Package ‘blasso’

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Title MCMC for Bayesian Lasso Regression Model
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Description Implementations of Gibbs sampling for “Bayesian Lasso Regression”.
License GPL-2
URL http://www.stat.osu.edu/~hans/
LazyLoad yes

R topics documented:

    blasso-package ................................................................. 1
    blasso .......................................................................... 2
    blasso.vs ............................................................... 4

Index

    blasso-package blasso: MCMC for Bayesian Lasso Regression

Description

Three Gibbs samplers for the Bayesian Lasso regression model. Two of the Gibbs samplers - the basic and orthogonalized samplers - fit the “full” model that uses all predictor variables. The variable selection Gibbs sampler accommodates model uncertainty by fitting a model that uses a point-mass/double-exponential mixture prior on the regression coefficients.
Details

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References

http://www.stat.osu.edu/~hans

blasso

Gibbs sampler for Bayesian Lasso regression model.

Description

blasso implements MCMC for the Bayesian lasso regression model.

Usage

blasso(Y, X, iters, burn = 0, thin = 1, sampler = c("basic", "orthogonalized"), beta, sig2, tau, beta.prior = c("scaled", "classic"), fixsig2 = FALSE, sig2prior = fixtau = FALSE, tauprior = NULL, noisy = TRUE)

Arguments

Y
An n×1 vector of response data. WARNING: blasso centers Y to have sample mean zero before the MCMC is run!

X
An n×p matrix of predictor variables. WARNING: blasso centers the columns of X to have sample mean zero before the MCMC is run, and they are rescaled to have unit sample variance!

iters
Length of desired MCMC output

burn
Number of MCMC iterations before output is saved

thin
Thinning for chain (1 = save every iteration, 2 = save every other iteration, etc.)

sampler
The “basic” sampler updates each component of β one element at a time. The “orthogonalized” sampler transforms the regression coefficients to reduce autocorrelation.
blasso

beta A $p \times 1$ vector of starting values for the regression coefficients

sig2 Starting value for $\sigma^2$ if fixsig2 is FALSE, otherwise the value at which to fix $\sigma^2$

tau Starting value for $\tau$ if fixtau is FALSE, otherwise the value at which to fix $\tau$

beta.prior The “classic” prior for $\beta$ does not depend on $\sigma^2$. The “scaled” prior for $\beta$ contains the term $\tau/\sigma$

fixsig2 TRUE if $\sigma^2$ is to be fixed

sig2prior Parameters for inverse-gamma prior on $\sigma^2$ (when it is not fixed). The prior is parameterized so that $(a,b)$ corresponds to a prior expected value of $b/(a-1)$. The default is (0,0), an improper prior on $\sigma^2$.

fixtau TRUE if $\tau$ is to be fixed

tauprior Parameters for gamma prior on $\tau$. The prior is parameterized so that $(r,s)$ corresponds to a prior mean of $r/s$.

noisy If TRUE, prints output describing sampler progress when R is run from the command line

Details

NOTE: blasso mean centers both Y and the columns of X, and standardizes the predictors X to have unit sample variance. Please adjust your models and priors accordingly! No intercept term is included in the model. The function blasso will only obtain samples from models with $p \leq n$ predictor variables. For the $p > n$ case, see the function blasso.vs.

Value

X The mean-centered and rescaled design matrix

Y The mean-centered response data

beta A matrix with MCMC samples of $\beta$

sig2 If fixsig2 is FALSE, a vector with MCMC samples of $\sigma^2$; otherwise the value at which $\sigma^2$ was fixed.

tau If fixtau is FALSE, a vector with MCMC samples of $\tau$; otherwise the value at which $\tau$ was fixed.

sampler The type of sampler that was run

sig2prior The parameters for the prior on $\sigma^2$ (if not fixing $\sigma^2$)

tauprior The parameters for the prior on $\tau$ (if not fixing $\tau$)

beta.prior The prior used for $\beta$.

H If using the orthogonalized sampler, $H$ is the matrix of eigenvectors of $(X'X)^{-1}$

Lambda If using the orthogonalized sampler, Lambda contains the eigenvalues of $(X'X)^{-1}$

Note

Please contact Chris Hans <hans@stat.osu.edu> with comments or suggestions.

Author(s)

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blasso.vs

Variable selection Gibbs sampler for Bayesian Lasso regression model.

Description

blasso.vs implements a variable selection Gibbs sampler for Bayesian lasso regression.

Usage

blasso.vs(Y, X, iters, burn = 0, thin = 1, beta, sig2, tau, phi, 
  beta.prior = c("scaled", "classic"), fixsig2 = FALSE, sig2prior = NULL, fixtau = 
  tauprior = NULL, fixphi = FALSE, phiprior = NULL, noisy = TRUE)

Arguments

Y An n × 1 vector of response data. WARNING: Y is centered to have sample 
mean zero before the MCMC is run!

X An n × p matrix of predictor variables. WARNING: the columns of X are cen-
tered to have sample mean zero before the MCMC is run, and they are rescaled 
to have unit sample variance!

iters Length of desired MCMC output

burn Number of MCMC iterations before output is saved

thin Thinning for chain (1 = save every iteration, 2 = save every other iteration, etc.)

beta A p × 1 vector of starting values for the regression coefficients

References

http://www.stat.osu.edu/~hans

See Also

blasso.vs

Examples

## Generate some fake data
X <- scale(matrix(rnorm(30),ncol=3))[,]
Y <- matrix(rnorm(10, X%*%matrix(c(-0.2,0.5,1.5),ncol=1), sd=0.8),ncol=1)
# NOTE: Y and the columns of X are mean centered by the blasso function, 
# and the columns of X and scaled to have unit variance 
# (they already do in this example)
# Use the basic sampler
mcmc.basic <- blasso(Y, X, iters=2000, burn=100, thin=2, beta=c(0,0,0), sig2=1, tau=1, 
  phi, beta.prior = c("scaled", "classic"), fixsig2 = FALSE, sig2prior = NULL, fixtau =
  tauprior = NULL, fixphi = FALSE, phiprior = NULL, noisy = TRUE)

# Use the orthogonalized sampler
mcmc.orth <- blasso(Y, X, iters=2000, burn=100, thin=2, beta=c(0,0,0), sig2=1, tau=1,
blasso.vs

sig2
Starting value for \( \sigma^2 \) if \texttt{fixsig2} is \texttt{FALSE}, otherwise the value at which to fix \( \sigma^2 \)

tau
Starting value for \( \tau \) if \texttt{fixtau} is \texttt{FALSE}, otherwise the value at which to fix \( \tau \)

phi
Starting values for \( \phi \) if \texttt{fixphi} is \texttt{FALSE}, otherwise the value at which to fix \( \phi \)

beta.prior
The “classic” prior for \( \beta \) does not depend on \( \sigma^2 \). The “scaled” prior for \( \beta \) contains the term \( \tau/\sigma \)

fixsig2
TRUE if \( \sigma^2 \) is to be fixed

sig2prior
Parameters for inverse-gamma prior on \( \sigma^2 \) (when it is not fixed). The prior is parameterized so that \((a, b)\) corresponds to a prior expected value of \( b/(a-1) \). The default is \((0,0)\), an improper prior on \( \sigma^2 \).

fixtau
TRUE if \( \tau \) is to be fixed

tauprior
Parameters for gamma prior on \( \tau \). The prior is parameterized so that \((r, s)\) corresponds to a prior mean of \( r/s \).

fixphi
TRUE if \( \phi \) is to be fixed

phiprior
Parameters for beta distribution prior on \( \phi \). The default is \((1,1)\), the uniform distribution.

noisy
If \texttt{TRUE} prints output describing sampler progress when R is run from the command line

Details

NOTE: blasso.vs mean centers both Y and the columns of X, and standardizes the predictors X to have unit sample variance. Please adjust your models and priors accordingly! No intercept term is included in the model.

Value

X
The mean-centered and rescaled design matrix

Y
The mean-centered response data

beta
A matrix with MCMC samples of \( \beta \)

sig2
If \texttt{fixsig2} is \texttt{FALSE}, a vector with MCMC samples of \( \sigma^2 \); otherwise the value at which \( \sigma^2 \) was fixed.

tau
If \texttt{fixtau} is \texttt{FALSE}, a vector with MCMC samples of \( \tau \); otherwise the value at which \( \tau \) was fixed.

phi
If \texttt{fixphi} if \texttt{FALSE}, a vector with MCMC samples of \( \phi \)

marginc
Rao-Blackwellized estimates of the marginal variable inclusion probabilities.

sig2prior
The parameters for the prior on \( \sigma^2 \) (if not fixing \( \sigma^2 \))

tauprior
The parameters for the prior on \( \tau \) (if not fixing \( \tau \))

phiprior
The parameters for the prior on \( \phi \) (if not fixing \( \phi \))

beta.prior
The prior used for \( \beta \).

Note

Please contact Chris Hans <hans@stat.osu.edu> with comments or suggestions.
Author(s)

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References

http://www.stat.osu.edu/~hans

See Also

blasso

Examples

## Generate some fake data
X <- scale(matrix(rnorm(30),ncol=3))[,]
Y <- matrix(rnorm(10, X%*%matrix(c(0,2,2.5),ncol=1),sd=0.5),ncol=1)

# NOTE: Y and the columns of X are mean centered by the blasso.vs function,
# and the columns of X are rescaled to have unit sample variance
# (they already do in this example)

mcmc.vs <- blasso.vs(Y, X, iters=10000, burn=100, thin=2, beta=c(1,1), sig2=1, tau=1)
Index

*Topic models
  blasso, 2
  blasso-package, 1
  blasso.vs, 4

*Topic regression
  blasso, 2
  blasso-package, 1
  blasso.vs, 4

blasso, 2, 6
blasso-package, 1
blasso.vs, 3, 4