

Package ‘vse4ts’

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Title Identify Memory Patterns in Time Series Using Variance Scale Exponent

Version 1.0.0

Description Methods for calculating the variance scale exponent to identify memory patterns in time series data. Includes tests for white noise, short memory, and long memory. See Fu, H. et al. (2018) <[doi:10.1016/j.physa.2018.06.092](https://doi.org/10.1016/j.physa.2018.06.092)>.

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URL <https://z-my-cn.github.io/vse4ts/>

BugReports <https://github.com/z-my-cn/vse4ts/issues>

Imports stats

Suggests pracma

Config/testthat/edition 3

Encoding UTF-8

RoxygenNote 7.3.1

NeedsCompilation no

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Contents

SLmemory.test	2
vse	3
Wnoise.test	4
Index	6

SLmemory.test	<i>Testing Long Memory in Time Series</i>
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Description

The function `SLmemory.test` computes the test statistic for long memory in time series based on the variance scale exponent. The null hypothesis is that the time series is white noise or short memory, while the alternative hypothesis is that the time series has long memory.

Usage

```
SLmemory.test(x, m = 0.5, n = NULL)
```

Arguments

<code>x</code>	A time series vector.
<code>m</code>	A parameter to control the number of scales. Default is 0.5.
<code>n</code>	The number of scales. If <code>NULL</code> , it will be calculated as <code>floor(N^m)</code> .

Value

A list with class "SLmemory.test" containing the following components:

<code>SLmemory</code>	the test statistic
<code>df</code>	the degrees of freedom of the test.
<code>p.value</code>	the p-value of the test.

References

Fu, H., Chen, W., & He, X.-J. (2018). On a class of estimation and test for long memory. In *Physica A: Statistical Mechanics and its Applications* (Vol. 509, pp. 906–920). Elsevier BV. <https://doi.org/10.1016/j.physa.2018.06.092>

Examples

```
## Test long memory in time series
library(pracma)

set.seed(123)
data("brown72")
x72 <- brown72                                # H = 0.72
xgn <- rnorm(1024)                             # H = 0.50
xlm <- numeric(1024); xlm[1] <- 0.1           # H = 0.43
for (i in 2:1024) xlm[i] <- 4 * xlm[i-1] * (1 - xlm[i-1])

SLmemory.test(x72)
SLmemory.test(xgn)
SLmemory.test(xlm)
```

vse

*Calculate the Variance Scale Exponent of a Time Series***Description**

Calculate the variance scale exponent of a time series.

Usage

```
vse(x, m = 0.5, n = NULL, type = c("weak", "strong"))
```

Arguments

x	A time series vector.
m	A parameter to control the number of scales. Default is 0.5.
n	The number of scales. If NULL, it will be calculated as $\text{floor}(N^m)$.
type	The type of variance scale exponent. Default is "weak".

Value

The variance scale exponent.

References

Fu, H., Chen, W., & He, X.-J. (2018). On a class of estimation and test for long memory. In *Physica A: Statistical Mechanics and its Applications* (Vol. 509, pp. 906–920). Elsevier BV. <https://doi.org/10.1016/j.physa.2018.06.092>

Examples

```
## Compute the variance scale exponent of a time series
# Generate a random time series
set.seed(123)
x <- rnorm(1024) # F = H = 0.5 also d = 0
vse(x)

## Compare the result with the Hurst exponent
library(pracma)

# A time series with Hurst exponent 0.72
data("brown72")
x <- brown72      # F = H = 0.72 also d = 0.22
hurstexp(x)
vse(x)

# A time series with Hurst exponent 0.43
xlm <- numeric(1024); xlm[1] <- 0.1
for (i in 2:1024) xlm[i] <- 4 * xlm[i-1] * (1 - xlm[i-1])
```

```
x <- xlm          # F = H = 0.43 also d = -0.07
hurstexp(x)
vse(x)
```

Wnoise.test

Testing White Noise in Time Series

Description

The function `Wnoise.test` computes the test statistic for white noise in time series based on the variance scale exponent. The null hypothesis is that the time series is independent white noise, while the alternative hypothesis is that the time series is a non-independent stochastic process.

Usage

```
Wnoise.test(x, m = 0.5, n = NULL)
```

Arguments

<code>x</code>	A time series vector.
<code>m</code>	A parameter to control the number of scales. Default is 0.5.
<code>n</code>	The number of scales. If <code>NULL</code> , it will be calculated as <code>floor(N^m)</code> .

Value

A list with class "Wnoise.test" containing the following components:

<code>Wnoise</code>	the test statistic
<code>df</code>	the degrees of freedom of the test.
<code>p.value</code>	the p-value of the test.

References

Fu, H., Chen, W., & He, X.-J. (2018). On a class of estimation and test for long memory. In *Physica A: Statistical Mechanics and its Applications* (Vol. 509, pp. 906–920). Elsevier BV. <https://doi.org/10.1016/j.physa.2018.06.092>

Examples

```
## Test white noise in time series
library(pracma)

set.seed(123)
data("brown72")
x72 <- brown72          # H = 0.72
xgn <- rnorm(1024)      # H = 0.50
xlm <- numeric(1024); xlm[1] <- 0.1  # H = 0.43
```

```
for (i in 2:1024) xlm[i] <- 4 * xlm[i-1] * (1 - xlm[i-1])  
  
Wnoise.test(x72)  
Wnoise.test(xgn)  
Wnoise.test(xlm)
```

Index

SLmemory.test, [2](#)

vse, [3](#)

Wnoise.test, [4](#)