# 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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## R topics documented:

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)
```

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`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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