Package 'quad'

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Type Package

Title Exact permutation moments of quadratic form statistics

Version 1.0

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Imports PearsonDS

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Description This package gives you the exact first four permutation moments for the most commonly used quadratic form statistics, which need not be positive definite. The extension of this work to quadratic forms greatly expands the utility of density approximations for these problems, including for high-dimensional applications, where the statistics must be extreme in order to exceed stringent testing thresholds. Approximate p-values are obtained by matching the exact moments to the Pearson family of distributions using the PearsonDS package.

License GPL (>= 2)

LazyLoad yes

NeedsCompilation no

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R topics documented:

quad-package *This package gives the exact the first four moments of any quadratic form and its corresponding pvlaues.*

Description

The Mantel and Knox space-time clustering statistics are popular tools to establish transmissibility of a disease and detect outbreaks. The most commonly used null distributional approximations may provide poor fits, and researchers often resort to direct sampling from the permutation distribution. However, the exact first four moments for these statistics are available, and Pearson distributional approximations are often effective. Thus, our first goals are to clarify the literature and make these tools more widely available. In addition, by rewriting terms in the statistics, we obtain the exact first four permutation moments for the most commonly used quadratic form statistics, which need not be positive definite. The extension of this work to quadratic forms greatly expands the utility of density approximations for these problems, including for high-dimensional applications, where the statistics must be extreme in order to exceed stringent testing thresholds.

Details

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Version:	1.0
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License:	GPL (>= 2)

Author(s)

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References

YH Zhou, G Mayhew, Z Sun, X Xu, F Zou, FA Wright, 2013 *Space-time clustering and the permutation moments of quadratic forms*, Stat 2(1), 292-302

lincombfun *linear combination function*

Description

This is a prestep function for *momentfun*

Usage

```
lincombfun(S,mycoef)
```

Arguments

S	S is a list of sums output from the sum function
mycoef	global coefficients for the linear combination function

References

YH Zhou, G Mayhew, Z Sun, X Xu, F Zou, FA Wright, 2013 *Space-time clustering and the permutation moments of quadratic forms*, Stat 2(1), 292-302

See Also

coef, sumfun, momentfun.

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momentfun — *Generate the first four exact permutation moments of quadratic form statistics.*

Description

For symmetric C and D (with zero diagonals), we implement the Siemiatycki moment computation.

Usage

```
momentfun(Px, Py, n, mycoef)
```

Arguments

Px	list of linear combinations
Py	list of linear combinations
n	sample size n has to be at least 8.
mycoef	global coefficients we need for the function.

Value

first	first permutation moment of quadratic form
second	second permutation moment
third	third permutation moment
fourth	fourth permutation moment

References

YH Zhou, G Mayhew, Z Sun, X Xu, F Zou, FA Wright, 2013 *Space-time clustering and the permutation moments of quadratic forms*, Stat 2(1), 292-302

See Also

quadp,lincombfun.

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mycoef *Global variables for several main functions.*

Description

We need the global variables to generate the linear combination function.

Usage

```
data(mycoef)
```

Details

It gives all the global variables

References

YH Zhou, G Mayhew, Z Sun, X Xu, F Zou, FA Wright, 2013 *Space-time clustering and the permutation moments of quadratic forms*, Stat 2(1), 292-302

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quadp *This function provides you the pvalue based on the Pearson Family distribution.*

Description

Main function of this package. It returns the pvalue of the quadratic form statistics.

Usage

```
quadp(y, A, mycoef)
```

Arguments

y	y is the vector in quadratic form $y^T Ay$
A	A is the symmetric matrix
mycoef	global variables

Details

This is the main function in the package. It returns the test statistics of the quadratic form and its corresponding p value using Pearson family for the fitting.

Value

stat	test statistics value
p	pvalue based on the Pearson family fitting using the exact four moments

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See Also

lincombfun, sumfun

Examples

```
#####  m is the dimension of the A matrix, n is the length of y        ##
#####  no row/column of A can be all constant, as this is degenerate and creates problems.
library(PearsonDS)

m=15
n=20
set.seed(1)
x=matrix(rnorm(m*n),m,n) # just an example
y=rnorm(n)
A=t(x-rowMeans(x))
data(mycoef)
##### The code below assumes that y and A have been presepecified or otherwise preloaded
#result=quadp(y,A,mycoef)
#print(result)
```

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sumfun *Get Sum*

Description

This is a prestep function for *momentfun*

Usage

```
sumfun(W)
```

Arguments

W	mid step for generating linear combination function

References

YH Zhou, G Mayhew, Z Sun, X Xu, F Zou, FA Wright, 2013 *Space-time clustering and the permutation moments of quadratic forms*, Stat 2(1), 292-302

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