Package 'tilting'

May 8, 2026

Type Package

Title Variable Selection via Tilted Correlation Screening Algorithm

Version 1.1.1

Date 2016-12-22

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Description Implements an algorithm for variable selection in high-dimensional linear regression using the ``tilted correlation'', a new way of measuring the contribution of each variable to the response which takes into account high correlations among the variables in a data-driven way.

Depends R (>= 2.14.0), mvtnorm

License GPL (>= 2)

LazyLoad yes

NeedsCompilation no

Repository CRAN

Date/Publication 2016-12-26 12:25:13

Contents

`tilting-package` *Variable Selection via Tilted Correlation Screening Algorithm*

Description

Implements an algorithm for variable selection in high-dimensional linear regression using the "tilted correlation", a way of measuring the contribution of each variable to the response which takes into account high correlations among the variables in a data-driven way.

Details

Package:	tilting
Type:	Package
Version:	1.1.1
Date:	2016-12-22
License:	GPL (>= 2)
LazyLoad:	yes

The main function of the package is `tilting`.

Author(s)

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References

H. Cho and P. Fryzlewicz (2012) High-dimensional variable selection via tilting, Journal of the Royal Statistical Society Series B, 74: 593-622.

Examples

```
X <- matrix(rnorm(100*100), 100, 100) # 100-by-100 design matrix
y <- apply(X[,1:5], 1, sum)+rnorm(100) # first five variables are significant

tilt <- tilting(X, y, op=2)
tilt$active.hat # returns the finally selected variables
```

col.norm *Compute the L2 norm of each column*

Description

The function returns a vector containing the L2 norm of each column for a given matrix.

Usage

```
col.norm(X)
```

Arguments

X	a matrix for which the column norms are computed.

Value

A vector containing the L2 norm of the columns of X is returned.

Author(s)

Haeran Cho

get.thr *Select a threshold for sample correlation matrix*

Description

The function selects a threshold for sample correlation matrix.

Usage

```
get.thr(C, n, p, max.num = 1, alpha = NULL, step = NULL)
```

Arguments

C	sample correlation matrix of a design matrix.
n	the number of observations of the design matrix.
p	the number of variables of the design matrix.
max.num	the number of times for which the threshold selection procedure is repeated. Usually max.num==1 is used.
alpha	The level at which the false discovery rate is controlled. When alpha==NULL, it is set to be 1/sqrt(p).
step	the size of a step taken when screening the p(p-1)/2 off-diagonal elements of C.

Value

thr	selected threshold.
thr.seq	when max.num>1, the sequence of thresholds selected at each iteration.

Author(s)

Haeran Cho

References

H. Cho and P. Fryzlewicz (2012) High-dimensional variable selection via tilting, Journal of the Royal Statistical Society Series B, 74: 593-622.

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lse.beta *Compute the least squares estimate on a given index set*

Description

The function returns an estimate of the coefficient vector for a linear regression problem by setting the coefficients corresponding to a given index set to be the least squares estimate and the rest to be equal to zero.

Usage

```
lse.beta(X, y, active = NULL)
```

Arguments

X	design matrix.
y	response vector.
active	the index set on which the least squares estimate is computed.

Value

An estimate of the coefficient vector is returned as above. If active==NULL, a vector of zeros is returned.

Author(s)

Haeran Cho

projection *Compute the projection matrix onto a given set of variables*

Description

The function computes the projection matrix onto a set of columns of a given matrix.

Usage

```
projection(X, active = NULL)
```

Arguments

X	a matrix containing the columns onto which the projection matrix is computed.
active	an index set of the columns of X.

Value

Returns the projection matrix onto the columns of "X" whose indices are included in "active". When active==NULL, a null matrix is returned.

Author(s)

Haeran Cho

select.model *Select the final model*

Description

The function returns the final model as a subset of the active set chosen by Tilted Correlation Screening algorithm, for which the extended BIC is minimised.

Usage

```
select.model(bic.seq, active)
```

Arguments

bic.seq	the sequence of extended BIC at each iteration.
active	the index set of selected variables by Tilted Correlation Screening algorithm.

Value

The index set of finally selected variables is returned.

Author(s)

Haeran Cho

`thresh` *Hard-threshold a matrix*

Description

For a given matrix and a threshold, the function performs element-wise hard-thresholding based on the absolute value of each element.

Usage

```
thresh(C, alph, eps = 1e-10)
```

Arguments

`C`	a matrix on which the hard-thresholding is performed.
`alph`	threshold.
`eps`	effective zero.

Value

Returns the matrix C after hard-thresholding.

Author(s)

Haeran Cho

`tilting` *Variable selection via Tilted Correlation Screening algorithm*

Description

Given a design matrix and a response vector, the function selects a threshold for the sample correlation matrix, computes an adaptive measure for the contribution of each variable to the response variable based on the thus-thresholded sample correlation matrix, and chooses a variable at each iteration. Once variables are selected in the "active" set, the extended BIC is used for the final model selection.

Usage

```
tilting(X, y, thr.step = NULL, thr.rep = 1, max.size = NULL, max.count = NULL,
op = 2, bic.gamma = 1, eps = 1e-10)
```

Arguments

X	design matrix.
y	response vector.
thr.step	a step size used for threshold selection. When thr.step==NULL, it is chosen automatically.
thr.rep	the number of times for which the threshold selection procedure is repeated.
max.size	the maximum number of the variables conditional on which the contribution of each variable to the response is measured (when max.size==NULL, it is set to be half the number of observations).
max.count	the maximum number of iterations.
op	when op==1, rescaling 1 is used to compute the tilted correlation. If op==2, rescaling 2 is used.
bic.gamma	a parameter used to compute the extended BIC.
eps	an effective zero.

Value

active	active set containing the variables selected over the iterations.
thr.seq	a sequence of thresholds selected over the iterations.
bic.seq	extended BIC computed over the iterations.
active.hat	finally chosen variables using the extended BIC.

Author(s)

Haeran Cho

References

H. Cho and P. Fryzlewicz (2012) High-dimensional variable selection via tilting, Journal of the Royal Statistical Society Series B, 74: 593-622.

Examples

```
X<-matrix(rnorm(100*100), 100, 100) # 100-by-100 design matrix
y<-apply(X[,1:5], 1, sum)+rnorm(100) # first five variables are significant

tilt<-tilting(X, y, op=2)
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```

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