Package ‘saturnin’

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Description

Bayesian inference of graphical model structures using spanning trees. For further details on the considered framework, we refer the reader to the paper quoted in the references section.

Details

Package: saturnin  
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Author(s)

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References

This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples

```r
library('saturnin')
data(data_gaussian)

W <- lweights_gaussian(data_gaussian)
prob <- edge.prob(W, log = TRUE, account.prior = TRUE, q0 = 0.5)
```

account.for.prior  Accounting for prior edge appearance probability.
Description

The function transforms the posterior edge appearance probability matrix given by edge.prob to account for prior edge appearance probability. For further details on the transformation, we refer the reader to the paper quoted in the references section. The function can be directly applied in edge.prob by setting account.prior to TRUE.

Usage

account.for.prior(prob, q0)

Arguments

prob  Posterior edge appearance probability matrix.
q0    Desired prior edge appearance probability.

Value

prob.q0  Transformed posterior edge appearance probability matrix.

Author(s)

Loïc Schwaller

References

This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples

library('saturnin')
data(data_gaussian)

W <- lweights_gaussian(data_gaussian)
prob <- edge.prob(W, log = TRUE)

prob.q0 <- account.for.prior(prob, q0 = 0.5)

---

data_gaussian  Gaussian data.

Description

Sample of size \( n = 100 \) from a multivariate gaussian distribution with \( p = 50 \) variables.
Usage

data("data_gaussian")

Format

The format is: num [1:50, 1:100] 1.001 -0.21 0.513 0.166 2.135 ...

Examples

data(data_gaussian)

data_gaussian

Description

Sample of size \( n = 100 \) from a multinomial distribution with \( p = 100 \) variables.

Usage

data("data_multinomial")

Format

The format is: int [1:100, 1:100] 8 10 5 3 2 8 3 5 8 3 ...

Examples

data(data_multinomial)

data_multinomial

Description

Computation of posterior edge appearance probabilities in a random tree.

Usage

edge.prob(W, log = TRUE, account.prior = FALSE, q0 = 0.5)
Arguments

- \( W \) (log-)weight matrix
- \( \log \) TRUE when using a log-weight matrix, FALSE otherwise.
- \( \text{account.prior} \) FALSE for no accounting, TRUE otherwise.
- \( q_0 \) Desired prior edge appearance probability.

Value

- \( \text{prob} \) Posterior edge appearance probability matrix.

Author(s)

Loïc Schwaller

References

This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples

```r
library('saturnin')
data(data_gaussian)

W <- lweights_gaussian(data_gaussian)
prob <- edge.prob(W, log = TRUE, account.prior = TRUE, q0 = 0.5)
```

Description

The function computes the log-weights of all edges in a gaussian setting. The result should be used in `edge.prob` with argument `log` set to TRUE. Usual values are used as default for the prior normal-Wishart hyperparameters. Computation can be parallelized by setting `nbcores` to more than 2. Parallelization relies on `parallel`.

Usage

```r
lweights_gaussian(data,
a = ncol(data),
mu = numeric(p),
au = 1,
T = diag(ncol(data),
ncol(data)),
nbcores = 1)
```
Arguments

data Matrix containing continuous data.
a Prior degree of freedom of the normal-Wishart distribution.
mu Prior mean for the mean of the normal-Wishart distribution.
au Prior relative precision of the normal-Wishart distribution.
t Prior scale matrix of the normal-Wishart distribution.
nbcores Number of cores to be used in parallelized computation.

Value

w log-weight matrix

Author(s)

Loïc Schwaller

References

This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples

```r
library('saturnin')
data(data_gaussian)

W <- lweights_gaussian(data_gaussian)

prob <- edge.prob(W, log = TRUE)
```

Description

The function computes the log-weights of all edges in a multinomial setting. The result should be used in `edge.prob` with argument `log` set to TRUE. Prior counts can be generated using the function `prior_unif_dirichlet`. Computation can be parallelized by setting `nbcores` to more than 2. Parallelization relies on `parallel`.

Usage

```r
lweights_multinomial(data, prior = defaut.prior, nbcores = 1)
```
prior_unif_dirichlet

Arguments

- data: Matrix containing discrete data.
- prior: Prior to be used for the Dirichlet distribution.
- nbcores: Number of cores to be used in parallelized computation.

Value

- \( W \): log-weight matrix.

Author(s)

Loïc Schwaller

References

This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples

```r
library('saturnin')
data(data_multinomial)

W <- lweights_multinomial(data_multinomial)
prob <- edgeNprob(W, log = TRUE)
```

prior_unif_dirichlet

Uniform prior counts for the hyper-Dirichlet distribution.

Description

The function generates a \((r, r, p, p)\)-array filled with uniform counts for the hyper-Dirichlet distribution used as prior in `lweights_multinomial` when there are \( p \) variables with \( r \) levels. \( \text{Neq} \) is the equivalent prior sample size.

Usage

```r
prior_unif_dirichlet(p, r, Neq = 0.5 * r^2)
```

Arguments

- \( p \): Number of variables.
- \( r \): Number of levels.
- \( \text{Neq} \): Equivalent sample size.
weights_gausscopula

Value
prior A \( (r, r, p, p) \)-array containings counts.

Author(s)
Loïc Schwaller

References
This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples
library('saturnin')
p <- 100
r <- 10
prior <- prior_unif_dirichlet(p,r)

weights_gausscopula Computation of the weight matrix in a gaussian copula setting.

Description
The function computes the weights of all edges in a gaussian copula setting. The result should be used in edge.prob with argument log set to FALSE. The function brings the values of all variables back to \([0; 1]\) by computing univariate empirical cdf functions. The prior distribution for the correlation of the bivariate gaussian copulas prior can be set to either "uniform" or "beta". Beta prior is understood as a beta distribution with a change of variables to bring it back to \([-1; 1]\). Computation can be paralleled by setting nbcores to more than 2. Parallelization relies on parallel.

Usage
weights_gausscopula(data, prior_type = "uniform", a = 1, b = 1, nbcores = 1)

Arguments
data Matrix containing the data.
prior_type Prior to be used for the correlation.
a Shape parameter 1 for beta prior.
b Shape parameter 2 for beta prior.
nbcores Number of cores to be used in parallelized computation.

Value
W weight matrix.
weights_gausscopula

Author(s)
Loïc Schwaller

References
This package implements the method described in the paper "Bayesian Inference of Graphical Model Structures Using Trees" by L. Schwaller, S. Robin, M. Stumpf, 2015 (submitted and available on arXiv).

Examples

library('saturnin')
data(data_multinomial)

W <- weights_gausscopula(data_multinomial)

prob <- edge.prob(W, log = FALSE)
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