Package 'SILM'

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Type Package

Title Simultaneous Inference for Linear Models

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Description Simultaneous inference procedures for high-dimensional linear models as described by Zhang, X., and Cheng, G. (2017) <doi:10.1080/01621459.2016.1166114>.

Depends scalreg

DependsNote scalreg does not correctly import lars etc, so we need to depend on it

Imports glmnet, hdi, SIS, stats, parallel, utils

License GPL-3

NeedsCompilation no

Encoding UTF-8

Repository CRAN

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Contents

Sim.CI *Simultaneous Confidence Interval*

Description

This function implements the method for constructing simultaneous confidence interval in Zhang and Cheng (2017).

Usage

```
Sim.CI(X, Y, set, M = 500, alpha = 0.95)
```

Arguments

X	n times p design matrix.
Y	Response variable.
set	The set of variables of interest.
M	The number of bootstrap replications (default 500).
alpha	The nominal level alpha (default 0.95).

Value

The de-biased Lasso estimator, the confidence bands (lower bound and upper bound) delivered by the non-studentized and the studentized statistics.

References

Zhang, X., and Cheng, G. (2017) Simultaneous Inference for High-dimensional Linear Models, *Journal of the American Statistical Association*, 112, 757-768.

Examples

```
## The function is intended for large n and p.
## Use small p here for illustration purpose only.
n <- 100
p <- 10
s0 <- 3
set <- 1:s0
Sigma <- matrix(NA, p, p)
for (i in 1:p) Sigma[i,] <- 0.9^(abs(i-(1:p)))
X <- matrix(rnorm(n*p), n, p)
X <- t(t(chol(Sigma))%*%t(X))
beta <- rep(0,p)
beta[1:s0] <- runif(s0,0,2)
Y <- X%*%beta+rt(n,4)/sqrt(2)
Sim.CI(X, Y, set)
```

SR *Support Recovery Procedure*

Description

This function implements the support recovery procedure in Zhang and Cheng (2017).

Usage

```
SR(X, Y)
```

Arguments

X	n times p design matrix.
Y	Response variable.

Value

The sets of active variables selected by the support recovery procedure and the scaled Lasso.

References

Zhang, X., and Cheng, G. (2017) Simultaneous Inference for High-dimensional Linear Models, *Journal of the American Statistical Association*, 112, 757-768.

Examples

```
## The function is intended for large n and p.
## Use small p here for illustration purpose only.
n <- 100
p <- 10
s0 <- 7
set <- 1:s0
Sigma <- matrix(NA, p, p)
for (i in 1:p) Sigma[i,] <- 0.9^(abs(i-(1:p)))
X <- matrix(rnorm(n*p), n, p)
X <- t(t(chol(Sigma))%*%t(X))
beta <- rep(0,p)
beta[1:s0] <- runif(s0,1,2)
Y <- X%*%beta+rt(n,4)/sqrt(2)
SR(X, Y)
```

ST *Testing for Sparse Signals*

Description

This function implements the method for testing sparse signals in Zhang and Cheng (2017).

Usage

```
ST(X.f, Y.f, sub.size, test.set, M = 500, alpha = 0.05)
```

Arguments

X.f	n times p design matrix.
Y.f	Response variable.
sub.size	The sub-sample size used for screening.
test.set	The set of variables of interest.
M	The number of bootstrap replications (default 500).
alpha	The nominal level alpha (default 0.05).

Value

Values of the non-studentized and studentized statistics, and whether the tests get rejected at the level alpha.

References

Zhang, X., and Cheng, G. (2017) Simultaneous Inference for High-dimensional Linear Models, *Journal of the American Statistical Association*, 112, 757-768.

Examples

```
## The function is intended for large n and p.
## Use small p here for illustration purpose only.
n <- 100
p <- 10
s0 <- 3
set <- 1:s0
Sigma <- matrix(NA, p, p)
for (i in 1:p) Sigma[i,] <- 0.9^(abs(i-(1:p)))
X <- matrix(rnorm(n*p), n, p)
X <- t(t(chol(Sigma))%*%t(X))
beta <- rep(0,p)
beta[1:s0] <- runif(s0,0,2)
Y <- X%*%beta+rt(n,4)/sqrt(2)
test.set <- (s0+1):p
sub.size <- n*0.3
```

```
ST(X, Y, sub.size, test.set)
test.set <- s0:p
ST(X, Y, sub.size, test.set)
```

`Step` *Stepdown Method for Multiple Testing*

Description

This function implements the stepdown method in Zhang and Cheng (2017).

Usage

```
Step(X, Y, M = 500, alpha = 0.05)
```

Arguments

`X`	n times p design matrix.
`Y`	Response variable.
`M`	The number of bootstrap replications (default 500).
`alpha`	The nominal level alpha (default 0.05).

Value

A vector indicating which hypotheses are being rejected.

References

Zhang, X., and Cheng, G. (2017) Simultaneous Inference for High-dimensional Linear Models, *Journal of the American Statistical Association*, 112, 757-768.

Examples

```
## The function is intended for large n and p.
## Use small p here for illustration purpose only.
n <- 100
p <- 10
s0 <- 3
set <- 1:s0
Sigma <- matrix(NA, p, p)
for (i in 1:p) Sigma[i,] <- 0.9^(abs(i-(1:p)))
X <- matrix(rnorm(n*p), n, p)
X <- t(t(chol(Sigma))%*%t(X))
beta <- rep(0,p)
beta[1:s0] <- runif(s0,1,2)
Y <- X%*%beta+rt(n,4)/sqrt(2)
Step(X, Y, M=500, alpha=0.05)
```

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