Package ‘MultiSkew’

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Type Package

Title Measures, Tests and Removes Multivariate Skewness

Version 1.1.1

Date 2017-06-13

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Description Computes the third multivariate cumulant of either the raw, centered or standardized data. Computes the main measures of multivariate skewness, together with their bootstrap distributions. Finally, computes the least skewed linear projections of the data.

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Depends MaxSkew

NeedsCompilation no

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MultiSkew-package

Description
Computes the third multivariate cumulant of either the raw, centered or standardized data. Computes the main measures of multivariate skewness, together with their bootstrap distributions. Finally, computes the least skewed linear projections of the data.

Details
Package: MultiSkew
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License: GPL-2

References

Examples

data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)

MinSkew(PM10_2006_matrix[,2:5],4)
PartialSkew(PM10_2006_matrix[,2:5])
SkewMardia(PM10_2006_matrix[,2:5])
Third(PM10_2006_matrix[,2:5],"raw")
FisherSkew

#library(MaxSkew)

SkewBoot(PM10_2006_matrix[,2:5], 50, 50, "Directional")
SkewBoot(PM10_2006_matrix[,2:5], 50, 50, "Mardia")
SkewBoot(PM10_2006_matrix[,2:5], 50, 50, "Partial")

<table>
<thead>
<tr>
<th>FisherSkew</th>
<th>Fisher’s measure of skewness</th>
</tr>
</thead>
</table>

**Description**

Computes Fisher’s measure of skewness, that is the third standardized moment of each variable in the dataset.

**Usage**

FisherSkew(data)

**Arguments**

data data matrix

**Value**

Dataframe containing Fisher’s measure of skewness of each variable of the dataset

**Author(s)**

Cinzia Franceschini and Nicola Loperfido

**Examples**

data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)
FisherSkew(PM10_2006_matrix)
MinSkew

Description

Reduces sample skewness by projecting the data onto appropriate linear subspaces

Usage

MinSkew(data, dimension)

Arguments

data: data matrix

dimension: number of required projections

Value

Linear: linear function of the variables

Projections: projected data

Author(s)

Cinzia Franceschini and Nicola Loperfido

References


Examples

data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)
MinSkew(PM10_2006_matrix[,2:5],4)
**Description**

Multivariate skewness, as defined in Mori, Rohatgi e Szekely (1993).

**Usage**

`PartialSkew(data)`

**Arguments**

data  
data matrix

**Value**

- Scalar: The squared norm of Vector
- pvalue: The probability of observing a value of Scalar greater than the observed one, when data are normally distributed

**Author(s)**

Cinzia Franceschini and Nicola Loperfido

**References**


**Examples**

```r
data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)
PartialSkew(PM10_2006_matrix[,2:5])
```
The PM10 dataset provides an evaluation of PM10 (particulate matter with an aerodynamic equivalent diameter of up to 10 m) concentrations recorded in Italy during year 2006. The variables, collected from 257 stations, are: average (MEAN) and 50th percentile (MEDIAN) for stations which have valid data with a time coverage of at least 50; 98th percentile (98TH) and maximum value (MAX). Stations are classified by region, province and zone (rural, urban, suburban).

Usage

data("PM10_2006")

Format

A data frame with 257 observations on the following 5 variables.

zone  a factor with levels R S U
mean  a numeric vector
median  a numeric vector
‘98th’ a numeric vector
max  a numeric vector

Source


References


Examples

data(PM10_2006)
## maybe str(PM10_2006) ; plot(PM10_2006) ...
SkewBoot

**Bootstrap inference for multivariate skewness measures**

**Description**

Computes the bootstrap distribution, its histogram and the corresponding p-value of the chosen measure of multivariate skewness (Mardia, Partial or Directional), using a given number of bootstrap replicates.

**Usage**

\[
\text{SkewBoot(data, replicates, units, type)}
\]

**Arguments**

- **data**: data matrix
- **replicates**: number of bootstrap replicates
- **units**: number of rows in the data matrices sampled from the original data matrix
- **type**: "Directional", "Partial" or "Mardia". If type is set equal to "Directional" or "Mardia", units is an integer greater than the number of variables. If type set equal to "Partial", units is an integer greater than the number of variables + 1

**Details**

The function calls the package MaxSkew 1.1, which needs to be downloaded. The number of iterations required by the package MaxSkew is set equal to 5.

**Value**

- **histogram**: plot of the above mentioned bootstrap distribution
- **Pvalue**: p-value of the chosen skewness measure
- **Vector**: vector containing the bootstrap replicates of the chosen skewness measure

**Author(s)**

Cinzia Franceschini and Nicola Loperfido

**Examples**

```r
library(MaxSkew)
data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)
#source("SkewBoot.R")
#SkewBoot(PM10_2006_matrix[,2:5], 50, 50, "Partial")
#SkewBoot(PM10_2006_matrix[,2:5], 50, 50, "Mardia")
#SkewBoot(PM10_2006_matrix[,2:5], 50, 50, "Directional")
```
**SkewMardia**  
*Multivariate skewness as defined in Mardia (1970)*

**Description**

Sum of squared elements in the third standardized cumulant of the data matrix.

**Usage**

```r
SkewMardia(data)
```

**Arguments**

- `data`  
data matrix

**Value**

- `MardiaSkewness`  
Squared norm of the third cumulant of the standardized data
- `pvalue`  
Probability of observing a value of MardiaSkewness greater than the observed one, when data are normally distributed.

**Note**

The measure has been introduced in Mardia, K.V. (1970)

**Author(s)**

Cinzia Franceschini and Nicola Loperfido

**References**


**Examples**

```r
data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)
SkewMardia(PM10_2006_matrix[,2:5])
```
**Third**

**Third multivariate moment of a data matrix**

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**Description**

It contains all moments of order three which can be obtained from the variables.

**Usage**

Third(data, type)

**Arguments**

data  data matrix

<table>
<thead>
<tr>
<th>type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;raw&quot;</td>
<td>is the third raw moment</td>
</tr>
<tr>
<td>&quot;central&quot;</td>
<td>is the third central moment</td>
</tr>
<tr>
<td>&quot;standardized&quot;</td>
<td>is the third standardized moment</td>
</tr>
</tbody>
</table>

**Details**

Some general information about the third multivariate moment of both theoretical and empirical distributions are reviewed in Loperfido, N. (2015).

**Value**

Third moment: all moments of order three which can be obtained from the variables in "data".

**Author(s)**

Cinzia Franceschini and Nicola Loperfido

**References**


**Examples**

data(PM10_2006)
PM10_2006_matrix<-data.matrix(PM10_2006)
Third(PM10_2006_matrix[,2:5], "raw")
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