

Package ‘bayesGDS’

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Type Package

Title Functions to implement Generalized Direct Sampling

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Description This package contains functions to help users implement the Generalized Direct Sampling algorithm for Bayesian hierarchical models (Braun and Damien, 2013). GDS is useful for sampling from posterior distributions for which there is a large number of conditionally independent heterogeneous units.

License MPL (== 2.0)

Depends R (>= 3.0.2), Matrix (>= 1.1.0), compiler

Suggests

sparseHessianFD(>= 0.1.1), sparseMVN(>= 0.1.0), mvtnorm, trustOptim (>= 0.8.3), plyr (>= 1.8)

NeedsCompilation no

Repository CRAN

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bayesGDS-package	<i>Functions to support implementation of the Braun and Damien (2013) Generalized Direct Sampling algorithm.</i>
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Description

These functions will be useful in running the Braun and Damien (2013) Generalized Direct Sampling algorithm. The latest version of this paper is available in the package documentation.

Details

Package:	bayesGDS
Type:	Package
Version:	0.6-0
Date:	2013-12-13
License:	see LICENSE file
LazyLoad:	yes

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demo_funcs	<i>Functions for the binary choice example in the vignette.</i>
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Description

Functions for the binary choice example in the vignette.

Usage

```
demo.get.f(pars, Y, X, inv.Omega, inv.Sigma,T)
demo.get.grad(pars, Y, X, inv.Omega, inv.Sigma,T)
demo.get.hess.struct(N,k)
```

Arguments

pars	parameter vector
Y	Observed counts
X	Covariate matrix
inv.Omega	Hyperparameter
inv.Sigma	Hyperparameter
N	Number of agents (households)
k	Number of covariates
T	Number of purchase opportunities per household

Value

See vignette for details.

get.cutoffs	<i>Draw thresholds for the accept-reject stage of the GDS sampling algorithm.</i>
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Description

Returns a vector of $\log(u)$, where u is the threshold to determine if a proposal draw should be accepted as a draw from the target posterior distribution.

Usage

```
get.cutoffs(log.phi, n.draws)
```

Arguments

log.phi	Vector of log.phi from the proposal draws. All must be non-positive.
n.draws	an integer. number of draws to be taken from the target posterior.

Details

For use in conjunction with the Braun and Damien (2012) Generalized Direct Sampling algorithm. This is usually not called directly, since it is called from the sample.GDS function.

Value

a numeric vector for $v = -\log.u$ (the thresholds for the accept-reject stage).

get.LML *Estimate log marginal likelihood of model*

Description

Estimate log marginal likelihood of model from GDS output

Usage

```
get.LML(counts, log.phi, post.mode, fn.dens.post, fn.dens.prop, prop.params, ...)
```

Arguments

counts	vector of counts of the number of proposals that were generated before accepting a draw. Length of vector is equal to the number of draws from the posterior. If the first proposal for a particular posterior draw is accepted, that count is a 1.
log.phi	Numeric vector of draws of log.phi from the proposal draws.
post.mode	The posterior mode.
fn.dens.post	Function that returns the log posterior density. Function should take the parameter vector as the first argument. Additional arguments are passed as ...
fn.dens.prop	Function that returns the log density of the proposal distribution. The first argument of the function should take either a vector or a matrix. If the argument is a matrix, each row is considered a sample. Additional parameters are passed as a list, prop.params.
prop.params	Object (list or vector) to be passed to both fn.dens.prop and fn.draw.prop. Contains parameters for the proposal distribution. See details.
...	Additional parameters to be passed to fn.dens.post

Value

The estimate log marginal likelihood of the model.

inv.logit *inverse logit function*

Description

Returns the inverse logit of x.

Usage

```
inv.logit(x)
```

Arguments

x a scalar, vector or matrix.

Value

result = $\exp(x) / (1 + \exp(x))$

inv.vech *inverse vech operator on a vector*

Description

Returns a lower triangular matrix, with elements determined by x.

Usage

inv.vech(x)

Arguments

x a vector of conforming length

Details

x must be a vector of length $k(k+1)/2$, where k is the number of rows (and columns) of the result.

Value

A k x k lower triangular matrix.

logit *logit function*

Description

Returns the logit of p.

Usage

logit(p)

Arguments

p a scalar, vector or matrix.

Value

result = $\log(p/(1-p))$

log_inv.logit	<i>log of inverse logit function</i>
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Description

Returns the log inverse logit of x.

Usage

```
log_inv.logit(x)
```

Arguments

x a scalar, vector or matrix.

Details

Intended to be a numerically stable alternative to just doing $\log(\text{inv.logit}(x))$. Should be less sensitive to overflow and underflow with very large or very small x.

Value

result = $\log[\exp(x) / (1+\exp(x))]$

sample.GDS	<i>Collect draws from the target posterior distribution.</i>
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Description

Runs the accept-reject phase of the Braun and Damien (2013) Generalized Direct Sampling algorithm.

Usage

```
sample.GDS(n.draws, log.phi,
  post.mode,
  fn.dens.post,
  fn.dens.prop,
  fn.draw.prop,
  prop.params, ...,
  max.tries=1000000,
  report.freq=1,
  announce=FALSE,
  thread.id=1,
  seed=.Random.seed
)
```

Arguments

n.draws	number of draws to take from the target posterior density.
log.phi	Vector of log.phi, as computed from the proposal draws.
post.mode	Mode of the target posterior density (numeric vector).
fn.dens.post	Function that returns the log posterior density. Function should take the parameter vector as the first argument. Additional arguments are passed as ...
fn.dens.prop	Function that returns the log density of the proposal distribution. The first argument of the function should take either a vector or a matrix. If the argument is a matrix, each row is considered a sample. Additional parameters are passed as a list, prop.params.
fn.draw.prop	Function that returns random samples from the proposal density. This function should return a matrix, with each row being a sample. Additional parameters are passed as a list, prop.params.
prop.params	Object (list or vector) to be passed to both fn.dens.prop and fn.draw.prop. Contains parameters for the proposal distribution. See details.
...	Additional parameters to be passed to fn.dens.post.
max.tries	Maximum number of proposal draws to try, without a success. This prevents the routine from being stuck in an endless loop.
report.freq	The frequency that the function will report the current iteration. For example, if report.freq=5, the function will display a message after every fifth iteration.
announce	If TRUE, will print a message when a proposal is accepted as a sample from the target posterior distribution.
thread.id	An identifier used in the announce function. This is useful if running sample.GDS on multiple processors, to collect multiple batches of samples. Defaults to 1.
seed	Sets a random seed within the call to sample.GDS. Useful for assigning different seeds to calls to sample.GDS that are running on different threads or processors. Defaults to .Random.seed.

Value

a list with the following elements:

draws	A matrix with each draw in a row, and each parameter in a column
counts	The number of attempts that it took to get an accepted draw. The accepted draw counts, so the count will always be at least 1.
gt.1	A vector that indicates if the phi for that draw was greater than 1. Available as a diagnostic. Normally, these should all be FALSE. Any values of TRUE suggest that a change in proposal density might be warranted.
log.post.dens	A numeric vector. Log posterior density for each draw.
log.prop.dens	A numeric vector. Log of the proposal density for each draw.
log.thresholds	Vector of threshold draws (log u) from the accept-reject algorithm. Sorted in ascending order.
log.phi	A numeric vector. Value of log.phi for the accepted draws.

vech	<i>vech operator on a square matrix</i>
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Description

Returns elements of lower triangle of a square matrix in a vector, ordered column-wise.

Usage

vech(M)

Arguments

M a matrix

Value

A vector containing the lower triangle of M, ordered column-wise.

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