

Package ‘TSEntropies’

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Title Time Series Entropies

Version 0.9

Description Computes various entropies of given time series. This is the initial version that includes ApEn() and SampEn() functions for calculating approximate entropy and sample entropy. Approximate entropy was proposed by S.M. Pincus in "Approximate entropy as a measure of system complexity", Proceedings of the National Academy of Sciences of the United States of America, 88, 2297-2301 (March 1991). Sample entropy was proposed by J. S. Richman and J. R. Moorman in "Physiological time-series analysis using approximate entropy and sample entropy", American Journal of Physiology, Heart and Circulatory Physiology, 278, 2039-2049 (June 2000). This package also contains FastApEn() and FastSampEn() functions for calculating fast approximate entropy and fast sample entropy. These are newly designed very fast algorithms, resulting from the modification of the original algorithms. The calculated values of these entropies are not the same as the original ones, but the entropy trend of the analyzed time series determines equally reliably. Their main advantage is their speed, which is up to a thousand times higher. A scientific article describing their properties has been submitted to The Journal of Supercomputing and in present time it is waiting for the acceptance.

Depends R (>= 3.4.0)

License GPL-3

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Contents

ApEn	2
ApEn_C	3

ApEn_R	3
FastApEn	4
FastApEn_C	4
FastApEn_R	5
FastSampEn	6
FastSampEn_C	6
FastSampEn_R	7
SampEn	7
SampEn_C	8
SampEn_R	9

Index	10
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ApEn	<i>ApEn</i>
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Description

This function computes approximate entropy of given time series.

Usage

```
ApEn(TS, dim = 2, lag = 1, r = 0.2 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is 0.2*sd(TS)

Examples

```
timser <- rnorm(2000)
ApEn(timser)
ApEn(timser, r = 0.1*sd(timser))
ApEn(timser, dim = 3, r = 0.1*sd(timser))
```

ApEn_C

ApEn_C

Description

This function computes approximate entropy of given time series. It is implemented in C.

Usage

```
ApEn_C(TS, dim = 2, lag = 1, r = 0.2 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is 0.2*sd(TS)

Examples

```
timser <- rnorm(2000)
ApEn_C(timser)
ApEn_C(timser, r = 0.1*sd(timser))
ApEn_C(timser, dim = 3, r = 0.1*sd(timser))
```

ApEn_R

ApEn_R

Description

This function computes approximate entropy of given time series. It is implemented in R.

Usage

```
ApEn_R(TS, dim = 2, lag = 1, r = 0.2 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is 0.2*sd(TS)

Examples

```

timser <- rnorm(2000)
ApEn_R(timser)
ApEn_R(timser, r = 0.1*sd(timser))
ApEn_R(timser, dim = 3, r = 0.1*sd(timser))

```

FastApEn

FastApEn

Description

This function computes fast approximate entropy of given time series.

Usage

```
FastApEn(TS, dim = 2, lag = 1, r = 0.15 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is 0.15*sd(TS)

Examples

```

timser <- rnorm(2000)
FastApEn(timser)
FastApEn(timser, r = 0.1*sd(timser))
FastApEn(timser, dim = 3, r = 0.1*sd(timser))

```

FastApEn_C

FastApEn_C

Description

This function computes fast approximate entropy of given time series. It is implemented in C.

Usage

```
FastApEn_C(TS, dim = 2, lag = 1, r = 0.15 * sd(TS))
```

Arguments

TS - given time series
dim - dimension of given time series, default value is 2
lag - downsampling, default value is 1
r - radius of searched areas, default value is $0.15 * \text{sd}(\text{TS})$

Examples

```
timser <- rnorm(2000)
FastApEn_C(timser)
FastApEn_C(timser, r = 0.1*sd(timser))
FastApEn_C(timser, dim = 3, r = 0.1*sd(timser))
```

FastApEn_R

FastApEn_R

Description

This function computes fast approximate entropy of given time series. It is implemented in R.

Usage

```
FastApEn_R(TS, dim = 2, lag = 1, r = 0.15 * sd(TS))
```

Arguments

TS - given time series
dim - dimension of given time series, default value is 2
lag - downsampling, default value is 1
r - radius of searched areas, default value is $0.15 * \text{sd}(\text{TS})$

Examples

```
timser <- rnorm(2000)
FastApEn_R(timser)
FastApEn_R(timser, r = 0.1*sd(timser))
FastApEn_R(timser, dim = 3, r = 0.1*sd(timser))
```

FastSampEn

FastSampEn

Description

This function computes fast sample entropy of given time series.

Usage

```
FastSampEn(TS, dim = 2, lag = 1, r = 0.15 * sd(TS))
```

Arguments

TS - given time series
dim - dimension of given time series, default value is 2
lag - downsampling, default value is 1
r - radius of searched areas, default value is $0.15 * sd(TS)$

Examples

```
timser <- rnorm(2000)  
FastSampEn(timser)  
FastSampEn(timser, r = 0.1*sd(timser))  
FastSampEn(timser, dim = 3, r = 0.1*sd(timser))
```

FastSampEn_C*FastSampEn_C*

Description

This function computes fast sample entropy of given time series. It is implemented in C.

Usage

```
FastSampEn_C(TS, dim = 2, lag = 1, r = 0.15 * sd(TS))
```

Arguments

TS - given time series
dim - dimension of given time series, default value is 2
lag - downsampling, default value is 1
r - radius of searched areas, default value is $0.15 * sd(TS)$

Examples

```

timser <- rnorm(2000)
FastSampEn_C(timser)
FastSampEn_C(timser, r = 0.1*sd(timser))
FastSampEn_C(timser, dim = 3, r = 0.1*sd(timser))

```

FastSampEn_R

FastSampEn_R

Description

This function computes fast sample entropy of given time series. It is implemented in R.

Usage

```
FastSampEn_R(TS, dim = 2, lag = 1, r = 0.15 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is 0.15*sd(TS)

Examples

```

timser <- rnorm(2000)
FastSampEn_R(timser)
FastSampEn_R(timser, r = 0.1*sd(timser))
FastSampEn_R(timser, dim = 3, r = 0.1*sd(timser))

```

SampEn

SampEn

Description

This function computes sample entropy of given time series.

Usage

```
SampEn(TS, dim = 2, lag = 1, r = 0.2 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is $0.2 * sd(TS)$

Examples

```
timser <- rnorm(2000)
SampEn(timser)
SampEn(timser, r = 0.1*sd(timser))
SampEn(timser, dim = 3, r = 0.1*sd(timser))
```

SampEn_C

SampEn_C

Description

This function computes sample entropy of given time series. It is implemented in C.

Usage

```
SampEn_C(TS, dim = 2, lag = 1, r = 0.2 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is $0.2 * sd(TS)$

Examples

```
timser <- rnorm(2000)
SampEn_C(timser)
SampEn_C(timser, r = 0.1*sd(timser))
SampEn_C(timser, dim = 3, r = 0.1*sd(timser))
```

SampEn_R

SampEn_R

Description

This function computes sample entropy of given time series. It is implemented in R.

Usage

```
SampEn_R(TS, dim = 2, lag = 1, r = 0.2 * sd(TS))
```

Arguments

TS	- given time series
dim	- dimension of given time series, default value is 2
lag	- downsampling, default value is 1
r	- radius of searched areas, default value is $0.2 * sd(TS)$

Examples

```
timser <- rnorm(2000)
SampEn_R(timser)
SampEn_R(timser, r = 0.1*sd(timser))
SampEn_R(timser, dim = 3, r = 0.1*sd(timser))
```

Index

* **ApEn**

ApEn, 2
ApEn_C, 3
ApEn_R, 3
FastApEn_R, 5
SampEn_R, 9

* **C**

ApEn_C, 3
FastApEn_C, 4
FastSampEn_C, 6
SampEn_C, 8

* **FastApEn**

FastApEn, 4
FastApEn_C, 4

* **FastSampEn**

FastSampEn, 6
FastSampEn_C, 6
FastSampEn_R, 7

* **R**

ApEn_R, 3
FastApEn_R, 5
FastSampEn_R, 7
SampEn_R, 9

* **SampEn**

SampEn, 7
SampEn_C, 8

* **approximate**

ApEn, 2
ApEn_C, 3
ApEn_R, 3
FastApEn, 4
FastApEn_C, 4
FastApEn_R, 5
SampEn_R, 9

* **entropy**

ApEn, 2
ApEn_C, 3
ApEn_R, 3
FastApEn, 4

FastApEn_C, 4
FastApEn_R, 5
FastSampEn, 6
FastSampEn_C, 6
FastSampEn_R, 7
SampEn, 7
SampEn_C, 8
SampEn_R, 9

* **fast**

FastApEn, 4
FastApEn_C, 4
FastSampEn, 6
FastSampEn_C, 6
FastSampEn_R, 7

* **sample**

FastSampEn, 6
FastSampEn_C, 6
FastSampEn_R, 7
SampEn, 7
SampEn_C, 8

ApEn, 2
ApEn_C, 3
ApEn_R, 3

FastApEn, 4
FastApEn_C, 4
FastApEn_R, 5
FastSampEn, 6
FastSampEn_C, 6
FastSampEn_R, 7

SampEn, 7
SampEn_C, 8
SampEn_R, 9