

Package: covTestR (via r-universe)

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Type Package

Title Covariance Matrix Tests

Version 0.1.4

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Description Testing functions for Covariance Matrices. These tests include high-dimension homogeneity of covariance matrix testing described by Schott (2007) <[doi:10.1016/j.csda.2007.03.004](https://doi.org/10.1016/j.csda.2007.03.004)> and high-dimensional one-sample tests of covariance matrix structure described by Fisher, et al. (2010) <[doi:10.1016/j.jmva.2010.07.004](https://doi.org/10.1016/j.jmva.2010.07.004)>. Covariance matrix tests use C++ to speed performance and allow larger data sets.

License GPL-2

LazyData TRUE

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URL <https://www.bearstatistics.com/covTestR>

BugReports <https://github.com/BenBarnard/covTestR/issues>

Depends R (>= 3.3)

Imports rlang, purrr, Rcpp

LinkingTo Rcpp, RcppArmadillo

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Repository <https://benbarnard.r-universe.dev>

RemoteUrl <https://github.com/benbarnard/covtestr>

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covTestR-package	<i>Covariance Matrix Testing Functions</i>
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Description

Testing functions for Covariance Matrices. These tests include high-dimension homogeneity of covariance matrix testing described by Schott (2007) [10.1016/j.csda.2007.03.004](https://doi.org/10.1016/j.csda.2007.03.004) and high-dimensional one-sample tests of covariance matrix structure described by Fisher, et al. (2010) [10.1016/j.jmva.2010.07.004](https://doi.org/10.1016/j.jmva.2010.07.004). Covariance matrix tests use C++ to speed performance and allow larger data sets.

Ahmad2015	<i>Tests for Structure of Covariance Matrices</i>
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Description

Performs Tests for the structure of covariance matrices.

Usage

```
Ahmad2015(x, Sigma = "identity", ...)
Chen2010(x, Sigma = "identity", ...)
Fisher2012(x, Sigma = "identity", ...)
LedoitWolf2002(x, Sigma = "identity", ...)
Nagao1973(x, Sigma = "identity", ...)
Srivastava2005(x, Sigma = "identity", ...)
Srivastava2011(x, Sigma = "identity", ...)
```

Arguments

x	data as a list of matrices
Sigma	Population covariance matrix as a matrix
...	other options passed to covTest method

Value

A list with class "htest" containing the following components:

statistic	the value of equality of covariance test statistic
parameter	the degrees of freedom for the chi-squared statistic
p.value	the p=value for the test
estimate	the estimated covariances if less than 5 dimensions
null.value	the specified hypothesized value of the covariance difference
alternative	a character string describing the alternative hypothesis
method	a character string indicating what type of equality of covariance test was performed
data.name	a character string giving the names of the data

References

Ahmad, M. R. and Rosen, D. von. (2015). Tests for High-Dimensional Covariance Matrices Using the Theory of U-statistics. *Journal of Statistical Computation and Simulation*, 85(13), 2619-2631. [10.1080/00949655.2014.948441](https://doi.org/10.1080/00949655.2014.948441)

Chen, S., et al. (2010). Tests for High-Dimensional Covariance Matrices. *Journal of the American Statistical Association*, 105(490):810-819. [10.1198/jasa.2010.tm09560](https://doi.org/10.1198/jasa.2010.tm09560)

Fisher, T. J. (2012). On Testing for an Identity Covariance Matrix when the Dimensionality Equals or Exceeds the Sample Size. *Journal of Statistical Planning and Inference*, 142(1), 312-326. [10.1016/j.jspi.2011.07.019](https://doi.org/10.1016/j.jspi.2011.07.019)

Ledoit, O., and Wolf, M. (2002). Some Hypothesis Tests for the Covariance Matrix When the Dimension Is Large Compared to the Sample Size. *The Annals of Statistics*, 30(4), 1081-1102. [10.1214/aos/1031689018](https://doi.org/10.1214/aos/1031689018)

Nagao, H. (1973). On Some Test Criteria for Covariance Matrix. *The Annals of Statistics*, 1(4), 700-709

Srivastava, M. S. (2005). Some Tests Concerning the Covariance Matrix in High Dimensional Data. *Journal of the Japan Statistical Society*, 35(2), 251-272. [10.14490/jjss.35.251](https://doi.org/10.14490/jjss.35.251)

Srivastava, M. S., Kollo, T., and Rosen, D. von. (2011). Some Tests for the Covariance Matrix with Fewer Observations than the Dimension Under Non-normality. *Journal of Multivariate Analysis*, 102(6), 1090-1103. [10.1016/j.jmva.2011.03.003](https://doi.org/10.1016/j.jmva.2011.03.003)

See Also

Other Testing for Structure of Covariance Matrices: [structureCovariances](#)

Examples

```
Chen2010(as.matrix(iris[1:50, 1:3]))
```

Description

Performs tests for homogeneity of 2 and k covariance matrices.

Usage

```
Ahmad2017(x, ...)
BoxesM(x, ...)
Chaipitak2013(x, ...)
Ishii2016(x, ...)
Schott2001(x, ...)
Schott2007(x, ...)
Srivastava2007(x, ...)
Srivastava2014(x, ...)
SrivastavaYanagihara2010(x, ...)
```

Arguments

x	data as a list of matrices
...	other options passed to covTest method

Value

A list with class "htest" containing the following components:

statistic	the value of homogeneity of covariance test statistic
parameter	the degrees of freedom for the chi-squared statistic
p.value	the p=value for the test
estimate	the estimated covariances if less than 5 dimensions
null.value	the specified hypothesized value of the covariance difference
alternative	a character string describing the alternative hyposthesis

method a character string indicating what type of homogeneity of covariance test was performed

data.name a character string giving the names of the data

References

- Ahmad, R. (2017). Location-invariant test of homogeneity of large-dimensional covariance matrices. *Journal of Statistical Theory and Practice*, 11(4):731-745. [10.1080/15598608.2017.1308895](https://doi.org/10.1080/15598608.2017.1308895)
- Chaipitak, S. and Chongcharoen, S. (2013). A test for testing the equality of two covariance matrices for high-dimensional data. *Journal of Applied Sciences*, 13(2):270-277. [10.3923/jas.2013.270.277](https://doi.org/10.3923/jas.2013.270.277)
- Ishii, A., Yata, K., and Aoshima, M. (2016). Asymptotic properties of the first principal component and equality tests of covariance matrices in high-dimension, low-sample-size context. *Journal of Statistical Planning and Inference*, 170:186-199. [10.1016/j.jspi.2015.10.007](https://doi.org/10.1016/j.jspi.2015.10.007)
- Schott, J (2001). Some Tests for the Equality of Covariance Matrices. *Journal of Statistical Planning and Inference*. 94(1), 25-36. [10.1016/S0378-3758\(00\)00209-3](https://doi.org/10.1016/S0378-3758(00)00209-3)
- Schott, J. (2007). A test for the equality of covariance matrices when the dimension is large relative to the sample sizes. *Computational Statistics & Data Analysis*, 51(12):6535-6542. [10.1016/j.csda.2007.03.004](https://doi.org/10.1016/j.csda.2007.03.004)
- Srivastava, M. S. (2007). Testing the equality of two covariance matrices and independence of two sub-vectors with fewer observations than the dimension. In *International Conference on Advances in Interdisciplinary Statistics and Combinatorics*, University of North Carolina at Greensboro, NC, USA.
- Srivastava, M., Yanagihara, H., and Kubokawa T. (2014). Tests for covariance matrices in high dimension with less sample size. *Journal of Multivariate Analysis*, 130:289-309. [10.1016/j.jmva.2014.06.003](https://doi.org/10.1016/j.jmva.2014.06.003)
- Srivastava, M. and Yanagihara, H. (2010). Testing the equality of several covariance matrices with fewer observation than the dimension. *Journal of Multivariate Analysis*, 101(6):1319-1329. [10.1016/j.jmva.2009.12.010](https://doi.org/10.1016/j.jmva.2009.12.010)

See Also

Other Testing for Homogeneity of Covariance Matrices: [homogeneityCovariances](#)

Examples

```
irisSpecies <- unique(iris$Species)

iris_ls <- lapply(irisSpecies,
  function(x){as.matrix(iris[iris$Species == x, 1:4])}
)

names(iris_ls) <- irisSpecies

Ahmad2017(iris_ls)
```

`homogeneityCovariances`*Test Wrapper for Homogeneity of Covariance Matrices*

Description

Performs 2 and k sample homogeneity of covariance matrices test using test, 'covTest.'

Usage

```
homogeneityCovariances(x, ..., covTest = BoxesM)
```

Arguments

<code>x</code>	data as a data frame, list of matrices, grouped data frame, or resample object
<code>...</code>	other options passed to covTest method
<code>covTest</code>	homogeneity of covariance matrices test method

Details

The `homogeneityCovariances` function is a wrapper function that formats the data for the specific covTest functions.

Value

A list with class "htest" containing the following components:

<code>statistic</code>	the value of homogeneity of covariance test statistic
<code>parameter</code>	the degrees of freedom for the chi-squared statistic
<code>p.value</code>	the p=value for the test
<code>estimate</code>	the estimated covariances if less than 5 dimensions
<code>null.value</code>	the specified hypothesized value of the covariance difference
<code>alternative</code>	a character string describing the alternative hypothesis
<code>method</code>	a character string indicating what type of homogeneity of covariance test was performed
<code>data.name</code>	a character string giving the names of the data

See Also

Other Testing for Homogeneity of Covariance Matrices: [Ahmad2017](#)

Examples

```
homogeneityCovariances(iris, group = Species)
```

structureCovariances *Test Wrapper for Structure of a Covariance Matrices*

Description

Performs a structure of a covariance matrix test.

Usage

```
structureCovariances(x, Sigma = "identity", ..., covTest = Nagao1973)
```

Arguments

x	data
Sigma	Population covariance matrix
...	other options passed to covTest method
covTest	structure of covariance matrix test method

Details

The [structureCovariances](#) function is a wrapper function that formats the data for the specific covTest functions.

Value

A list with class "hctest" containing the following components:

statistic	the value of equality of covariance test statistic
parameter	the degrees of freedom for the chi-squared statistic
p.value	the p=value for the test
estimate	the estimated covariances if less than 5 dimensions
null.value	the specified hypothesized value of the covariance difference
alternative	a character string describing the alternative hyposthesis
method	a character string indicating what type of equality of covariance test was performed
data.name	a character string giving the names of the data

See Also

Other Testing for Structure of Covariance Matrices: [Ahmad2015](#)

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