Package ‘rWishart’

November 20, 2019

Title Random Wishart Matrix Generation

Version 0.1.2

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Description An expansion of R's 'stats' random wishart matrix generation.
This package allows the user to generate singular, Uhlig and Harald (1994)
<doi:10.1006/jmva.1997.1689>, matrices. In addition the user can generate
wishart matrices with fractional degrees of freedom, Adhikari (2008)
modeling. Users can also use this package to create random covariace matrices.

Depends R (>= 3.3)
Imports Matrix, MASS, stats, lazyeval
License GPL-2

LazyData true
RoxygenNote 6.1.1
Suggests covr, knitr, rmarkdown, testthat

URL https://rwishart.bearstatistics.com

NeedsCompilation no

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Repository CRAN

Date/Publication 2019-11-19 23:10:02 UTC

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**Description**

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

**Usage**

```r
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 \( p \times p \times n \), where each array is a positive semidefinite matrix, a realization of the Wishart distribution \( W_p(\Sigma, df) \)

**References**


**Examples**

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

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

Usage

\[
\text{rNonsingularWishart}(n, \text{df}, \Sigma, \text{covariance} = \text{FALSE}, \text{simplify} = \text{"array"})
\]

Arguments

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

Details

If \( X_1, \ldots, X_m \) 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 \( p \times p \times n \), where each array is a positive semidefinite matrix, a realization of the Wishart distribution \( W_p(\Sigma, \text{df}) \)

Examples

\[
\text{rNonsingularWishart}(2, 20, \text{diag}(1, 5))
\]
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 x 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

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 \( \text{df} \), \( W_p(\Sigma, \text{df}) \).

**Usage**

```r
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 \( X_1, \ldots, X_m \) is a sample of \( m \) independent multivariate Gaussians with mean vector 0, and covariance matrix \( \Sigma \), the distribution of \( M = X'X \) is \( W_p(\Sigma, \text{df}) \).

**Value**

A numeric array of dimension \( p \times p \times n \), where each array is a positive semidefinite matrix, a realization of the Wishart distribution \( W_p(\Sigma, \text{df}) \).

**References**


**Examples**

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

Random Wishart Matrix Generation

Description

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 x 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 $\left(a' B a\right) / \left(a' \Sigma a\right)$ 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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