

Package ‘ExactPath’

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Type Package

Title Exact solution paths for regularized LASSO regressions with L₁ penalty

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Depends R(>= 2.12), ncvreg, lars

Description ExactPath implements an algorithm for exact LASSO solution. Two methods are provided to print and visualize the whole solution paths. Use ?ExactPath to see an introduction. Packages ncvreg and lars are required so that their data sets can be used in examples.

License GPL (>= 2)

LazyLoad yes

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Description

ExactPath implements an algorithm for exact LASSO solution. Two methods are provided to print and visualize the whole solution paths. Use `?ExactPath` to see an introduction. Packages `ncvreg` and `lars` are required so that their data sets can be used in examples.

Details

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Type:	Package
Version:	1.0
Date:	2013-02-05
License:	GPL (>=2)
LazyLoad:	yes

Author(s)

Kai Wang <kai-wang@uiowa.edu>

References

Wang K. (2013) Exact LASSO linear regression. Submitted.

Examples

```
library(ncvreg)
data(prostate)
myfit = exact.path(as.matrix(prostate[,-9]), prostate$lpsa, verbose=TRUE)
myfit
plot(myfit)
```

```
library(ncvreg)
data(heart)
myfit = exact.path(as.matrix(heart[,-1]), heart$sbp)
myfit
plot(myfit)
```

```
library(lars)
data(diabetes)
myfit = exact.path(diabetes$x, diabetes$y, verbose=TRUE)
myfit
plot(myfit)
```

exact.path	<i>Generate Exact Solution Path</i>
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Description

exact.path generates the whole solution paths.

Usage

```
exact.path(X, y, max.var=20, verbose=FALSE)
```

Arguments

X	an $n \times p$ design matrix for the predictors.
y	a vector of the response values.
max.var	a numerical value (default value: 20) that gives the maximum number of steps. Extra 4 steps are allowed in case the same set of predictors enter or exit the set of active predictors more than once. This value contributes to the determination of how many λ_k s are to be found.
verbose	If TRUE, the value of λ_k and the associated information will be printed at every step a new λ_k is found. The default is FALSE.

Details

Starting with a large value, this function finds recursively $\lambda_1, \lambda_2, \dots$ until the desired number of steps is achieved. At each step, inactive predictors become active, active predictors become inactive, or both. The selection indicator is automatically determined. The backend engine is LASSO.exact.

It is not necessary to standardize the columns of X and the response vector y. Such standardization is conducted anyway in this function.

Value

A list object of class "path". This list contains the following components:

breaks	a length K vector of λ_k s
tau	a $p \times K$ matrix of selection indicators.
beta	a $p \times K$ matrix of regression coefficients. See also LASSO.exact.
score	a $p \times K$ matrix of scores. See also LASSO.exact.

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References

Wang K. (2013) Exact LASSO linear regression. Submitted.

See Also

[LASSO.exact](#) is the function for generating λ_k at each step.

Examples

```
library(ncvreg)
data(prostate)
exact.path(as.matrix(prostate[,-9]), prostate$lpsa, verbose=TRUE)
```

```
library(ncvreg)
data(heart)
exact.path(as.matrix(heart[,-1]), heart$sbp)
```

```
library(lars)
data(diabetes)
exact.path(diabetes$x, diabetes$y, verbose=TRUE)
```

LASSO.exact

Generate Information on the Next Interval for λ

Description

LASSO.exact() generates the next value of λ_k and the associated selection indicator vector.

Usage

```
LASSO.exact(lambda, tau, X, y)
```

Arguments

lambda	a numerical value for lambda. It does not need to be one of the λ_k s.
tau	a vector of length p . Its elements are equal to 1, -1 , or 0. This is the selection indicator vector.
X	an $n \times p$ design matrix for the predictors.
y	a vector of the response values.

Details

This function computes the next λ_k that $\lambda_k < \lambda$. Although it is a stand-alone function, it is meant to be called by exact.path(). exact.path() automatically finds recursively the λ_k s and sets up the correct values for tau for each λ_k .

It is not necessary to standardize the columns of X and the response vector y. Such standardization is conducted anyway in this function.

Value

Given the value $\lambda \in [\lambda_k, \lambda_{k-1})$ and $\tau(\lambda)$, this function returns a data frame with the following variables:

beta	a vector of length p . This is the vector of regression coefficients of the predictors evaluated at λ_k . Note that for active predictors, their coefficients are non-zero; for inactive predictors their coefficients are equal to 0.
S	a vector of length p . This is the vector of scores of the predictors evaluated at λ_k . Note that for active predictors, the absolute values of their scores should be equal to λ ; for inactive predictors the absolute value of their scores are $\leq \lambda$.
breaks	a vector of length p . This is the vector of candidate λ_k s provided by each predictor. For active predictors, this is the value at which its regression coefficient is equal to 0. For inactive predictors, this is the value at which the absolute value of its score is equal to λ . The largest value of this vector that is less than λ is chosen to be λ_k .
tau	a vector of length p . This is the vector of selection indicators predicted for λ_k^- .
change	a vector of length p . This is the vector of predicted status changes at λ_k^- : a predictor becomes active ("+"), inactive ("-"), or remains unchanged (" ").

Author(s)

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References

Wang K. (2013) Exact LASSO linear regression. Submitted.

See Also

[exact.path](#) automatically generates the whole solution paths.

Examples

```
library(lars)
data(diabetes)
LASSO.exact(0.05, c(0,-1,1,1,0,0,-1,0,1,1), diabetes$x, diabetes$y)
```

plot.path

Plot Exact Solution Paths from a "path" Object

Description

plot.path produces the solution paths generated by exact.path.

Usage

```
## S3 method for class "path"  
## S3 method for class 'path'  
plot(x, ...)
```

Arguments

x an object of class path. See also [exact.path](#).
... not used.

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See Also

[exact.path](#).

Examples

```
library(ncvreg)  
data(prostate)  
plot(exact.path(as.matrix(prostate[,-9]), prostate$lpsa, verbose=TRUE))
```

```
library(ncvreg)  
data(heart)  
plot(exact.path(as.matrix(heart[,-1]), heart$sbp))
```

```
library(lars)  
data(diabetes)  
plot(exact.path(diabetes$x, diabetes$y, verbose=TRUE))
```

print.path	<i>Print a "path" Object</i>
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Description

print.path prints out the content of a "path" object generated by exact.path.

Usage

```
## S3 method for class 'path'  
print(x, ...)
```

Arguments

x an object of class path. See also [exact.path](#).
... not used.

Author(s)

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See Also

[exact.path.](#)

Examples

```
library(ncvreg)
data(prostate)
exact.path(as.matrix(prostate[,-9]), prostate$lpsa, verbose=TRUE)
```

```
library(ncvreg)
data(heart)
exact.path(as.matrix(heart[,-1]), heart$sbp)
```

```
library(lars)
data(diabetes)
exact.path(diabetes$x, diabetes$y, verbose=TRUE)
```

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