Package ‘convo’

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Type Package

Title Fast Computation of Running Sample Statistics

Version 0.1.0

Description Provides methods for fast computation of running (aka rolling) sample statistics. These include running sample mean of a single numeric sequence, running sample variance of a single numeric sequence, running sample covariance of two numeric sequences. Implementation of the methods uses convolution via Fast Fourier Transform. The complexity of the convolution can be reduced from O(n^2) to O(n log n) with fast Fourier transform compared to conventional computation.

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Imports stats

Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

Suggests knitr, rmarkdown, testthat, covr

VignetteBuilder knitr

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R topics documented:

DigFilter *Bandpass Digital Filter*

Description

Bandpass digital filter; passes frequencies within a certain range and rejects frequencies outside that range.

Usage

```
DigFilter(x, fs, LD, LU)
```

Arguments

x	numeric sequence
fs	sampling frequency of a numeric sequence x
LD	lower bandpass frequency
LU	higher bandpass frequency

Examples

```
## generate components of a signal x
fs <- 1000
t.seq <- seq(0, 1, length.out = 1000)
x1 <- sin(2 * pi * t.seq * 50)
x2 <- sin(2 * pi * t.seq * 150)
x3 <- sin(2 * pi * t.seq * 250)
x0 <- rnorm(length(t.seq), sd = 0.1)
plot(x0, ylim = range(c(x0, x1, x2, x3)), main = "x components")
lines(x1, col = "blue")
lines(x2, col = "red")
lines(x3, col = "green")
## generate signal x
x <- x1 + x2 + x3 + x0
plot(x, main = "x", type = "l")
## use filter with passband frequencies [100 Hz, 200 Hz]
x.filtered <- DigFilter(x, 1000, 100, 200)
plot(x.filtered, type = "l", main = "x filtered with [100 Hz, 200 Hz] frequency bandpass")
plot(x2, type = "l", main = "compare: x2 component of x")
```

RunningCor *Fast Running Correlation Computation*

Description

Computes running correlation between two sequences in a fixed width window, whose length corresponds to the length of the shorter sequence. Uses convolution via Fast Fourier Transform.

Usage

```
RunningCor(x, y, circular = FALSE)
```

Arguments

x	numeric sequence
y	numeric sequence, of equal or shorter length than x sequence
circular	logical; whether running correlation is computed assuming circular nature of x sequence (see Details)

Details

Computes running correlation between two sequences in a fixed width window. The length of a window is equal to the shorter of the two sequences (y), and window "runs" over the length of longer sequence (x).

Parameter circular determines whether x sequence is assumed to have a circular nature. Assume l_x is the length of sequence x, l_y is the length of shorter sequence y.

If circular equals TRUE then

- output sequence length equals l_x,
- first element of the output sequence corresponds to sample correlation between x[1:l_y] and y,
- last element of the output sequence corresponds to sample correlation between c(x[l_x], x[1:(l_y - 1)]) and y.

If circular equals FALSE then

- output sequence length equals $l_x - l_y + 1$,
- first element of the output sequence corresponds to sample correlation between x[1:l_y] and y,
- last element of the output sequence corresponds to sample correlation between x[(l_x - l_y + 1):l_x].

Value

numeric sequence

Examples

```
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")
```

RunningCov *Fast Running Covariance Computation*

Description

Computes running covariance between two sequences in a fixed width window, whose length corresponds to the length of the shorter sequence. Uses convolution via Fast Fourier Transform.

Usage

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

Arguments

x	numeric sequence
y	numeric sequence, of equal or shorter length than x sequence
circular	logical; whether running variance is computed assuming circular nature of x sequence (see Details)

Details

Computes running covariance between two sequences in a fixed width window. The length of a window is equal to the shorter of the two sequences (y), and window "runs" over the length of longer sequence (x).

Parameter circular determines whether x sequence is assumed to have a circular nature. Assume l_x is the length of sequence x, l_y is the length of shorter sequence y.

If circular equals TRUE then

- output sequence length equals l_x,
- first element of the output sequence corresponds to sample covariance between x[1:l_y] and y,
- last element of the output sequence corresponds to sample covariance between c(x[l_x], x[1:(l_y - 1)]) and y.

If circular equals FALSE then

- output sequence length equals $l_x - l_y + 1$,
- first element of the output sequence corresponds to sample covariance between x[1:l_y] and y,
- last element of the output sequence corresponds to sample covariance between x[(l_x - l_y + 1):l_x].

Value

numeric sequence

Examples

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

`RunningL2Norm` *Fast Running L2 Norm Computation*

Description

Computes running L2 norm between two sequences in a fixed width window, whose length corresponds to the length of the shorter sequence. Uses convolution via Fast Fourier Transform.

Usage

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

Arguments

`x`	numeric sequence
`y`	numeric sequence, of equal or shorter length than `x` sequence
`circular`	logical; whether running L2 norm is computed assuming circular nature of `x` sequence (see Details)

Details

Computes running L2 norm between two sequences in a fixed width window. The length of a window is equal to the shorter of the two sequences (`y`), and window "runs" over the length of longer sequence (`x`).

Parameter `circular` determines whether `x` sequence is assumed to have a circular nature. Assume l_x is the length of sequence `x`, l_y is the length of shorter sequence `y`.

If `circular` equals `TRUE` then

- output sequence length equals l_x,
- first element of the output sequence corresponds to sample L2 norm between `x[1:l_y]` and `y`,
- last element of the output sequence corresponds to sample L2 norm between `c(x[l_x], x[1:(l_y - 1)])` and `y`.

If `circular` equals `FALSE` then

- output sequence length equals $l_x - l_y + 1$,
- first element of the output sequence corresponds to sample L2 norm between `x[1:l_y]` and `y`,
- last element of the output sequence corresponds to sample L2 norm between `x[(l_x - l_y + 1):l_x]`.

Value

numeric sequence

Examples

```
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")
```

`RunningMean` *Fast Running Mean Computation*

Description

Computes running sample mean of a sequence in a fixed width window. Uses convolution via Fast Fourier Transform.

Usage

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

Arguments

`x`	numeric sequence
`W`	numeric; width of `x` sequence window
`circular`	logical; whether running sample mean is computed assuming circular nature of `x` sequence (see Details)

Details

Parameter `circular` determines whether `x` sequence is assumed to have a circular nature. Assume l_x is the length of sequence `x`, `W` is a fixed length of `x` sequence window.

If `circular` equals `TRUE` then

- output sequence length equals l_x,
- first element of the output sequence corresponds to sample mean of `x[1:W]`,
- last element of the output sequence corresponds to sample mean of `c(x[l_x], x[1:(W - 1)])`.

If `circular` equals `FALSE` then

- output sequence length equals $l_x - W + 1$,
- first element of the output sequence corresponds to sample mean of `x[1:W]`,
- last element of the output sequence corresponds to sample mean of `x[(l_x - W + 1):l_x]`.

Value

numeric sequence

Examples

```
x <- rnorm(1000)
RunningMean(x, 100)
length(RunningMean(x, 100, circular = FALSE))
length(RunningMean(x, 100, circular = TRUE))
```

RunningSd — *Fast Running Standard Deviation Computation*

Description

Computes running sample standard deviation of a sequence in a fixed width window. Uses convolution via Fast Fourier Transform.

Usage

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

Arguments

`x`	numeric sequence
`W`	numeric; width of `x` sequence window
`circular`	logical; whether running sample standard deviation is computed assuming circular nature of `x` sequence (see Details)

Details

Parameter `circular` determines whether `x` sequence is assumed to have a circular nature. Assume l_x is the length of sequence `x`, `W` is a fixed length of `x` sequence window.

If `circular` equals `TRUE` then

- output sequence length equals l_x,
- first element of the output sequence corresponds to sample standard deviation of `x[1:W]`,
- last element of the output sequence corresponds to sample standard deviation of `c(x[l_x], x[1:(W - 1)])`.

If `circular` equals `FALSE` then

- output sequence length equals $l_x - W + 1$,
- first element of the output sequence corresponds to sample standard deviation of `x[1:W]`,
- last element of the output sequence corresponds to sample standard deviation of `x[(l_x - W + 1):l_x]`.

Value

numeric sequence

Examples

```
x <- rnorm(1000)
RunningSd(x, 100)
length(RunningSd(x, 100, circular = FALSE))
length(RunningSd(x, 100, circular = TRUE))
```

RunningVar *Fast Running Variance Computation*

Description

Computes running sample variance of a sequence in a fixed width window. Uses convolution via Fast Fourier Transform.

Usage

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

Arguments

x	numeric sequence
W	numeric; width of x sequence window
circular	logical; whether running sample variance is computed assuming circular nature of x sequence (see Details)

Details

Parameter `circular` determines whether `x` sequence is assumed to have a circular nature. Assume l_x is the length of sequence `x`, `W` is a fixed length of `x` sequence window.

If `circular` equals `TRUE` then

- output sequence length equals l_x,
- first element of the output sequence corresponds to sample variance of `x[1:W]`,
- last element of the output sequence corresponds to sample variance of `c(x[l_x], x[1:(W - 1)])`.

If `circular` equals `FALSE` then

- output sequence length equals $l_x - W + 1$,
- first element of the output sequence corresponds to sample variance of `x[1:W]`,
- last element of the output sequence corresponds to sample variance of `x[(l_x - W + 1):l_x]`.

Value

numeric sequence

Examples

```
x <- rnorm(1000)
RunningVar(x, 100)
length(RunningVar(x, 100, circular = FALSE))
length(RunningVar(x, 100, circular = TRUE))
```

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