Package: Docovt (via r-universe)

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Title Distributed Online Covariance Matrix Tests

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Description Distributed Online Covariance Matrix Tests is a powerful tool designed to efficiently process and analyze distributed datasets. It enables users to perform covariance matrix tests in an online, distributed manner, making it highly suitable for large-scale data analysis. By leveraging advanced computational techniques, 'Docovt' ensures robust and scalable solutions for statistical analysis, particularly in scenarios where data is dispersed across multiple nodes or sources. This package is ideal for researchers and practitioners working with high-dimensional data, providing a flexible and efficient framework for covariance matrix estimation and hypothesis testing. The philosophy of 'Docovt' is described in Guo G.(2025) <doi:10.1016/j.physa.2024.130308>.

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Imports stats

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Contents

`cm13` *One-Sample Covariance Test by Cai and Ma (2013)*

Description

Given data, it performs 1-sample test for Covariance where the null hypothesis is

$$H_0 : \Sigma_n = \Sigma_0$$

where Σ_n is the covariance of data model and Σ_0 is a hypothesized covariance based on a procedure proposed by Cai and Ma (2013).

Usage

```
cm13(X,Sigma0, alpha)
```

Arguments

`X`	an $(n \times p)$ data matrix where each row is an observation.
`Sigma0`	a $(p \times p)$ given covariance matrix.
`alpha`	level of significance.

Value

a named list containing:

statistic a test statistic value.

threshold rejection criterion to be compared against test statistic.

reject a logical; `TRUE` to reject null hypothesis, `FALSE` otherwise.

Examples

```
## generate data from multivariate normal with trivial covariance.
p = 5;n=10
X=data = matrix(rnorm(n*p), ncol=p)
alpha=0.05
Sigma0=diag(ncol(X))
cm13(X,Sigma0, alpha)
```

cmtwo *Two-Sample Covariance Test by Cai and Ma (2013)*

Description

Given two sets of data, it performs 2-sample test for equality of covariance matrices where the null hypothesis is

$$H_0 : \Sigma_1 = \Sigma_2$$

where Σ_1 and Σ_2 represent true (unknown) covariance for each dataset based on a procedure proposed by Cai and Ma (2013). If `statistic` $>$ `threshold`, it rejects null hypothesis.

Usage

```
cmtwo(X, Y, alpha)
```

Arguments

`X`	an $(m \times p)$ matrix where each row is an observation from the first dataset.
`Y`	an $(n \times p)$ matrix where each row is an observation from the second dataset.
`alpha`	level of significance.

Value

a named list containing

statistic a test statistic value.

threshold rejection criterion to be compared against test statistic.

reject a logical; `TRUE` to reject null hypothesis, `FALSE` otherwise.

Examples

```
## generate 2 datasets from multivariate normal with identical covariance.
p= 5;  n1 = 100; n2 = 150; alpha=0.05
X=data1 = matrix(rnorm(n1*p), ncol=p)
Y=data2 = matrix(rnorm(n2*p), ncol=p)

# run test
cmtwo(X, Y, alpha)
```

syk *One-Sample Covariance Test by Srivastava, Yanagihara, and Kubokawa (2014)*

Description

Given data, it performs 1-sample test for Covariance where the null hypothesis is

$$H_0 : \Sigma_n = \Sigma_0$$

where Σ_n is the covariance of data model and Σ_0 is a hypothesized covariance based on a procedure proposed by Srivastava, Yanagihara, and Kubokawa (2014).

Usage

```
syk(data, Sigma0, alpha)
```

Arguments

`data`	an $(n \times p)$ data matrix where each row is an observation.
`Sigma0`	a $(p \times p)$ given covariance matrix.
`alpha`	level of significance.

Value

a named list containing

statistic a test statistic value.

threshold rejection criterion to be compared against test statistic.

reject a logical; `TRUE` to reject null hypothesis, `FALSE` otherwise.

Examples

```
## generate data from multivariate normal with trivial covariance.
p = 5;n=10
data = matrix(rnorm(n*p), ncol=p)
alpha=0.05
Sigma0=diag(ncol(data))
## run the test
syk(data, Sigma0, alpha)
```

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