

# Package ‘baygel’

July 8, 2023

**Type** Package

**Title** Bayesian Estimators for Gaussian Graphical Models

**Version** 0.2.0

**Date** 2023-07-07

## Description

This R package offers a Bayesian graphical ridge and a naïve Bayesian adaptive graphical elastic net data-augmented block Gibbs sampler. These samplers facilitate the simulation of the posterior distribution of precision matrices for Gaussian distributed data. These samplers were originally proposed in two separate studies, both detailing their methodologies and applications: Smith, Arashi, and Bekker (2022) <[doi:10.48550/arXiv.2210.16290](https://doi.org/10.48550/arXiv.2210.16290)> and Smith, Bekker, and Arashi (2023) <[doi:10.48550/arXiv.2307.07070](https://doi.org/10.48550/arXiv.2307.07070)>

**License** GPL (>= 3)

**Imports** Rcpp (>= 1.0.8), RcppArmadillo (>= 0.11.1.1.0), pracma, statmod, stats

**LinkingTo** Rcpp, RcppArmadillo, RcppProgress

**Suggests** MASS

**RoxygenNote** 7.2.3

**Encoding** UTF-8

**URL** <https://github.com/Jarod-Smith/baygel>

**NeedsCompilation** yes

**Author** Jarod Smith [aut, cre] (<<https://orcid.org/0000-0003-4235-6147>>),  
Mohammad Arashi [aut] (<<https://orcid.org/0000-0002-5881-9241>>),  
Andriette Bekker [aut] (<<https://orcid.org/0000-0003-4793-5674>>)

**Maintainer** Jarod Smith <[jarodsmith706@gmail.com](mailto:jarodsmith706@gmail.com)>

**Repository** CRAN

**Date/Publication** 2023-07-08 11:00:02 UTC

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blockBAE *Naïve Bayesian Adaptive Graphical Elastic Net*

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### Description

A naïve Bayesian adaptive graphical elastic net data-augmented block Gibbs sampler.

### Usage

```
blockBAE(X, burnin = 1000, nmc = 2000, tauPrior, lambdaPrior)
```

### Arguments

X	Numeric matrix.
burnin	An integer specifying the number of burn-in iterations.
nmc	An integer specifying the number of MCMC samples.
tauPrior	A numeric specifying the shrinkage hyperparameter for the off-diagonal taus.
lambdaPrior	A numeric specifying the shrinkage hyperparameter for the off-diagonal lambdas.

### Value

list containing:

**Omega** A  $p$  by  $p$  by  $nmc$  array of saved posterior samples of precision matrices.

### Examples

```
# Generate true covariance matrix:
p      <- 10
n      <- 50
SigTrue <- pracma::Toeplitz(c(0.7^rep(1:p-1)))
CTrue  <- pracma::inv(SigTrue)
# Generate expected value vector:
mu     <- rep(0,p)
# Generate multivariate normal distribution:
set.seed(123)
X      <- MASS::mvrnorm(n,mu=mu,Sigma=SigTrue)
omega_post <- blockBAE(X,burnin = 1000,nmc = 500,tauPrior = 0.5,lambdaPrior = 0.05)
```

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blockBAGR                      *Block Gibbs sampler function.*

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### Description

A Bayesian adaptive graphical ridge-type data-augmented block Gibbs sampler for simulating the posterior distribution of the concentration matrix specifying a Gaussian graphical model.

### Usage

```
blockBAGR(X, burnIn, iterations, s = 1, t = 1, verbose = TRUE)
```

### Arguments

X	Numeric data matrix, data is assumed to be Gaussian distributed.
burnIn	An integer specifying the number of burn-in iterations.
iterations	An integer specifying the length of the Markov chain after the burn-in iterations.
s	A double specifying the value of the prior inverse gamma's shape parameter.
t	A double specifying the value of the prior inverse gamma's scale parameter.
verbose	A logical determining whether the progress of the MCMC sampler should be displayed.

### Value

blockBAGR: List of precision matrices from the Markov chains.

### Examples

```
# Generate true covariance matrix:
p      <- 10
n      <- 50
SigTrue <- pracma::Toeplitz(c(0.7^rep(1:p-1)))
CTrue  <- pracma::inv(SigTrue)
# Generate expected value vector:
mu     <- rep(0,p)
# Generate multivariate normal distribution:
set.seed(123)
X      <- MASS::mvrnorm(n,mu=mu,Sigma=SigTrue)
posterior <- blockBAGR(X,iterations = 1000, burnIn = 500)
```

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blockBSGR                      *Block Gibbs sampler function.*

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### Description

A Bayesian standard graphical ridge-type data-augmented block Gibbs sampler for simulating the posterior distribution of the concentration matrix specifying a Gaussian graphical model.

### Usage

```
blockBSGR(X, burnIn, iterations, tau = 1, mu = 0, verbose = TRUE)
```

### Arguments

X	Numeric data matrix, data is assumed to be Gaussian distributed.
burnIn	An integer specifying the number of burn-in iterations.
iterations	An integer specifying the length of the Markov chain after the burn-in iterations.
tau	A double specifying the value of the variance parameter of both the Gaussian and truncated Gaussian distribution in Bayesian graphical ridge prior.
mu	A double specifying the value of the mean parameter of both the Gaussian and truncated Gaussian distribution in Bayesian graphical ridge prior.
verbose	A logical determining whether the progress of the MCMC sampler should be displayed.

### Value

blockBSGR: List of precision matrices from the Markov chains.

### Examples

```
# Generate true covariance matrix:
p      <- 10
n      <- 50
SigTrue <- pracma::Toeplitz(c(0.7^rep(1:p-1)))
CTrue  <- pracma::inv(SigTrue)
# Generate expected value vector:
mu     <- rep(0,p)
# Generate multivariate normal distribution:
set.seed(123)
X      <- MASS::mvrnorm(n,mu=mu,Sigma=SigTrue)
posterior <- blockBSGR(X,iterations = 1000, burnIn = 500)
```

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