Package 'SLIC'

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Type Package

Title LIC for Distributed Skewed Regression

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Description This comprehensive toolkit for skewed regression is designated as ``SLIC'' (The LIC for Distributed Skewed Regression Analysis). It is predicated on the assumption that the error term follows a skewed distribution, such as the Skew-Normal, Skew-t, or Skew-Laplace. The methodology and theoretical foundation of the package are described in Guo G.(2020) <doi:10.1080/02664763.2022.2053949>.

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Depends R (>= 3.5.0)

Imports stats, LaplacesDemon, sn

NeedsCompilation no

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Suggests testthat (>= 3.0.0)

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Contents

`beta_AD` *Caculate the estimators of beta on the A-opt and D-opt*

Description

Caculate the estimators of beta on the A-opt and D-opt

Usage

```
beta_AD(K = K, nk = nk, alpha = alpha, X = X, y = y)
```

Arguments

`K`	is the number of subsets
`nk`	is the length of subsets
`alpha`	is the significance level
`X`	is the observation matrix
`y`	is the response vector

Value

A list containing:

`betaA`	The estimator of beta on the A-opt.
`betaD`	The estimator of beta on the D-opt.

References

Guo, G., Song, H. & Zhu, L. The COR criterion for optimal subset selection in distributed estimation. *Statistics and Computing*, 34, 163 (2024). doi:10.1007/s1122202410471z

Examples

```
p=6;n=1000;K=2;nk=200;alpha=0.05;sigma=1
e=rnorm(n,0,sigma); beta=c(sort(c(runif(p,0,1))));
data=c(rnorm(n*p,5,10));X=matrix(data, ncol=p);
y=X%*%beta+e;
beta_AD(K=K,nk=nk,alpha=alpha,X=X,y=y)
```

beta_cor *Caculate the estimator of beta on the COR*

Description

Caculate the estimator of beta on the COR

Usage

```
beta_cor(K = K, nk = nk, alpha = alpha, X = X, y = y)
```

Arguments

K	is the number of subsets
nk	is the length of subsets
alpha	is the significance level
X	is the observation matrix
y	is the response vector

Value

A list containing:

betaC	The estimator of beta on the COR.

References

Guo, G., Song, H. & Zhu, L. The COR criterion for optimal subset selection in distributed estimation. *Statistics and Computing*, 34, 163 (2024). doi:10.1007/s1122202410471z

Examples

```
p=6;n=1000;K=2;nk=200;alpha=0.05;sigma=1
e=rnorm(n,0,sigma); beta=c(sort(c(runif(p,0,1))));
data=c(rnorm(n*p,5,10));X=matrix(data, ncol=p);
y=X%*%beta+e;
beta_cor(K=K,nk=nk,alpha=alpha,X=X,y=y)
```

`LICnew` *Calculate the LIC estimator based on A-optimal and D-optimal criterion*

Description

Calculate the LIC estimator based on A-optimal and D-optimal criterion

Usage

```
LICnew(X, Y, alpha, K, nk)
```

Arguments

`X`	A matrix of observations (design matrix) with size n x p
`Y`	A vector of responses with length n
`alpha`	The significance level for confidence intervals
`K`	The number of subsets to consider
`nk`	The size of each subset

Value

A list containing:

`E5`	The LIC estimator based on A-optimal and D-optimal criterion.

References

Guo, G., Song, H. & Zhu, L. The COR criterion for optimal subset selection in distributed estimation. *Statistics and Computing*, 34, 163 (2024). doi:10.1007/s1122202410471z

Examples

```
p = 6; n = 1000; K = 2; nk = 200; alpha = 0.05; sigma = 1
e = rnorm(n, 0, sigma); beta = c(sort(c(runif(p, 0, 1))));
data = c(rnorm(n * p, 5, 10)); X = matrix(data, ncol = p);
Y = X %*% beta + e;
LICnew(X = X, Y = Y, alpha = alpha, K = K, nk = nk)
```

serr *Generate data with skewed errors*

Description

Generate data with skewed errors

Usage

```
serr(n, nr, p, dist_type, ...)
```

Arguments

n	Number of total observations
nr	Number of observations with a different error distribution
p	Number of predictors
dist_type	Type of error distribution ("skew_normal", "skew_t", "skew_laplace")
...	Additional parameters for the error distribution

Value

A list with X (design matrix), Y (response), and e (error)

Examples

```
set.seed(123)
data <- serr(1000, 200, 5, "skew_t")
str(data)
```

SLIC *SLIC function based on LIC with skewed error distributions*

Description

The SLIC function extends the LIC method by assuming that the error term follows a skewed distribution (Skew-Normal, Skew-t, or Skew-Laplace), thereby improving the length and information optimisation criterion.

Usage

```
SLIC(X, Y, alpha = 0.05, K = 10, nk = NULL, dist_type = "skew_normal")
```

Arguments

X	is a design matrix
Y	is a random response vector of observed values
alpha	is the significance level
K	is the number of subsets
nk	is the sample size of subsets
dist_type	is the type of skewed error distribution: "skew_normal", "skew_t", or "skew_laplace"

Value

MUopt, Bopt, MAEMUopt, MSEMUopt, opt, Yopt

Examples

```
set.seed(123)
n <- 1000
p <- 5
X <- matrix(rnorm(n * p), ncol = p)
beta <- runif(p, 1, 2)
e <- sn::rsn(n = n, xi = 0, omega = 1, alpha = 5)
Y <- X %*% beta + e
SLIC(X, Y, alpha = 0.05, K = 10, dist_type = "skew_normal")
```

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