Package ‘MixedIndTests’

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Type Package
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Description Functions for testing randomness for a univariate time series with arbitrary distribution (discrete, continuous, mixture of both types) and for testing independence between random variables with arbitrary distributions. The test statistics are based on the multilinear empirical copula and multipliers are used to compute P-values. The test of independence between random variables appeared in <doi:10.1093/biomet/asy059>.
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**AutoDep**

Dependogram for Kendall’s tau and Spearman’s rho

**Description**

This function, used in EstDepSerial, draws the P-values of Kendall’s tau and Spearman’s rho for a given number of lags.

**Usage**

```
AutoDep(out)
```

**Arguments**

- `out` List of the output of EstDepSerial (P-values, subsets)

**Value**

Plot of the graph of P-values of dependence measures for serial dependence

**References**

B.R Nasri (2021). Test of serial dependence for arbitrary distributions

**Examples**

```r
out <- EstDepSerial(SimAR1Poisson(c(5, 0.4), 100), 10)
AutoDep(out)
```
Dependogram

Dependogram for Cramer-von Mises statistics

Description

This function, used in EstDep, TestIndCopula and TestIndSerCopula, draws the P-values of the Moebius Cramer-von Mises statistics from the multilinear copula and their combination for a test of randomness for k consecutive values X(1), ..., X(k) or for a test of independence between random variables.

Usage

Dependogram(out, stat = "CVM")

Arguments

out List of the output from EstDep, TestIndCopula or TestIndSerCopula (P-values, subsets)
stat Name of statistics to be used (default is "CVM")

Value

Plot of the graph of P-values of statistics

References

Genest, Neslehova, Remillard & Murphy (2019). Testing for independence in arbitrary distributions

Examples

x <- matrix(rnorm(250), ncol=5)
out <- TestIndCopula(x)
Dependogram(out)

EstDep

Kendall’s tau and Spearman’s rho statistics for testing independence between random variables

Description

This function computes the matrix of pairs of Kendall’s tau and Spearman’s rho statistics between random variables with arbitrary distributions.

Usage

EstDep(x, graph = FALSE)
Arguments

\begin{itemize}
\item **x** \hspace{1cm} Data matrix
\item **graph** \hspace{1cm} Set to TRUE for a dependogram for all pairs of Kendall’s taus and Spearman’s rhos.
\end{itemize}

Value

\begin{itemize}
\item **stat** \hspace{1cm} List of Cramer-von Mises statistics cvm, Sn from the multilinear copula, and test combinations Tn and Tn2
\item **pvalue** \hspace{1cm} Approximated P-values for the tests using Gaussian multipliers
\end{itemize}

References

Genest, Neslehova, Remillard & Murphy (2018). Test for independence in arbitrary distributions

Examples

\begin{verbatim}
x <- matrix(rnorm(500), ncol=10)
out <- EstDep(x)
\end{verbatim}

\begin{verbatim}
EstDepSerial
\end{verbatim}

\textit{Kendall’s tau and Spearman’s rho statistics for testing randomness in a time series}

Description

This function computes Kendall’s tau and Spearman’s rho statistics for tests of randomness in a time series with arbitrary distribution for pairs (X[i], X[i+k]), k=1:lags

Usage

\begin{verbatim}
EstDepSerial(x, lag, graph = FALSE)
\end{verbatim}

Arguments

\begin{itemize}
\item **x** \hspace{1cm} Time series
\item **lag** \hspace{1cm} Number of lags
\item **graph** \hspace{1cm} Set to TRUE for a dependogram for Kendall’s tau and Spearman’s rho
\end{itemize}

Value

\begin{itemize}
\item **stat** \hspace{1cm} List of Kendall’s tau and Spearman’s rho statistics from multilinear copula, and test combinations LB
\item **pvalue** \hspace{1cm} Approximated P-values for the tests using Gaussian multipliers
\end{itemize}
horseshoecrabs

References

B.R Nasri (2021). Test of serial dependence for arbitrary distributions

Examples

g <- EstDepSerial(SimAR1Poisson(c(5,0.4),100),10)

horseshoecrabs  Horseshoecrabs dataset

Description

Horseshoe Crab Data from Table 3.2 of Agresti(2007). This data set consists of five variables, three of which are categorical, measured on 173 female crabs, each having a male attached in her nest.

Usage

data(horseshoecrabs)

Format

Data frame with 173 rows and 5 variables:

- X1: Color of the female (1: light medium, 2: medium, 3: dark medium, 4: dark)
- X2: Spine condition (1: both good, 2: one worn or broken, 3: both worn or broken)
- X3: Carapace width (cm)
- X4: Number of satellites, i.e., other males around the female
- X5: Weight (kg)

References


Examples

data(horseshoecrabs)
x = data.matrix(horseshoecrabs)
out = TestIndCopula(x,trunc.level=5,graph=TRUE)
SimAR1Poisson

**Fetal lamb dataset**

**Description**

240 body movement measurements of a fetal lamb at consecutive 5 second intervals.

**Usage**

```r
data(lamb)
```

**Format**

Count data.

**References**


**Examples**

```r
data(lamb)
plot(lamb)
```

---

**SimAR1Poisson**

*Simulation of an AR(1) Poisson process*

**Description**

Conditionally on the past, $X[t]$ is Poisson with lambda[t] = $a+bX[t-1]$

**Usage**

```r
SimAR1Poisson(param, n)
```

**Arguments**

- `param`  
  `param[1] = a>0, param[2] = b, 0<=b <1` (for stationarity)
- `n`  
  length of the series.

**Value**

- `X`  
  simulated series

**Examples**

```r
data <- SimAR1Poisson(c(5,0.4),500)
```
Description

This function computes Cramer-von Mises statistics and their combination for a test of independence between random variables with arbitrary distributions. The P-values are computed using Gaussian multipliers.

Usage

TestIndCopula(
  x,
  trunc.level = 2,
  B = 1000,
  par = FALSE,
  ncores = 2,
  graph = FALSE
)

Arguments

- **x**: Data matrix
- **trunc.level**: Only subsets of cardinality <= trunc.level (default=2) are considered for the Moebius statistics.
- **B**: Number of multipliers samples (default = 1000)
- **par**: Set to TRUE if one prefers parallel computing (slower)
- **ncores**: Number of cores for parallel computing (default is 2)
- **graph**: Set to TRUE if one wants the dependogram of P-values for the Moebius statistics

Value

- **stat**: List of Cramer-von Mises statistics cvm, Sn from the multilinear copula, and test combinations Tn and Tn2 (only pairs)
- **pvalue**: Approximated P-values for the tests using Gaussian multipliers

References

Genest, Neslehova, Remillard & Murphy (2019). Testing for independence in arbitrary distributions

Examples

```r
x <- matrix(rnorm(250),ncol=5)
out <- TestIndCopula(x)
```
TestIndSerCopula

Statistics for a test of randomness for a time series

Description

This function computes Cramer-von Mises statistics from the multilinear copula and their combination for a test of randomness for p consecutive values $X(1), ..., X(p)$. The p-values are computed using Gaussian multipliers.

Usage

```r
TestIndSerCopula(
  x,
  p,
  trunc.level = 2,
  B = 1000,
  par = FALSE,
  ncores = 2,
  graph = FALSE
)
```

Arguments

- `x`: Time series
- `p`: Number of consecutive observations
- `trunc.level`: Only subsets of cardinality $\leq$ trunc.level (default=2) are considered for the Moebius statistics.
- `B`: Number of multipliers samples (default = 1000)
- `par`: Set to TRUE if one prefers parallel computing (slower)
- `ncores`: Number of cores for parallel computing (default = 2)
- `graph`: Set to TRUE if one wants the dependogram of P-values for the Moebius statistics

Value

- `stat`: List of Cramer-von Mises statistics cvm, Sn, and test combinations $Tn$ and $Tn^2$ (only pairs)
- `pvalue`: Approximated P-values for the tests using Gaussian multipliers

References

B.R Nasri (2021). Test of serial dependence for arbitrary distributions
Description
Simulated AR(1) Poisson sequence of length n=100 with parameters c(5,0.4).

Usage
data(X)

Format
Count data.

Examples
data(X)
acf(X)

Description
Simulated Bernoulli sequence.

Usage
data(Xbin)

Format
Count data.

Examples
data(Xbin)
plot(Xbin)
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