Package ‘bayesGDS’

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Type Package
Title Scalable Rejection Sampling for Bayesian Hierarchical Models
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Description Functions for implementing the Braun and Damien (2015) rejection sampling algorithm for Bayesian hierarchical models. The algorithm generates posterior samples in parallel, and is scalable when the individual units are conditionally independent.
License MPL (== 2.0)
Depends R (>= 3.2.4), Matrix (>= 1.2.4)
Suggests sparseHessianFD(>= 0.3.0), sparseMVN(>= 0.2.0), mvtnorm,
trustOptim (>= 0.8.5), plyr (>= 1.8), dplyr, testthat, knitr,
R.rsp, MCMCpack
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bayesGDS-package  
Braun and Damien Algorithm for Scalable Rejection Sampling

Description

Functions for implementing the Braun and Damien (BD) Scalable Rejection Sampling algorithm.

References


binary

Binary choice example

Description

Functions for binary choice example in the vignette.

Usage

binary.f(P, data, priors)

binary.grad(P, data, priors)

binary.hess(P, data, priors)

Arguments

P  
Numeric vector of length (N+1)*k. First N*k elements are heterogeneous coefficients. The remaining k elements are population parameters.

data  
List of data matrices Y and X, and choice count integer T

priors  
List of named matrices inv.Omega and inv.Sigma

Details

Hessian is sparse, and returned as a dgeMatrix object

Value

Log posterior density, gradient and Hessian.
Sample simulated data for binary choice model in vignette

Description
Simulated data, with $N=20$ and $k=2$. See vignette. Generated from data-raw/binary.R
Simulated data, with $N=800$ and $k=3$. See vignette. Generated from data-raw/binary.R

Deprecated functions
These functions were in earlier versions, but will no longer be maintained in this package. They will likely be moved to another package at some time.

Usage
vech(M)
inv.vech(y)
logit(p)
inv.logit(x)
log_inv.logit(x)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>a matrix</td>
</tr>
<tr>
<td>y</td>
<td>A vector of conforming length</td>
</tr>
<tr>
<td>p</td>
<td>A scalar, vector or matrix, where each element is between 0 and 1.</td>
</tr>
<tr>
<td>x</td>
<td>A scalar, vector or matrix</td>
</tr>
</tbody>
</table>

Value
A vector containing the lower triangle of M, ordered column-wise.
A k x k lower triangular matrix
result = log(p/(1-p))
result = exp(x)/(1+exp(x))
result = log[exp(x)/(1+exp(x))]
get.cutoffs  

*Draw thresholds for the accept-reject stage of the BD sampling algorithm.*

**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**

```r
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 (and, thus, it is not exported), since it is called from the sample.GDS function.

**Value**

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

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get.LML  

*Log marginal likelihood of model*

**Description**

Estimate log marginal likelihood of model

**Usage**

```r
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.

---

**sample.GDS**

*Collect draws from the target posterior distribution*

Description

Runs the accept-reject phase of the Braun and Damien (2015) algorithm for scalable rejection sampling.

Usage

```r
sample.GDS(n.draws, log.phi, post.mode, fn.dens.post, fn.dens.prop, 
fn.draw.prop, prop.params, ..., max.tries = 1e+06, 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

- 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.

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