

Package ‘tilting’

October 14, 2022

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

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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 | <i>Compute the L2 norm of each column</i> |
|----------|---|

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 | <i>Select a threshold for sample correlation matrix</i> |
|---------|---|

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.

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 | <i>Compute the projection matrix onto a given set of variables</i> |
|------------|--|

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 | <i>Select the final model</i> |
|--------------|-------------------------------|

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 | <i>Hard-threshold a matrix</i> |
|--------|--------------------------------|

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 | <i>Variable selection via Tilted Correlation Screening algorithm</i> |
|---------|--|

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

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

Value

| | |
|-------------------------|---|
| <code>active</code> | active set containing the variables selected over the iterations. |
| <code>thr.seq</code> | a sequence of thresholds selected over the iterations. |
| <code>bic.seq</code> | extended BIC computed over the iterations. |
| <code>active.hat</code> | 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)
tilt$active.hat # returns the finally selected variables
```

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