Package: particlefield (via r-universe)

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Type Package

Title Sequential Monte Carlo for Latent Conditional Autoregressive Model

Version 0.0.1

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Description Functions for replicating the results of the latent Gaussian Markov random field experiment of Lindsten, Helske, Vihola (2018), XX. Contains also functions for performing particle Markov chain Monte Carlo estimation of the model parameters.

License GPL (>= 2)

Suggests testthat

Imports coda, Matrix, Rcpp (>= 0.12.9)

LinkingTo Rcpp, RcppEigen

SystemRequirements C++11

RoxygenNote 6.1.1

Encoding UTF-8

BugReports https://github.com/helske/particlefield/issues

Repository https://helske.r-universe.dev

RemoteUrl https://github.com/helske/particlefield

RemoteRef HEAD

RemoteSha 4cbb2c5c960506d592e415a5ae00cb0b99c598c7

Contents

`approximate_binomial_car` *Gaussian approximation for Binomial model with latent CAR field*

Description

Gaussian approximation for Binomial model with latent CAR field

Usage

```
approximate_binomial_car(nnbs, nbs, tau, d, y, u, idx, mu = 0,
  use_mu = TRUE, initial_mode, max_iter = 100, conv_tol = 1e-08,
  reorder = TRUE, ratio_correction = TRUE)
```

Arguments

`nnbs`	Vector defining the number of neighbours for each vertex.
`nbs`	Matrix of indices of defining neighbours for each vertex.
`tau`	Precision parameter for CAR field.
`d`	Properness parameter for the CAR field.
`y`	Vector of observations.
`u`	Vector of trials. Default to 1.
`idx`	Vector defining the dependencies between y and x.
`mu`	Intercept of the linear predictor. Defaults to 0.
`use_mu`	Use mu in the model or not. Default is `TRUE`.
`initial_mode`	Initial mode estimate of x.
`max_iter`	Maximum number of iterations for the approximation algorithm.
`conv_tol`	Tolerance parameter for the approximation algorithm.
`reorder`	If `TRUE` (default), reordering is performed for increased efficiency.
`ratio_correction`	Should the returned log-likelihood estimate contain the ratio correction term? Default is `TRUE`.

bsf_car *Boostrap SMC for CAR model with Binomial observations*

Description

Boostrap SMC for CAR model with Binomial observations

Usage

```
bsf_car(nnbs, nbs, tau, d, y, u, idx, mu = 0, use_mu = TRUE,
  n_particles, ess_threshold = NULL, reorder = TRUE,
  seed = sample(.Machine$integer.max, size = 1))
```

Arguments

nnbs	Vector defining the number of neighbours for each vertex.
nbs	Matrix of indices of defining neighbours for each vertex.
tau	Precision parameter for CAR field.
d	Properness parameter for the CAR field.
y	Vector of observations.
u	Vector of trials. Default to 1.
idx	Vector defining the dependencies between y and x.
mu	Intercept of the linear predictor. Defaults to 0.
use_mu	Use mu in the model or not. Default is TRUE.
n_particles	Number of particles for SMC.
ess_threshold	Resampling is done when the effective sample size estimator is less than this threshold times the number of particles. For example if ess_threshold=1 resampling is done at each iteration (default), whereas if ess_threshold=0 the algorithm reduces to simple importance sampling.
reorder	If TRUE (default), reordering is performed for increased efficiency.
seed	Seed for the random number generator.

mcmc_binomial_car *Markov chain Monte Carlo for Binomial CAR model*

Description

Markov chain Monte Carlo for Binomial CAR model

Usage

```
mcmc_binomial_car(nnbs, nbs, tau, d, y, u, idx, mu = 0, use_mu = TRUE,
  n_iter, n_burnin, n_particles = 0, initial_mode, max_iter = 100,
  conv_tol = 1e-08, seed = sample(.Machine$integer.max, size = 1),
  S = NULL, ratio_correction = TRUE, reorder = TRUE,
  ess_threshold = 1)
```

Arguments

nnbs	Vector defining the number of neighbours for each vertex.
nbs	Matrix of indices of defining neighbours for each vertex.
tau	Precision parameter for CAR field.
d	Properness parameter for the CAR field.
y	Vector of observations.
u	Vector of trials. Default to 1.
idx	Vector defining the dependencies between y and x.
mu	Intercept of the linear predictor. Defaults to 0.
use_mu	Use mu in the model or not. Default is TRUE.
n_iter	Number of iterations for the MCMC.
n_burnin	Number of iterations to discard as burn-in.
n_particles	Number of particles used in the SMC. If set to zero, approximate MCMC is used.
initial_mode	Initial mode estimate of x.
max_iter	Maximum number of iterations for the approximation algorithm.
conv_tol	Tolerance parameter for the approximation algorithm.
seed	Seed for the random number generator.
S	A lower triangular matrix defining the Cholesky decomposition of the Gaussian proposal distribution.
ratio_correction	Should the returned log-likelihood estimate contain the ratio correction term? Default is TRUE.
reorder	If TRUE (default), reordering is performed for increased efficiency.
ess_threshold	Resampling is done when the effective sample size estimator is less than this threshold times the number of particles. For example if ess_threshold=1 resampling is done at each iteration (default), whereas if ess_threshold=0 the algorithm reduces to simple importance sampling.

particlefield *Sequential Monte Carlo Methods for Markov Random Fields*

Description

This package contains codes for running sequential Monte Carlo (SMC) for simple latent Gaussian Markov random field (GMRF) where the observations are Poisson or binomial. The methodology is introduced in Lindsten, Helske, Vihola (2018).

print_graph *Print the graph structure to console*

Description

Print the graph structure to console

Usage

```
print_graph(nnbs, nbs)
```

Arguments

nnbs	Vector defining the number of neighbours for each vertex.
nbs	Matrix of indices of defining neighbours for each vertex.

Examples

```
# Graph on line with 10 vertices
nnbs <- c(1, rep(2, 8), 1)
nbs <- matrix(0, 10, 10)
nbs[1, 1] <- 2
for (i in 2:9) nbs[i, 1:2] <- c(i - 1, i + 1)
nbs[10, 1] <- 9
print_graph(nnbs, nbs)
```

psi_car *Twisted SMC for CAR model with Binomial observations*

Description

Twisted SMC for CAR model with Binomial observations

Usage

```
psi_car(nnbs, nbs, tau, d, y, u, idx, mu = 0, use_mu = TRUE,
  n_particles, ess_threshold = NULL, reorder = TRUE, initial_mode,
  max_iter = 100, conv_tol = 1e-08,
  seed = sample(.Machine$integer.max, size = 1))
```

Arguments

nnbs	Vector defining the number of neighbours for each vertex.
nbs	Matrix of indices of defining neighbours for each vertex.
tau	Precision parameter for CAR field.
d	Properness parameter for the CAR field.
y	Vector of observations.
u	Vector of trials. Default to 1.
idx	Vector defining the dependencies between y and x.
mu	Intercept of the linear predictor. Defaults to 0.
use_mu	Use mu in the model or not. Default is TRUE.
n_particles	Number of particles for SMC.
ess_threshold	Resampling is done when the effective sample size estimator is less than this threshold times the number of particles. For example if ess_threshold=1 resampling is done at each iteration (default), whereas if ess_threshold=0 the algorithm reduces to simple importance sampling.
reorder	If TRUE (default), reordering is performed for increased efficiency.
initial_mode	Initial mode estimate of x.
max_iter	Maximum number of iterations for the approximation algorithm.
conv_tol	Tolerance parameter for the approximation algorithm.
seed	Seed for the random number generator.

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