Package ‘quad’

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Type Package
Title Exact permutation moments of quadratic form statistics
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Date 2014-07-05
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)
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Repository CRAN
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quad-package

This package gives the exact the first four moments of any quadratic form and its corresponding pvalues.

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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Author(s)

Yi-Hui Zhou
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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
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


See Also

cos, sumfun, momentfun.

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


See Also

quadp, lincombfun.

---

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


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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

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td><em>y</em> is the vector in quadratic form $y^T Ay$</td>
</tr>
<tr>
<td>A</td>
<td><em>A</em> is the symmetric matrix</td>
</tr>
<tr>
<td>mycoef</td>
<td>global variables</td>
</tr>
</tbody>
</table>

------
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

<table>
<thead>
<tr>
<th>stat</th>
<th>test statistics value</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>pvalue based on the Pearson family fitting using the exact four moments</td>
</tr>
</tbody>
</table>

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See Also

lincombfun, sumfun

Examples

```r
##### 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)
```

Description

This is a prestep function for momentfun

Usage

`sumfun(W)`

Arguments

| W    | mid step for generating linear combination function |
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