Package 'changepointTests'

September 23, 2024

Type Package

Title Change Point Tests for Joint Distributions and Copulas

Version 0.1.7

Maintainer Bruno N Remillard <bruno.remillard@hec.ca>

Description

Change point tests for joint distributions and copulas using pseudo-observations with multipliers or bootstrap. The processes used here have been defined in Bucher, Kojadinovic, Rohmer & Segers <doi:10.1016/j.jmva.2014.07.012> and Nasri & Remillard <doi:10.1016/j.jmva.2019.03.002>.

License GPL-3

Encoding UTF-8

LazyData true

Depends R (>= 3.5.0), doParallel, parallel, foreach, stats

RoxygenNote 7.3.2

NeedsCompilation yes

Author Bouchra R Nasri [aut],
Bruno N Remillard [aut, cre, cph]

Repository CRAN

Date/Publication 2024-09-23 15:00:07 UTC

Contents

pseudos *Pseudo-observations*

Description

Pseudo-observations used in Nasri, Remillard, Bahraoui (2021). The values represent conditional cdfs of Gaussian HMM models applied to log-returns of Nasdaq and Dow Jones Industrial indexes from 2007 and 2008. If the models are correct, the pseudo-observations should be almost iid with uniform distribution.

Usage

```
data(pseudos)
```

Format

Pseudo-observations from Gaussian HMM models with 3 regimes for log-returns of the to Nasdaq index and Dow Jones Industrial indexes from 2007 and 2008.

- 1st column: pseudo-observations of a Gaussian HMM model with 3 regimes applied to the Nasdaq log-returns.
- 2nd column: pseudo-observations of a Gaussian HMM model with 3 regimes applied to the Dow Jones Industrial log-returns.

test.change.point *Function to perform changepoint tests with multiplier bootstrap using the usual sequential process*

Description

This function compute the Cramer-von Mises and Kolmogorov-Smirnov test statistics based on the new sequential process of Bucher et al (2014), using multipliers and parallel computing.

Usage

```
test.change.point(
  x,
  N = 1000,
  n_cores = 2,
  boot.method = "multipliers",
  est = FALSE
)
```

Arguments

x	(n x d) matrix of data (observations or pseudo-observations, including residuals), d>=1
N	number of multipliers samples to compute the P-value
n_cores	number of cores for parallel computing (default = 2)
boot.method	bootstrapping method: 'multipliers' (default, fastest) or 'bootstrap'
est	if TRUE, tau is estimated (default = FALSE)

Value

CVM	Cramer-von Mises statistic
KS	Kolmogorov-Smirnov statistic
pvalueCVM	Pvalue for the Cramer-von Mises statistic
pvalueKS	Pvalue for theKolmogorov-Smirnov statistic
tauCVM	Estimated changepoint using the Cramer-von Mises statistic
tauKS	Estimated changepoint using the Kolmogorov-Smirnov statistic

Author(s)

Bouchra R Nasri and Bruno N Remillard, August 6, 2020

References

Nasri, B. R. Remillard, B., & Bahraoui, T. (2022). Change-point problems for multivariate time series using pseudo-observations, J. Multivariate Anal., 187, 104857.

Examples

```
x=matrix(rnorm(600),ncol=3)
out = test.change.point(x)
```

---

test.change.point.copula.BKRS

Function toperform changepoint test for the copula with multiplier bootstrap using for changepoint the new sequential process of Bucher et al (2014)

Description

This function compute the Cramer-von Mises and Kolmogorov-Smirnov test statistics based on the new sequential process of Bucher et al (2014), using multipliers and parallel computing. Two methods of bootstrapping are used: non-sequential (fastest) and sequential. Both methods yields basically the same P-valueas.

Usage

```
test.change.point.copula.BKRS(
  x,
  N = 1000,
  n_cores = 2,
  method = "nonseq",
  est = FALSE
)
```

Arguments

x	(n x d) matrix of data (observations or pseudo-observations, including residuals), d >=2
N	number of multipliers samples to compute the P-value
n_cores	number of cores for parallel computing (default = 2)
method	'nonseq' (default) or 'seq'
est	if TRUE, tau is estimated (default = FALSE)

Value

CVM	Cramer-von Mises statistic
KS	Kolmogorov-Smirnov statistic
pvalueCVM	Pvalue for the Cramer-von Mises statistic
pvalueKS	Pvalue for theKolmogorov-Smirnov statistic
tauCVM	Estimated changepoint using the Cramer-von Mises statistic
tauKS	Estimated changepoint using the Kolmogorov-Smirnov statistic

Author(s)

Bouchra R Nasri and Bruno N Remillard, August 6, 2020

References

Nasri, B. R. Remillard, B., & Bahraoui, T. (2022). Change-point problems for multivariate time series using pseudo-observations, J. Multivariate Anal., 187, 104857.

Bucher, A., Kojadinovic, I., Rohmer, T., & Segers, J. (2014). Detecting changes in cross-sectional dependence in multivariate time series, J. Multiv. Anal., 132, 111–128.

Examples

```
x<-matrix(rnorm(100),ncol=2)
out = test.change.point.copula.BKRS(x)
```

Index