Package 'rWishart'

September 9, 2018

Title Random Wishart Matrix Generation

Version 0.1.1

Maintainer ORPHANED

Description An expansion of R's 'stats' random wishart matrix generation.
This package allows the user to generate singular, Uhlig and Harald (1994)
<doi:10.1214/aos/1176325375>, and pseudo wishart, Diaz-Garcia, et al.(1997)
<doi:10.1006/jmva.1997.1689>, matrices. In addition the user can generate
wishart matrices with fractional degrees of freedom, Adhikari (2008)
<doi:10.1061/(ASCE)0733-9399(2008)134:12(1029)>, commonly used in volatility
modeling. Users can also use this package to create random covariance matrices.

Depends R (>= 3.3)

Imports Matrix, MASS, stats, lazyeval

License GPL-2

Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

Suggests covr, knitr, rmarkdown, testthat

URL https://rwishart.bearstatistics.com

NeedsCompilation no

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Repository CRAN

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X-CRAN-Comment Orphaed on 2018-09-09 as there was no response to
requests to repair an intermittent test error.

R topics documented:

`rFractionalWishart` *Random Fractional Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rFractionalWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite ($p \times p$) "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

References

Adhikari, S. (2008). Wishart random matrices in probabilistic structural mechanics. Journal of engineering mechanics, 134(12), doi:10.1061/(ASCE)0733-9399(2008)134:12(1029).

Examples

```
rFractionalWishart(2, 22.5, diag(1, 20))
```

`rNonsingularWishart` *Random Nonsingular Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rNonsingularWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite ($p \times p$) "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

Examples

```
rNonsingularWishart(2, 20, diag(1, 5))
```

`rPsuedoWishart` *Random Psuedo Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rPsuedoWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite ($p \times p$) "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

References

Diaz-Garcia, Jose A, Ramon Gutierrez Jaimez, and Kanti V Mardia. 1997. "Wishart and Pseudo-Wishart Distributions and Some Applications to Shape Theory." Journal of Multivariate Analysis 63 (1): 73–87. doi:10.1006/jmva.1997.1689.

Examples

```
rPsuedoWishart(2, 5, diag(1, 20))
```

`rSingularWishart` *Random Singular Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rSingularWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite ($p \times p$) "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

References

Uhlig, Harald. 1994. "On Singular Wishart and Singular Multivariate Beta Distributions." The Annals of Statistics 22 (1): 395–405. doi:10.1214/aos/1176325375.

Examples

```
rSingularWishart(2, 5, diag(1, 20))
```

`rWishart` *Random Wishart Matrix Generation*

Description

An expansion of R's 'stats' random wishart matrix generation. This package allows the user to generate singular, Uhlig and Harald (1994) <doi:10.1214/aos/1176325375>, and pseudo wishart, Diaz-Garcia, et al.(1997) <doi:10.1006/jmva.1997.1689>, matrices. In addition the user can generate wishart matrices with fractional degrees of freedom, Adhikari (2008) <doi:10.1061/(ASCE)0733-9399(2008)134:12(1029)>, commonly used in volatility modeling. Users can also use this package to create random covariance matrices.

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite ($p \times p$) "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

Examples

```
rWishart(2, 5, diag(1, 20))
```

`wishartTest` *Test if Matrix is a Wishart Matrix*

Description

Given a random Wishart matrix, B, from W_p(Sigma, df) and independent random vector a, then (a' B a) / (a' Sigma a) is chi-squared with df degrees of freedom.

Usage

```
wishartTest(WishMat, Sigma, vec = NULL)
```

Arguments

`WishMat`	random Wishart Matrix from W_p(Sigma, df)
`Sigma`	Covariance matrix for W_p(Sigma, df)
`vec`	independent random vector

Value

A chi-squared random variable with df degrees of freedom.

Examples

```
wishartTest(rWishart(1, 5, diag(1, 20), simplify = FALSE)[[1]], diag(1, 20))
```

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