Package 'saturnin'

July 23, 2015

Type Package

Title Spanning Trees Used for Network Inference

Version 1.1.1

Date 2015-07-22

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Description Bayesian inference of graphical model structures using spanning trees.

Suggests parallel

Imports Rcpp

LinkingTo Rcpp, RcppEigen

License GPL-2

Encoding UTF-8

NeedsCompilation yes

Repository CRAN

Date/Publication 2015-07-23 11:35:07

R topics documented:

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
Type:	Package
Version:	1.0
Date:	2015-04-10
License:	GPL-2

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 availavable 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

`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 availavable 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 *Multinomial data.*

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 *Computation of posterior edge appearance probabilities in a random tree.*

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

W	(log-)weight matrix
log	TRUE when using a log-weight matrix, FALSE otherwise.
account.prior	FALSE for no accounting, TRUE otherwise.
q0	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 availavable 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.
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 availavable 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 nbcores to more than 2. Parallelization relies on parallel.

Usage

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

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 availavable 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 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 availavable 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

`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.

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 availavable on arXiv).

Examples

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

W <- weights_gausscopula(data_multinomial)

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

Index