Package ‘runstats’

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Type Package
Title Fast Computation of Running Statistics for Time Series
Version 1.1.0
Description Provides methods for fast computation of running sample statistics for time series. These include: (1) mean, (2) standard deviation, and (3) variance over a fixed-length window of time-series, (4) correlation, (5) covariance, and (6) Euclidean distance (L2 norm) between short-time pattern and time-series. Implemented methods utilize Convolution Theorem to compute convolutions via Fast Fourier Transform (FFT).
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Description
Computes running correlation between time-series \( x \) and short-time pattern \( y \).

Usage

\[
\text{RunningCor}(x, y, \text{circular} = \text{FALSE})
\]

Arguments

\[
\begin{align*}
\text{x} & \quad \text{A numeric vector.} \\
\text{y} & \quad \text{A numeric vector, of equal or shorter length than} \ x. \\
\text{circular} & \quad \text{logical; whether running correlation is computed assuming circular nature of} \ x \\
\end{align*}
\]

Details
Computes running correlation between time-series \( x \) and short-time pattern \( y \). The length of output vector equals the length of \( x \). Parameter \( \text{circular} \) determines whether \( x \) time-series is assumed to have a circular nature. Assume \( l_x \) is the length of time-series \( x \), \( l_y \) is the length of short-time pattern \( y \).

If \( \text{circular} \) equals \( \text{TRUE} \) then

- first element of the output vector corresponds to sample correlation between \( x[1:1_y] \) and \( y \),
- last element of the output vector corresponds to sample correlation between \( c(x[1_x], x[1:(1_y -1)]) \) and \( y \).

If \( \text{circular} \) equals \( \text{FALSE} \) then

- first element of the output vector corresponds to sample correlation between \( x[1:1_y] \) and \( y \),
- the \( l_x - W + 1 \)-th element of the output vector corresponds to sample correlation between \( x[(1_x -1_y + 1):1_x] \),
- last \( W-1 \) elements of the output vector are filled with \( \text{NA} \).

See \text{runstats.demo(func.name = "RunningCor")} for a detailed presentation.
Value

A numeric vector.

Examples

```r
x <- sin(seq(0, 1, length.out = 1000) * 2 * pi * 6)
y <- x[1:100]
out1 <- RunningCor(x, y, circular = TRUE)
out2 <- RunningCor(x, y, circular = FALSE)
plot(out1, type = "l"); points(out2, col = "red")
```

Description

Computes running covariance between time-series \( x \) and short-time pattern \( y \).

Usage

```r
RunningCov(x, y, circular = FALSE)
```

Arguments

- \( x \) A numeric vector.
- \( y \) A numeric vector, of equal or shorter length than \( x \).
- \( \text{circular} \) Logical; whether running variance is computed assuming circular nature of \( x \) time-series (see Details).

Details

Computes running covariance between time-series \( x \) and short-time pattern \( y \).

The length of output vector equals the length of \( x \). Parameter \( \text{circular} \) determines whether \( x \) time-series is assumed to have a circular nature. Assume \( l_x \) is the length of time-series \( x \), \( l_y \) is the length of short-time pattern \( y \).

If \( \text{circular} \) equals \( \text{TRUE} \) then
- first element of the output vector corresponds to sample covariance between \( x[1:l_y] \) and \( y \),
- last element of the output vector corresponds to sample covariance between \( c(x[1_x], x[1:(1_y -1)]) \) and \( y \).

If \( \text{circular} \) equals \( \text{FALSE} \) then
- first element of the output vector corresponds to sample covariance between \( x[1:l_y] \) and \( y \),
- the \( l_x - W + 1 \)-th last element of the output vector corresponds to sample covariance between \( x[(1_x -1_y + 1):1_x] \),
- last \( W-1 \) elements of the output vector are filled with \( \text{NA} \).

See `runstats.demo(func.name = "RunningCov")` for a detailed presentation.
RunningL2Norm

Value
A numeric vector.

Examples

```r
x <- sin(seq(0, 1, length.out = 1000) * 2 * pi * 6)
y <- x[1:100]
out1 <- RunningL2Norm(x, y, circular = TRUE)
out2 <- RunningL2Norm(x, y, circular = FALSE)
plot(out1, type = "l"); points(out2, col = "red")
```

Description

Computes running L2 norm between between time-series `x` and short-time pattern `y`.

Usage

```r
RunningL2Norm(x, y, circular = FALSE)
```

Arguments

- `x` A numeric vector.
- `y` A numeric vector, of equal or shorter length than `x`.
- `circular` logical; whether running L2 norm is computed assuming circular nature of `x` time-series (see Details).

Details

Computes running L2 norm between between time-series `x` and short-time pattern `y`. The length of output vector equals the length of `x`. Parameter `circular` determines whether `x` time-series is assumed to have a circular nature. Assume \( l_x \) is the length of time-series `x`, \( l_y \) is the length of short-time pattern `y`.

If `circular` equals TRUE then

- first element of the output vector corresponds to sample L2 norm between `x[1:1_y]` and `y`.
- last element of the output vector corresponds to sample L2 norm between \( c(x[1\_x]_x, 1\_y \_1) \) and `y`.

If `circular` equals FALSE then

- first element of the output vector corresponds to sample L2 norm between `x[1:1_y]` and `y`.
- the \( l_x - W + 1 \)-th element of the output vector corresponds to sample L2 norm between \( x[1\_x \_1\_y + 1:1\_x] \).
- last \( W-1 \) elements of the output vector are filled with NA.

See `runstats.demo(func.name = "RunningL2Norm")` for a detailed presentation.
RunningMean

Value

A numeric vector.

Examples

## Ex.1.
x <- sin(seq(0, 1, length.out = 1000) * 2 * pi * 6)
y1 <- x[1:100] + rnorm(100)
y2 <- rnorm(100)
out1 <- RunningL2Norm(x, y1)
out2 <- RunningL2Norm(x, y2)
plot(out1, type = "l"); points(out2, col = "blue")
## Ex.2.
x <- sin(seq(0, 1, length.out = 1000) * 2 * pi * 6)
y <- x[1:100] + rnorm(100)
out1 <- RunningL2Norm(x, y, circular = TRUE)
out2 <- RunningL2Norm(x, y, circular = FALSE)
plot(out1, type = "l"); points(out2, col = "red")

RunningMean Fast Running Mean Computation

Description

Computes running sample mean of a time-series x in a fixed length window.

Usage

RunningMean(x, W, circular = FALSE)

Arguments

x A numeric vector.
W A numeric scalar; length of x window over which sample mean is computed.
circular Logical; whether running sample mean is computed assuming circular nature of x time-series (see Details).

Details

The length of output vector equals the length of x vector. Parameter circular determines whether x time-series is assumed to have a circular nature. Assume \( l_x \) is the length of time-series x, W is a fixed length of x time-series window.

If circular equals TRUE then

- first element of the output time-series corresponds to sample mean of x[1:W].
- last element of the output time-series corresponds to sample mean of c(x[1:l_x],x[1:(W -1)]).
If `circular` equals `FALSE` then

- first element of the output time-series corresponds to sample mean of \(x[1:W]\).
- \(l_x - W + 1\)-th element of the output time-series corresponds to sample mean of \(x[(1_x - W + 1):1_x]\),
- last \(W-1\) elements of the output time-series are filled with `NA`.

See `runstats.demo(func.name = "RunningMean")` for a detailed presentation.

**Value**

A numeric vector.

**Examples**

```r
x <- rnorm(10)
RunningMean(x, 3, circular = FALSE)
RunningMean(x, 3, circular = TRUE)
```

**RunningSd**

**Fast Running Standard Deviation Computation**

**Description**

Computes running sample standard deviation of a time-series \(x\) in a fixed length window.

**Usage**

`RunningSd(x, W, circular = FALSE)`

**Arguments**

- **x** A numeric vector.
- **W** A numeric scalar; length of \(x\) window over which sample variance is computed.
- **circular** Logical; whether running sample standard deviation is computed assuming circular nature of \(x\) time-series (see Details).

**Details**

The length of output vector equals the length of \(x\) vector. Parameter `circular` determines whether \(x\) time-series is assumed to have a circular nature. Assume \(l_x\) is the length of time-series \(x\), \(W\) is a fixed length of \(x\) time-series window.

If `circular` equals `TRUE` then

- first element of the output time-series corresponds to sample standard deviation of \(x[1:W]\),
- last element of the output time-series corresponds to sample standard deviation of \(c(x[1_x], x[1:(W -1)])\).
If `circular` equals `FALSE` then

- first element of the output time-series corresponds to sample standard deviation of \(x[1:W]\),
- the \(l_x - W + 1\)-th element of the output time-series corresponds to sample standard deviation of \(x[(1_x - W + 1):l_x]\),
- last \(W-1\) elements of the output time-series are filled with `NA`.

See `runstats.demo(func.name = "RunningSd")` for a detailed presentation.

**Value**

A numeric vector.

**Examples**

```r
x <- rnorm(10)
RunningSd(x, 3, circular = FALSE)
RunningSd(x, 3, circular = FALSE)
```

---

**RunningVar**

**Fast Running Variance Computation**

**Description**

Computes running sample variance of a time-series \(x\) in a fixed length window.

**Usage**

```r
RunningVar(x, W, circular = FALSE)
```

**Arguments**

- \(x\) A numeric vector.
- \(W\) A numeric scalar; length of \(x\) window over which sample variance is computed.
- `circular` Logical; whether running sample variance is computed assuming circular nature of \(x\) time-series (see Details).

**Details**

The length of output vector equals the length of \(x\) vector. Parameter `circular` determines whether \(x\) time-series is assumed to have a circular nature. Assume \(l_x\) is the length of time-series \(x\), \(W\) is a fixed length of \(x\) time-series window.

If `circular` equals `TRUE` then

- first element of the output time-series corresponds to sample variance of \(x[1:W]\),
- last \(W-1\) elements of the output time-series corresponds to sample variance of \(c(x[1_x],x[1:(W -1)])\).
If circular equals FALSE then

- first element of the output time-series corresponds to sample variance of \( x[1:W] \),
- the \( l_x - W + 1 \)-th element of the output time-series corresponds to sample variance of \( x[(1_x - W + 1):l_x] \),
- last \( W-1 \) elements of the output time-series are filled with NA.

See runstats.demo(func.name = "RunningVar") for a detailed presentation.

Value

A numeric vector.

Examples

```r
x <- rnorm(10)
RunningVar(x, W = 3, circular = FALSE)
RunningVar(x, W = 3, circular = TRUE)
```

Description

Generates demo visualization of output of methods for computing running statistics.

Usage

```r
runstats.demo(func.name = "RunningCov")
```

Arguments

- `func.name`: Character value; one of the following:
  - "RunningMean",
  - "RunningSd",
  - "RunningVar",
  - "RunningCov",
  - "RunningCor",
  - "RunningL2Norm".

Value

`NULL`
Examples

## Not run:
runstats.demo(func.name = "RunningMean")
runstats.demo(func.name = "RunningSd")
runstats.demo(func.name = "RunningVar")
runstats.demo(func.name = "RunningCov")
runstats.demo(func.name = "RunningCor")
runstats.demo(func.name = "RunningL2Norm")

## End(Not run)
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