Description

Estimation and statistical process control are performed under copula-based time-series models.
Clayton Markov DATA

Package: Copula.Markov
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Author(s)

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References


Clayton.Markov.DATA

Generating Time Series Data Under a Copula-Based Markov Chain Model with the Clayton Copula

Description

Time-series datasets are generated under a copula-based Markov chain model with the Clayton copula.

Usage

Clayton.Markov.DATA(n, mu, sigma, alpha)

Arguments

n sample size
mu mean
sigma standard deviation
alpha association parameter

Details

-1<alpha<0 for negative association; alpha>0 for positive association

Value

time series data
Author(s)
Takeshi Emura

References

Examples
```
set.seed(1)
y=Clayton.Markov.DATA(n=1000, mu=0, sigma=1, alpha=8)
Clayton.Markov.MLE(y, plot=TRUE)
```

Clayton.Markov.MLE

Maximum Likelihood Estimation and Statistical Process Control Under the Clayton Copula

Description
The maximum likelihood estimates are produced and the Shewhart control chart is drawn with k-sigma control limits (e.g., 3-sigma). The dependence model follows the Clayton copula and the marginal (stationary) distribution follows the normal distribution.

Usage
```
Clayton.Markov.MLE(Y, k = 3, D = 1, plot = TRUE, GOF=FALSE)
```

Arguments
- **Y**: vector of datasets
- **k**: constant determining the length between LCL and UCL (k=3 corresponds to 3-sigma limit)
- **D**: diameter for U(-D, D) used in randomized Newton-Raphson
- **plot**: show the control chart if TRUE
- **GOF**: show the model diagnostic plot if TRUE
Value

estimates estimates
out_of_control IDs for out-of-control points
Gradient gradients (must be zero)
Hessian Hessian matrix
Mineigenvalue_Hessian Minimum eigenvalue for the Hessian matrix
CM.test Cramer-von Mises test statistics
KS.test Kolmogorov-Smirnov test statistics

Author(s)
Takeshi Emura

References

Examples
set.seed(1)
Y=Clayton.Markov.DATA(n=1000, mu=0, sigma=1, alpha=2)
Clayton.Markov.MLE(Y, plot=TRUE)

Joe.Markov.DATA Generating Time Series Data Under a Copula-Based Markov Chain Model with the Joe Copula

Description
Time-series datasets are generated under a copula-based Markov chain model with the Joe copula.

Usage
Joe.Markov.DATA(n, mu, sigma, alpha)

Arguments
n sample size
mu mean
sigma standard deviation
alpha association parameter
Details

\( \alpha \geq 1 \) for positive association

Value

Time series data

Author(s)

Takeshi Emura

References

Emura T, Long TH, Sun LH (2015), R routines for performing estimation and statistical process control under copula-based time series models, Communications in Statistics - Simulation and Computation


Examples

```r
n = 1000
alpha = 2.856  ### Kendall's \( \tau = 0.5 \) ###
mu = 2
sigma = 1
Y = Joe.Markov.DATA(n, mu, sigma, alpha)
mean(Y)
sd(Y)
cor(Y[-1], Y[-n], method = "kendall")

Joe.Markov.mle(Y, k = 2)
```

---

**Joe.Markov.MLE**

*Maximum Likelihood Estimation and Statistical Process Control Under the Joe Copula*

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Description

The maximum likelihood estimates are produced and the Shewhart control chart is drawn with \( k \)-sigma control limits (e.g., 3-sigma). The dependence model follows the Joe copula and the marginal (stationary) distribution follows the normal distribution.

Usage

```r
Joe.Markov.MLE(Y, k = 3, D = 1, plot = TRUE, GOF = FALSE)
```
Arguments

Y   vector of datasets
k   constant determining the length between LCL and UCL (k=3 corresponds to 3-sigma limit)
D   diameter for U(-D, D) used in randomized Newton-Raphson
plot  show the control chart if TRUE
GOF  show the model diagnostic plot if TRUE

Value

estimates  estimates
out_of_control  IDs for out-of-control points
Gradient  gradients (must be zero)
Hessian  Hessian matrix
mineigenvalue_Hessian  Minimum eigenvalue for the Hessian matrix
CM.test  Cramer-von Mises test statistics
KS.test  Kolmogorov-Smirnov test statistics

Author(s)

Takeshi Emura

References


Examples

```R
n=1000
alpha=2.856 ### Kendall's tau =0.5 ###
mu=2
sigma=1
Y=Joe.Markov.DATA(n,mu,sigma,alpha)
mean(Y)
sd(Y)
cor(Y[-1],Y[-n],method="kendall")

Joe.Markov.MLE(Y,k=2)
```
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