y, halfwin, d)
```

summary_lm

summary_lm

Description

summary method for class ".lm.fit".. It's 200 times faster than traditional lm.

Usage

```
summary_lm(obj, ...)
```

Arguments

obj	Object returned by <code>.lm.fit</code> .
...	ignored

Value

a $p \times 4$ matrix with columns for the estimated coefficient, its standard error, t-statistic and corresponding (two-sided) p-value. Aliased coefficients are omitted.

Examples

```
set.seed(129)
n <- 100
p <- 2
X <- matrix(rnorm(n * p), n, p) # no intercept!
y <- rnorm(n)

obj <- .lm.fit (x = cbind(1, X), y = y)
info <- summary_lm(obj)
```


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