

Package ‘saturnin’

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Type Package

Title Spanning Trees Used for Network Inference

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R topics documented:

saturnin-package	2
account.for.prior	2
data_gaussian	3
data_multinomial	4
edge.prob	4
lweights_gaussian	5
lweights_multinomial	6
prior_unif_dirichlet	7
weights_gausscopula	8

Index	10
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saturnin-package

Spanning Trees Used for Network Inference

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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Date: 2015-04-10
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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

```
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

<code>prob</code>	Posterior edge appearance probability matrix.
<code>q0</code>	Desired prior edge appearance probability.

Value

<code>prob.q0</code>	Transformed posterior edge appearance probability matrix.
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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_multinomial	<i>Multinomial data.</i>
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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)
```

edge.prob	<i>Computation of posterior edge appearance probabilities in a random tree.</i>
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Description

The function computes posterior edge appearance probabilities in a random tree from a (log-)weight matrix. The (log-)weight matrix can be obtained from one of the functions `lweights_multinomial`, `lweights_gaussian` or `weights_gausscopula`. The function can also account for prior edge appearance probability.

Usage

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

Arguments

<code>W</code>	(log-)weight matrix
<code>log</code>	TRUE when using a log-weight matrix, FALSE otherwise.
<code>account.prior</code>	FALSE for no accounting, TRUE otherwise.
<code>q0</code>	Desired prior edge appearance probability.

Value

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

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

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

`lweights_gaussian` *Computation of the log-weight matrix in a gaussian setting.*

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

```
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.
nbccores 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

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

W <- lweights_gaussian(data_gaussian)

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

`lweights_multinomial` *Computation of the log-weight matrix in a multinomial setting.*

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 `nbccores` to more than 2. Parallelization relies on `parallel`.

Usage

```
lweights_multinomial(data, prior = default.prior, nbccores = 1)
```

Arguments

data Matrix containing discrete data.
prior Prior to be used for the Dirichlet distribution.
nbccores 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

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

W <- lweights_multinomial(data_multinomial)

prob <- edge.prob(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. Neq is the equivalent prior sample size.

Usage

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

Arguments

p Number of variables.
r Number of levels.
Neq Equivalent sample size.

Value

prior A (r, r, p, p) -array containing 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 parallelized 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

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

Value

`W` 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

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

W <- weights_gausscopula(data_multinomial)

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

Index

- * **bayesian inference**
 - saturnin-package, 2
 - * **datasets**
 - data_gaussian, 3
 - data_multinomial, 4
 - * **gaussian copula**
 - weights_gausscopula, 8
 - * **gaussian**
 - lweights_gaussian, 5
 - * **graphical models**
 - saturnin-package, 2
 - * **hyper Markov**
 - saturnin-package, 2
 - * **hyper dirichlet**
 - prior_unif_dirichlet, 7
 - * **multinomial**
 - lweights_multinomial, 6
 - * **network inference**
 - saturnin-package, 2
 - * **posterior edge probability**
 - account.for.prior, 2
 - edge.prob, 4
 - * **spanning trees**
 - saturnin-package, 2
- account.for.prior, 2
- data_gaussian, 3
- data_multinomial, 4
- edge.prob, 3, 4, 5, 6, 8
- lweights_gaussian, 5
- lweights_multinomial, 6, 7
- prior_unif_dirichlet, 7
- saturnin (saturnin-package), 2
- saturnin-package, 2
- weights_gausscopula, 8