

Package ‘sbgcop’

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Title Semiparametric Bayesian Gaussian Copula Estimation and Imputation

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Description Estimation and inference for parameters in a Gaussian copula model, treating the univariate marginal distributions as nuisance parameters as described in Hoff (2007) <doi:10.1214/07-AOAS107>. This package also provides a semiparametric imputation procedure for missing multivariate data.

License GPL (>= 2)

URL <https://pdhoff.github.io/>

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sbgcop-package	<i>Semiparametric Bayesian Gaussian Copula Estimation and Imputation</i>
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Description

Estimation and inference for parameters in a Gaussian copula model, treating univariate marginal distributions as nuisance parameters as described in Hoff (2007) <doi:10.1214/07-AOAS107>. This package also provides a semiparametric imputation procedure for missing multivariate data.

Details

Package: sbgcop
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This function produces MCMC samples from the posterior distribution of a correlation matrix, using a scaled inverse-Wishart prior distribution and an extended rank likelihood. It also provides imputation for missing values in a multivariate dataset.

Author(s)

Peter Hoff <peter.hoff@duke.edu>

References

Hoff (2007) “Extending the rank likelihood for semiparametric copula estimation”

Examples

```
fit<-sbgcop.mcmc(swiss)
summary(fit)
plot(fit)
```

ldmvnorm	<i>Log Multivariate Normal Density</i>
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Description

Computes the log of the multivariate normal density

Usage

```
ldmvnorm(Y, S)
```

Arguments

Y	an n x p matrix
S	a p x p positive definite matrix

Details

This function computes the log density of the data matrix Y under the model that the rows are independent samples from a mean-zero multivariate normal distribution with covariance matrix S.

Value

A real number.

Author(s)

Peter Hoff

Examples

```
Y<-matrix(rnorm(9*7),9,7)
ldmvnorm(Y,diag(7))
```

 plotci.sA

Plot Confidence Bands for Association Parameters

Description

Plots 95

Usage

```
plotci.sA(sA, ylabs = colnames(sA[, , 1]), mgp = c(1.75, 0.75, 0))
```

Arguments

sA	a p x p x nsamp array
ylabs	a p x 1 vector of names for plotting labels
mgp	margin parameters

Author(s)

Peter Hoff

Examples

```
fit<-sbgcop.mcmc(swiss)
plotci.sA(fit$C.psamp)
```

 qM.sM

Matrix Quantiles

Description

Computes quantiles along the third dimension of a 3-d array.

Usage

```
qM.sM(sM, quantiles = c(0.025, 0.5, 0.975))
```

Arguments

sM	an m x n x s array
quantiles	quantiles to be computed

Value

an array of dimension $m \times n \times l$, where l is the length of quantiles

Author(s)

Peter Hoff

rwish

Sample from the Wishart Distribution

Description

Generate a random sample from the Wishart distribution.

Usage

```
rwish(S0, nu)
```

Arguments

$S0$	a positive definite matrix
nu	a positive integer

Details

Return the sum of nu i.i.d. rank-one matrices generated as $z\%*t(z)$, where z is a sample from a multivariate normal distribution with covariance $S0$. The resulting random variable has mean $nu*S0$.

Value

a positive definite matrix.

Author(s)

Peter Hoff

sbgcop.mcmc

*Semiparametric Bayesian Gaussian copula estimation and imputation***Description**

sbgcop.mcmc is used to semiparametrically estimate the parameters of a Gaussian copula. It can be used for posterior inference on the copula parameters, and for imputation of missing values in a matrix of ordinal and/or continuous values.

Usage

```
sbgcop.mcmc(Y, S0 = diag(dim(Y)[2]), n0 = dim(Y)[2] + 2, nsamp = 100,
  odens = max(1, round(nsamp/1000)), impute = any(is.na(Y)),
  plugin.threshold = 100, plugin.marginal = (apply(Y, 2, function(x) {
  length(unique(x)) }) > plugin.threshold), seed = 1, verb = TRUE)
```

Arguments

Y	an n x p matrix. Missing values are allowed.
S0	a p x p positive definite matrix
n0	a positive integer
nsamp	number of iterations of the Markov chain.
odens	output density: number of iterations between saved samples.
impute	save posterior predictive values of missing data(TRUE/FALSE)?
plugin.threshold	if the number of unique values of a variable exceeds this integer, then plug-in the empirical distribution as the marginal.
plugin.marginal	a logical of length p. Gives finer control over which margins to use the empirical distribution for.
seed	an integer for the random seed
verb	print progress of MCMC(TRUE/FALSE)?

Details

This function produces MCMC samples from the posterior distribution of a correlation matrix, using a scaled inverse-Wishart prior distribution and an extended rank likelihood. It also provides imputation for missing values in a multivariate dataset.

Value

An object of class `psgc` containing the following components:

C.psamp	an array of size p x p x nsamp/odens, consisting of posterior samples of the correlation matrix.
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Y.pmean	the original datamatrix with imputed values replacing missing data
Y.impute	an array of size $n \times p \times \text{nsamp}/\text{odens}$, consisting of copies of the original data matrix, with posterior samples of missing values included.
LPC	the log-probability of the latent variables at each saved sample. Used for diagnostic purposes.

Author(s)

Peter Hoff

References<http://www.stat.washington.edu/hoff/>**Examples**

```
fit<-sbgcop.mcmc(swiss)
summary(fit)
plot(fit)
```

sR.sC

*Compute Regression Parameters***Description**

Compute an array of regression parameters from an array of correlation parameters.

Usage

```
sR.sC(sC)
```

Arguments

sC a $p \times p \times \text{nsamp}$ array of, made up of nsamp correlation matrices.

Details

For each of the nsamp correlation matrices C, a matrix of regression parameters is computed via $R[j, -j] \leftarrow C[j, -j] \%*\% \text{solve}(C[-j, -j])$

Value

a $p \times p \times \text{nsamp}$ array of regression parameters.

Author(s)

Peter Hoff

Examples

```
fit<-sbgcop.mcmc(swiss)
```

```
plotci.sA(sR.sC(fit$C.psamp))
```

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