

Package ‘covTestR’

August 17, 2018

Type Package

Title Covariance Matrix Tests

Version 0.1.4

Maintainer Ben Barnard <ben_barnard@outlook.com>

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> and high-dimensional one-sample tests of covariance matrix structure described by Fisher, et al. (2010) <doi: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

RoxygenNote 6.1.0

URL <https://covtestr.bearstatistics.com>

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

Depends R (>= 3.3)

Imports rlang, purrr, Rcpp

LinkingTo Rcpp, RcppArmadillo

SystemRequirements C++11

NeedsCompilation yes

Author Ben Barnard [aut, cre],
Dean Young [aut]

Repository CRAN

Date/Publication 2018-08-17 21:10:03 UTC

R topics documented:

covTestR-package	2
Ahmad2015	2
Ahmad2017	4
homogeneityCovariances	6
structureCovariances	7

Index	9
--------------	----------

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

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>
-----------	---

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 "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

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]))
```

Ahmad2017

Tests for Homogeneity of Covariance Matrices

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 hypothesis
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

x	data as a data frame, list of matrices, grouped data frame, or resample object
...	other options passed to covTest method
covTest	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:

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 hypothesis
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

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](#)

Index

Ahmad2015, [2](#), [8](#)

Ahmad2017, [4](#), [7](#)

BoxesM (Ahmad2017), [4](#)

Chaipitak2013 (Ahmad2017), [4](#)

Chen2010 (Ahmad2015), [2](#)

covTestR-package, [2](#)

Fisher2012 (Ahmad2015), [2](#)

homogeneityCovariances, [5](#), [6](#), [6](#)

homogeneityStatistics (Ahmad2017), [4](#)

Ishii2016 (Ahmad2017), [4](#)

LeditWolf2002 (Ahmad2015), [2](#)

Nagao1973 (Ahmad2015), [2](#)

Schott2001 (Ahmad2017), [4](#)

Schott2007 (Ahmad2017), [4](#)

Srivastava2005 (Ahmad2015), [2](#)

Srivastava2007 (Ahmad2017), [4](#)

Srivastava2011 (Ahmad2015), [2](#)

Srivastava2014 (Ahmad2017), [4](#)

SrivastavaYanagihara2010 (Ahmad2017), [4](#)

structureCovariances, [4](#), [7](#), [7](#)

structureStatistics (Ahmad2015), [2](#)