

Package ‘SILM’

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Type Package

Title Simultaneous Inference for Linear Models

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Author Xianyang Zhang, Guang Cheng, Jincheng Bai

Maintainer Xianyang Zhang <zhangxiany@stat.tamu.edu>

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

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 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)
```

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)
```

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

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

Value

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

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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