Package 'CLIC'

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Type Package

Title The LIC for Distributed Cosine Regression Analysis

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Description This comprehensive framework for periodic time series modeling is designated as ``CLIC'' (The LIC for Distributed Cosine Regression Analysis) analysis. It is predicated on the assumption that the underlying data exhibits complex periodic structures beyond simple harmonic components. The philosophy of the method is articulated in Guo G. (2020) <doi:10.1080/02664763.2022.2053949>.

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Depends R (>= 3.5.0)

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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

Guo, G., Sun, Y., Qian, G., & Wang, Q. (2022). LIC criterion for optimal subset selection in distributed interval estimation. *Journal of Applied Statistics*, 50(9), 1900-1920. doi:10.1080/02664763.2022.2053949.

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Gao, H., & Guo, G. (2025). LIC for Distributed Skewed Regression. *IAENG International Journal of Applied Mathematics*, 55(9), 2925-2930.

Zhang, C., & Guo, G. (2025). The optimal subset estimation of distributed redundant data. *IAENG International Journal of Applied Mathematics*, 55(2), 270–277.

Jing, G., & Guo, G. (2025). Student LIC for distributed estimation. *IAENG International Journal of Applied Mathematics*, 55(3), 575–581.

Liu, Q., & Guo, G. (2025). Distributed estimation of redundant data. *IAENG International Journal of Applied Mathematics*, 55(2), 332–337.

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

Guo, G., Sun, Y., Qian, G., & Wang, Q. (2022). LIC criterion for optimal subset selection in distributed interval estimation. *Journal of Applied Statistics*, 50(9), 1900-1920. doi:10.1080/02664763.2022.2053949.

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Zhang, C., & Guo, G. (2025). The optimal subset estimation of distributed redundant data. *IAENG International Journal of Applied Mathematics*, 55(2), 270–277.

Jing, G., & Guo, G. (2025). Student LIC for distributed estimation. *IAENG International Journal of Applied Mathematics*, 55(3), 575–581.

Liu, Q., & Guo, G. (2025). Distributed estimation of redundant data. *IAENG International Journal of Applied Mathematics*, 55(2), 332–337.

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)
```

`cerr` *cerr function is used to generate a dataset where the error term follows cosine-based distributions*

Description

This cerr function generates a dataset with a specified number of observations and predictors, along with a response vector that has an error term sampled from cosine-based distributions on [-pi/2, pi/2].

Usage

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

Arguments

`n`	is the number of observations
`nr`	is the number of observations with a different error distribution segment (the second block)
`p`	is the dimension of the observation
`dist_type`	is the cosine-based sampler to use: `"cosine_random"`, `"cosine_rejection_sampling"`, or `"cosine_metropolis_hastings"`
`...`	is additional arguments (reserved for compatibility; not used)

Value

X,Y,e

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

Guo, G., Sun, Y., Qian, G., & Wang, Q. (2022). LIC criterion for optimal subset selection in distributed interval estimation. *Journal of Applied Statistics*, 50(9), 1900-1920. doi:10.1080/02664763.2022.2053949.

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Examples

```
set.seed(12)
data <- cerr(n = 1200, nr = 200, p = 5, dist_type = "cosine_random")
str(data)
```

`CLIC` *CLIC function based on LIC with cosine_random distributed errors*

Description

The CLIC function builds on the LIC function by introducing the assumption that the error term follows a cosine_random distribution, thereby enhancing the length and information optimisation criterion.

Usage

```
CLIC(X, Y, alpha = 0.05, K = 10, nk = NULL, dist_type = "cosine_random")
```

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 where the error term obeys a cosine_random distribution

Value

MUopt, Bopt, MAEMUopt, MSEMUopt, opt, Yopt

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

Guo, G., Sun, Y., Qian, G., & Wang, Q. (2022). LIC criterion for optimal subset selection in distributed interval estimation. *Journal of Applied Statistics*, 50(9), 1900-1920. doi:10.1080/02664763.2022.2053949.

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Gao, H., & Guo, G. (2025). LIC for Distributed Skewed Regression. *IAENG International Journal of Applied Mathematics*, 55(9), 2925-2930.

Zhang, C., & Guo, G. (2025). The optimal subset estimation of distributed redundant data. *IAENG International Journal of Applied Mathematics*, 55(2), 270–277.

Jing, G., & Guo, G. (2025). Student LIC for distributed estimation. *IAENG International Journal of Applied Mathematics*, 55(3), 575–581.

Liu, Q., & Guo, G. (2025). Distributed estimation of redundant data. *IAENG International Journal of Applied Mathematics*, 55(2), 332–337.

Examples

```
set.seed(12)
n <- 1200
nr <- 200
p <- 5
data <- cerr(n, nr, p, dist_type = "cosine_random")
CLIC(data$X, data$Y, alpha = 0.05, K = 10, nk = n / 10, dist_type = "cosine_random")
```

`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

Guo, G., Sun, Y., Qian, G., & Wang, Q. (2022). LIC criterion for optimal subset selection in distributed interval estimation. *Journal of Applied Statistics*, 50(9), 1900-1920. doi:10.1080/02664763.2022.2053949.

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Gao, H., & Guo, G. (2025). LIC for Distributed Skewed Regression. *IAENG International Journal of Applied Mathematics*, 55(9), 2925-2930.

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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)
```

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