Package 'Qapprox'

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Type Package

Title Approximation to the Survival Functions of Quadratic Forms of Gaussian Variables

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Description Calculates the right-tail probability of quadratic forms of Gaussian variables using the skewness-kurtosis ratio matching method, modified Liu-Tang-Zhang method and Satterthwaite-Welch method. The technical details can be found in Hong Zhang, Judong Shen and Zheyang Wu (2020) <doi:10.48550/arXiv.2005.00905>.

License GPL-2

Imports stats

Encoding UTF-8

RoxygenNote 6.1.0

NeedsCompilation no

Repository CRAN

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Contents

Qapprox *Right-tail probability of quadratic forms of centered Gaussian variables.*

Description

Right-tail probability of quadratic forms of centered Gaussian variables.

Usage

```
Qapprox(q, Sigma, A = NULL, method = "MR")
```

Arguments

q	- quantile, could be a vector.
Sigma	- covariance matrix of Gaussian variables.
A	- a positive-semi-definite matrix that defines the quadratic form.
method	- "MR": moment-ratio (skewness-kurtosis) matching method; "SW": Satterthwaite-Welch method that matches mean and variance; "LTZ4": Liu-Tang-Zhang method that matches the kurtosis.

Value

The right-tail probability of a quadratic form (Q = X'AX) of centered Gaussian variables.

References

1. Hong Zhang, Judong Shen and Zheyang Wu. "An efficient and accurate approximation to the distribution of quadratic forms of Gaussian variables", arXiv:2005.00905.

Examples

```
n <- 100
Sigma <- toeplitz(1/(1:n))
thr <- 180
Qapprox(thr, Sigma, method="SW")
Qapprox(thr, Sigma, method="LTZ4")
Qapprox(thr, Sigma, method="MR")
```

Qapprox_nc *Right-tail probability of quadratic forms (Q = X'AX) of noncentral Gaussian variables.*

Description

Right-tail probability of quadratic forms (Q = X'AX) of noncentral Gaussian variables.

Usage

```
Qapprox_nc(q, mu, Sigma, A = NULL, method = "MR")
```

Arguments

q	- quantile, could be a vector.
mu	- mean vector of Gaussian variables.
Sigma	- covariance matrix of Gaussian variables.
A	- a positive-semi-definite matrix that defines the quadratic form.
method	- "MR": moment-ratio (skewness-kurtosis) matching method; "SW": Satterthwaite-Welch method that matches mean and variance; "LTZ4": Liu-Tang-Zhang method that matches the kurtosis.

Value

The right-tail probability of a quadratic form (Q = X'AX) of noncentral Gaussian variables.

References

1. Hong Zhang, Judong Shen and Zheyang Wu. "An efficient and accurate approximation to the distribution of quadratic forms of Gaussian variables", arXiv:2005.00905.

Examples

```
n <- 100
Sigma <- toeplitz(1/(1:n))
mu <- rep(1, n)
thr <- 500
Qapprox_nc(thr, mu, Sigma, method="SW")
Qapprox_nc(thr, mu, Sigma, method="LTZ4")
Qapprox_nc(thr, mu, Sigma, method="MR")
```

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