

Package ‘VecStatGraphs2D’

April 26, 2016

Type Package

Title Vector Analysis using Graphical and Analytical Methods in 2D

Version 1.8

Date 2016-03-11

Author Ruiz-Cuetos J.C., Felicísimo A.M., Cuartero A., Polo M.E., Rodríguez P.G., Haut J.M.

Maintainer Pablo García Rodríguez <pablogr@unex.es>

Depends R (>= 2.10.1), MASS

Description A 2D statistical analysis is performed, both numerical and graphical, of a set of vectors. Since a vector has two components (module and azimuth) vector analysis is performed in three stages: modules are analyzed by means of linear statistics, azimuths are analyzed by circular statistics, and the joint analysis of modules and azimuths is done using density maps that allow detecting another distribution properties (i.e. anisotropy) and outliers. Tests and circular statistic parameters have associated a full range of graphing: histograms, maps of distributions, point maps, vector maps, density maps, distribution modules and azimuths.

License GPL-3

URL <http://gim.unex.es/VecStatGraphs2D/>

Repository CRAN

Date/Publication 2016-04-26 16:50:30

NeedsCompilation no

R topics documented:

VecStatGraphs2D-package	3
AllAzimuthStatistics	4
AllModuleStatistics	6
ArithmeticMean	7
casiunifor	8
casiuniforpolar	8
casiuniforpolar1	9
CircularDispersion	9

CircularStandardDeviation	10
CircularVariance	11
concentra	12
concentrapolar	13
datos1	13
datos1.1	14
datos1050	14
datos1050.1	15
datos1050polar	15
datos1polar	16
datos2	16
datos2.1	17
datos2polar	17
datos3	18
datos3.1	18
datos3polar	19
datos4	19
datos4.1	20
datos4polar	20
datos4polarDir1	21
DrawAzimuthDensity	21
DrawDensityMap	22
DrawDistribution	24
DrawHistogram	26
DrawModuleAndAzimuthDistribution	27
DrawPoints	28
DrawQQPlot	29
DrawVectors	31
KurtosisAzimuthCoefficient	32
KurtosisModuleCoefficient	33
LoadData	35
mabel51polar	37
mabel61polar	38
masdatos	39
masdatos.1	39
masdatospolar	40
MeanAzimuth	40
MeanModule	41
MeasuredRealData.1	42
MedianAzimuth	43
ModulePopulationStandardDeviation	44
ModulePopulationVariance	45
ModuleStandardDeviation	46
ModuleVariance	47
muchocero	48
muchocero1	48
NumberOfElements	49
RaoTest	50

RayleighTest	51
RectangularData	52
simple.1	53
SkewnessAzimuthCoefficient	53
SkewnessModuleCoefficient	54
StandardError	55
vectores.1	56
vient	57
VonMisesParameter	57

Index	59
--------------	-----------

VecStatGraphs2D-package

Vectorial analysis using graphical and analytical methods in 2D

Description

This package performs a 2D statistical analysis, both numerical and graphical, of a set of vectors. Because a vector has two components, module and azimuth, vector analysis is performed in three stages. First, modules are analyzed using linear statistics. Second, azimuths are analyzed by circular statistics. Third a joint analysis of modules and azimuths is performed using density maps that allow detection of other distribution properties (i.e. anisotropy) and outliers. Tests and circular statistic parameters are accompanied by a full range of graphing: histograms, maps of distributions, point maps, vector maps, density maps, distribution modules and azimuths.

Details

Package:	VecStatGraphs2D
Type:	Package
Version:	1.7
Date:	2014-02-03
License:	GPL-3
LazyLoad:	yes

Author(s)

Juan Carlos Ruiz Cuetos, Angel Manuel Felicisimo, Aurora Cuartero, Maria Eugenia Polo Garcia, Pablo Garcia Rodriguez.

Maintainer: Pablo Garcia Rodriguez <pablogr@unex.es>

References

Bachelet E. (1981) Circular statistics in biology. London. London Academic Press.

- Dixon K. R., Chapman J. A. (1980) Harmonic mean measure of animal activity areas. *Ecology* 61, 1040-1044.
- Cuartero A., Felicísimo A.M., Polo M.E., Caro A., Rodríguez P.G. (2010) Positional Accuracy Analysis of Satellite Imagery by Circular Statistics. *Photogrammetric Engineering & Remote Sensing* (JCR-2010 = 0,926; Category: Imaging Science & Photographic Technology 9/19; second quartile), 76 (11), 1275-1286.
- Cuartero A., Armesto J., Rodríguez P.G., Arias P. (2010) Error Analysis of Terrestrial Laser Scanning Data by Means of Spherical Statistics and 3D Graphs. *Sensors* (JCR-2010 = 1,771; Category: Instruments & Instrumentation 14/61; first quartile), 10, 10128-10145.
- Fisher N.I. (1995) *Statistical analysis of circular data*. Cambridge. Cambridge University Press.
- Jammalamadaka S.R., Sengupta A. (2001) *Topic in circular statistics*. Singapore. World Scientific Publishing.
- Mardia K.V. , Jupp, P.E. (2000) *Directional statistics*. Chichester. Wiley.
- Pewsey, A., Neuhauser, M., Ruxton, G. D. (2013). *Circular statistics in R*. Oxford University Press.
- Rodríguez P.G., Polo M.E., Cuartero A., Felicísimo A.M., Ruiz-Cuetos J.C. (2014) VecStatGraphs2D, A Tool for the Analysis of Two-Dimensional Vector Data: An Example Using QuikSCAT Ocean Winds. *IEEE Geoscience and Remote Sensing Letters* (JCR-2012 = 1,823; Category: Remote Sensing 8/27; first quartile), 11(5), 921-925.
- Russell G.S. , Levitin D.J. (1995) An expanded table of probability values for Rao spacing test. *Communications in Statistics: Simulation and Computation*, 24(4), 879-888.
- Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[AllAzimuthStatistics](#), [AllModuleStatistics](#), [DrawHistogram](#), [DrawPoints](#),
[DrawModuleAndAzimuthDistribution](#), [DrawDensityMap](#), [DrawVectors](#),
[DrawAzimuthDensity](#), [DrawDistribution](#), [RaoTest](#), [RayleighTest](#),
[DrawQQPlot](#).

AllAzimuthStatistics *Calculation of all statistics of the azimuths*

Description

This function calculates the basic circular statistics from a sample of azimuths several circular data statistics from a set of input azimuths.

Usage

```
AllAzimuthStatistics(azimuths, ndig = 4)
```

AllModuleStatistics *Calculation of all statistics of the modules.*

Description

This function calculates the basic linear statistics of a sample of linear magnitudes.

Usage

```
AllModuleStatistics(modules, ndig = 4)
```

Arguments

modules	Vector containing the values of the modules
ndig	Integer value that indicates the decimal places. The default value is 4.

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

The statistics calculated are: Number Of Elements, Max Value, Min Value, Range, Mean Arithmetic, Standard Error

Value

The value all module statistics of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[StandardError](#), [ModuleStandardDeviation](#), [ModuleVariance](#), [ModulePopulationVariance](#), [ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
AllModuleStatistics(modules, ndig = 4)
```

ArithmeticMean	<i>Calculation of the Arithmetic Mean of the modules</i>
----------------	--

Description

This function calculates the arithmetic mean of a set of modules

Usage

```
ArithmeticMean(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The arithmetic mean value of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[NumberOfElements](#), [StandardError](#),
[ModuleStandardDeviation](#), [ModuleVariance](#), [ModulePopulationVariance](#),
[ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
ArithmeticMean(modules)
```

casiunifor	<i>Data Set</i>
------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

casiunifor

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

casiuniforpolar	<i>Data Set</i>
-----------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

casiuniforpolar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

casiuniforpolardir1 *Data Set*

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

casiuniforpolardir1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

CircularDispersal *Calculation of the Circular Dispersal of the Azimuths*

Description

This function calculates the circular dispersal from a set of input azimuths.

Usage

CircularDispersal(azimuths)

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to get a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

In the case of uniform distribution, this value is infinite, and with values close to 0, a highly concentrated data distribution is expected.

Value

The value circular dispersal of all input azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [MeanAzimuth](#), [CircularVariance](#), [CircularStandardDeviation](#),
[KurtosisAzimuthCoefficient](#), [VonMisesParameter](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
CircularDispersal(azimuths)
```

CircularStandardDeviation

Calculation of the Circular Standard Deviation of the azimuths

Description

This function calculates the circular standard deviation from a set of input azimuths.

Usage

```
CircularStandardDeviation(azimuths)
```

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to get a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value of the circular standard deviation of all input azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [MeanAzimuth](#), [CircularVariance](#),
[CircularDispersion](#), [KurtosisAzimuthCoefficient](#), [VonMisesParameter](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
CircularStandardDeviation(azimuths)
```

CircularVariance

Calculation of the Circular Variance of the azimuths

Description

This function calculates the circular variance from a set of input azimuths.

Usage

```
CircularVariance(azimuths)
```

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to get a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value of the circular variance of all input azimuths. This value ranges between 0 and 1.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [MeanAzimuth](#), [CircularStandardDeviation](#),
[CircularDispersion](#), [KurtosisAzimuthCoefficient](#), [VonMisesParameter](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
CircularVariance(azimuths)
```

concentra

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

concentra

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

concentrapolar	<i>Data Set</i>
----------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

concentrapolar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos1	<i>Data Set</i>
--------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos1.1

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos1.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos1050

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos1050

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos1050.1	<i>Data Set</i>
-------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos1050.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos1050polar	<i>Data Set</i>
----------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos1050polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos1polar

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos1polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos2

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos2

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos2.1	<i>Data Set</i>
----------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos2.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos2polar	<i>Data Set</i>
-------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos2polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos3

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos3

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos3.1

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos3.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos3polar	<i>Data Set</i>
-------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos3polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos4	<i>Data Set</i>
--------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos4

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos4.1

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos4.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos4polar

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos4polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

datos4polardir1	<i>Data Set</i>
-----------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

datos4polardir1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

DrawAzimuthDensity	<i>Graphical representation of the azimuth density</i>
--------------------	--

Description

This function creates a graph that represents a circular graphic when the data azimuths densities are represented by color bands. A vector is drawn representing the mode azimuth.

Usage

```
DrawAzimuthDensity(azimuths, Period = 15, SVGf = 0)
```

Arguments

azimuths	Vector containing the values of the azimuths
Period	Integer value which represents the number of moving average terms
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

With this function, a circular graphic is obtained, representing azimuths densities by color bands.

Typical usages are

```
DrawAzimuthDensity(azimuths, ...)
DrawAzimuthDensity(azimuths, Period = 15, ...)
DrawAzimuthDensity(azimuths, Period = 15, SVGf = 0)
.....
```

Value

This function returns a no value and creates a graph that represents the density of the azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawDistribution](#), [DrawHistogram](#), [DrawPoints](#),
[DrawModuleAndAzimuthDistribution](#), [DrawDensityMap](#), [DrawVectors](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
DrawAzimuthDensity(azimuths, Period = 15, SVGf=0)
```

DrawDensityMap

Graphic representation of a point density map

Description

The density map will be built as follows: a) vectors are moved to a common origin without changing its azimuth and module; b) end positions perform a point cloud of varying density that depends on the accumulation of vectors with similar properties; and c) end positions are used to calculate the density map as a surface with values depending on the end-position accumulation per area unit. The density map provides information about the joint distribution of modules and azimuths and allows the detection of errors or outliers. Areas in which there is a greater number of points (end position of the vectors) will have a deeper color (red), whereas the areas with lower density will have a less

intense color (white). The user can define how many points are classified as outliers. The outliers can be calculated using the higher value of the modules or the harmonic mean. For that, the module value or harmonic mean value is calculated for each vector. Points with the largest module value or harmonic mean value will be considered as outliers.

Usage

```
DrawDensityMap(data_x, data_y, PercentageOutliers = 5, PaintPoint = FALSE,
Div = 250, HarmonicMean = FALSE, PaintAxis = FALSE, SVGf=0)
```

Arguments

<code>data_x</code>	Vector containing the values of the X coordinates
<code>data_y</code>	Vector containing the values of the Y coordinates
<code>PercentageOutliers</code>	Integer value that indicates the percentage of points that are considered as outliers. The default value is 5
<code>PaintPoint</code>	Logical value. If <code>PaintPoint=TRUE</code> , then samples are represented by points. If <code>PaintPoint=FALSE</code> , then samples are not represented by points. The default value is <code>FALSE</code>
<code>Div</code>	Integer value that indicates the number of divisions that will have the density map. The default value is 250
<code>HarmonicMean</code>	Logical value. If <code>HarmonicMean=FALSE</code> , then the module is used for the calculation of outliers. If <code>HarmonicMean=TRUE</code> , then the harmonic mean is used for the calculation of outliers. The default value is <code>FALSE</code> .
<code>PaintAxis</code>	Logical value. If <code>PaintAxis=TRUE</code> , then the axis will be drawn. If <code>PaintAxis=FALSE</code> , then the axis will not be drawn. The default value is <code>FALSE</code> .
<code>SVGf</code>	Integer value. If <code>SVGf = 0</code> , the plot is showed only in the graphic window. If <code>SVGf = 1</code> , then the plot is saved as SVG graphic. The default value is 0.

Details

Kernel descriptors are used to create the density map. To perform these calculations, the MASS package is required.

The parameter `Div` is very important because a very large value will lead to the creation of a slow density map, whereas a very small value will create an ineffective density map.

One way to obtain a set of X and Y coordinates of the vectors is to use the [LoadData](#) function.

Typical usages are

```
DrawDensityMap(data_x, data_y, ...)
DrawDensityMap(data_x, data_y, Div = 100, ...)
DrawDensityMap(data_x, data_y, PaintPoint = TRUE, HarmonicMean = TRUE,
PaintAxis = TRUE, ...)
.....
```

Value

This function returns no value and creates a graph that represents a density map from the input values.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Dixon K. R., Chapman J. A. (1980) Harmonic mean measure of animal activity areas. *Ecology* 61, 1040-1044.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawAzimuthDensity](#), [DrawHistogram](#), [DrawDistribution](#), [DrawPoints](#),
[DrawModuleAndAzimuthDistribution](#), [DrawVectors](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
X_coordinate<-dat[,3]
Y_coordinate<-dat[,4]
DrawDensityMap(X_coordinate, Y_coordinate, PaintPoint = TRUE, Div=200, SVGf=0)
```

DrawDistribution

Graphic representation of the distribution of the azimuths

Description

This function creates a graph that represents the distribution of the azimuths. Every azimuth is plotted as a blue point in a unit circle. The mean azimuth is represented by a red arrow. A 95 percentage confidence interval for the mean azimuth is plotted in red. When the data concentration is too low (von Mises parameter below 0.9) the mean azimuth is not plotted. This confidence interval depends on the mean module, the number of azimuths and the von Mises parameter.

Usage

```
DrawDistribution(azimuths, SVGf = 0)
```


Arguments

azimuths	Vector containing the values of the azimuths
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

With this function, the positions of the largest and smallest concentrations of points can be observed.

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Typical usages are

```
DrawDistribution(azimuths, ...)  
.....
```

Value

This function returns no value and creates a graph that represents the distribution of the input data.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawAzimuthDensity](#), [DrawHistogram](#), [DrawPoints](#),
[DrawModuleAndAzimuthDistribution](#), [DrawDensityMap](#), [DrawVectors](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")  
dat<-LoadData(FileName, Type=2)  
azimuths<-dat[,2]  
DrawDistribution(azimuths, SVGf=0)
```

DrawHistogram*Graphic representation of the histogram of the azimuth distribution*

Description

This function creates a graph that represents a circumference divided into sectors with different radii. Each radius represents the percentage of azimuth data that belong to each sector. Each portion represents the azimuths that exist between the angles formed by the sides of the portion.

Usage

```
DrawHistogram(azimuths, ClassSize = 15, SVGf = 0)
```

Arguments

azimuths	Vector containing the values of the azimuths
ClassSize	Integer value that represents the size of each portion. The default value is 15.
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

This function shows where the highest concentration of points is located.

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Typical usages are

```
DrawHistogram(azimuths, ...)  
DrawHistogram(azimuths, ClassSize = 20, ...)  
.....
```

Value

This function returns no value and creates a graph that represents a circular histogram of the input data.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawDistribution](#), [DrawPoints](#), [DrawModuleAndAzimuthDistribution](#),
[DrawDensityMap](#), [DrawVectors](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
DrawHistogram(azimuths, ClassSize=15, SVGf=0)
```

DrawModuleAndAzimuthDistribution

Graphic representation of module and azimuth distributions

Description

This function creates a graph that allows us to check the angular and linear magnitudes simultaneously. The mean vector is plotted by a red arrow.

Usage

```
DrawModuleAndAzimuthDistribution(data_x, data_y, SVGf=0)
```

Arguments

data_x	Vector containing the values of the X coordinates
data_y	Vector containing the values of the Y coordinates
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

The graph draws a line for each vector. Each vector is moved to a common origin (0, 0) without changing its azimuth and module. The concentric circumferences allow us to identify linear magnitudes, and the legend of the angles allows us to determine the angular magnitude values.

One way to obtain a set of X and Y coordinates of the vectors is to use the [LoadData](#) function.

Typical usages are

```
DrawModuleAndAzimuthDistribution(data_x, data_y, ...)
.....
```

Value

This function returns no value and creates a graph that represents module and azimuth distributions.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawAzimuthDensity](#), [DrawHistogram](#), [DrawDistribution](#), [DrawPoints](#), [DrawDensityMap](#), [DrawVectors](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
X_coordinate<-dat[,3]
Y_coordinate<-dat[,4]
DrawModuleAndAzimuthDistribution(X_coordinate, Y_coordinate, SVGf=0)
```

DrawPoints

Graphic representation of points

Description

This function creates a graph that represents one point for each vector. Each vector is moved to a common origin (0, 0) without changing its azimuth and module. The user can define how many points are classified as outliers (in red color). The outliers can be calculated by the higher value of the modules or the harmonic mean. For that, the module value or the harmonic mean value is calculated for each vector. Points with the largest module value or harmonic mean value will be considered as outliers.

Usage

```
DrawPoints(data_x, data_y, PercentageOutliers = 5, SVGf=0)
```

Arguments

data_x	Vector containing the values of the X coordinates
data_y	Vector containing the values of the Y coordinates
PercentageOutliers	Integer value that indicates the percentage of outliers. The default value is 5.
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

Each vector is moved to a common origin (0, 0) without changing its azimuth and module. The graph represents the situation of the end nodes of the vectors.

One way to obtain a set of X and Y coordinates of the vectors is to use the [LoadData](#) function.

Typical usages are

```
DrawPoints(data_x, data_y, ...)
DrawPoints(data_x, data_y, PercentageOutliers = 3, ...)
.....
```

Value

This function returns no value and creates a graph that represents the end nodes of the vectors.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawAzimuthDensity](#), [DrawHistogram](#), [DrawDistribution](#), [DrawModuleAndAzimuthDistribution](#), [DrawDensityMap](#), [DrawVectors](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
X_coordinate<-dat[,3]
Y_coordinate<-dat[,4]
DrawPoints(X_coordinate, Y_coordinate, PercentageOutliers=8, SVGf=0)
```

DrawQQPlot

Graphical assessment of uniformity

Description

This function generates a graph that allows one to determine quickly the azimuths distribution can be considered uniform.

Usage

```
DrawQQPlot(azimuths, SVGf=0)
```

Arguments

azimuths	Vector containing the values of the azimuths
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

The graphic is created by placing in increasing order of n pairs of points from the calculation of the linear order statistics of the azimuths.

If the data fit to the uniform distribution, the points should lie along a 45 grades line passing through the origin.

The arbitrary choice of the origin of the azimuths may lead to a misunderstanding in the interpretation. We can solve this problem by adding the unit to each element of the pair of values of the first 20 percent of points and by subtracting the unit to each element of the pair of values of the last 20 percent. All these new points are plotted.

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

This function returns no value. A graph is displayed to show whether the hypothesis of uniform distribution can be accepted or rejected.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[RayleighTest](#), [RaoTest](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
DrawQQPlot(azimuths, SVGf=0)
```

Description

This function creates a graph that shows an arrow for each vector. The graph represents the situation of every vector by its coordinates. To represent this graph, the input data must be the cartesian coordinates (Type = 1).

Usage

```
DrawVectors(data, SVGf=0)
```

Arguments

data	Matrix containing the coordinates of the final and initial data
SVGf	Integer value. If SVGf = 0, the plot is showed only in the graphic window. If SVGf = 1, then the plot is saved as SVG graphic. The default value is 0.

Details

The cartesian coordinates cannot be calculated. They must be introduced as input data, although it is advisable to use [LoadData](#) for obtain the vectors of the X and Y coordinates as well as the azimuths of the final values.

Value

This function returns no value and creates a graph that represents the vectors of the input data.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawAzimuthDensity](#), [DrawHistogram](#), [DrawDistribution](#), [DrawPoints](#), [DrawModuleAndAzimuthDistribution](#), [DrawDensityMap](#).

Examples

```
FileName<-system.file("data/MeasuredRealData.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/datos1.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/datos2.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/datos3.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/datos4.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/datos1050.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/masdatos.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

```
FileName<-system.file("data/simple.1.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=1)
data<-dat[,1:8]
DrawVectors(data, SVGf=0)
```

KurtosisAzimuthCoefficient

Calculation of the kurtosis coefficient of the azimuths

Description

This function calculates the kurtosis coefficient from a set of the input azimuths.

Usage

```
KurtosisAzimuthCoefficient(azimuths)
```

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value of the kurtosis coefficient for all input azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press
Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [MeanAzimuth](#), [MedianAzimuth](#), [CircularVariance](#), [CircularStandardDeviation](#), [CircularDispersion](#), [VonMisesParameter](#), [SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
KurtosisAzimuthCoefficient(azimuths)
```

KurtosisModuleCoefficient

Calculation of the kurtosis coefficient of the modules

Description

This function calculates the kurtosis coefficient, which characterizes the shape of the distribution from a set of input modules.

Usage

```
KurtosisModuleCoefficient(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

The kurtosis coefficient is a measure of whether the data are flat or peaked relative to the normal distribution.

Value

The value of the kurtosis coefficient of all input modules

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#), [ModuleStandardDeviation](#), [ModuleVariance](#), [ModulePopulationVariance](#), [ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
KurtosisModuleCoefficient(modules)
```

LoadData	<i>Data loading and conversion of cartesian coordinates, incremental data, and polar coordinates</i>
----------	--

Description

This function reads data from a text file containing data of coordinates. Data can be read as cartesian coordinates, incremental data or polar coordinates. This functions returns a matrix with all possible data conversions according to topographical direction (0 grades N clockwise).

Usage

```
LoadData(FileName, Type = 2)
```

Arguments

FileName	File name to load data
Type	Integer value that indicates the type of data contained in the file. Type 1 = Cartesian, Type 2= Incremental, Type 3 = Polar

Details

Input files must be in a certain format for the data type. By default, the type is incremental data (Type = 2).

The cartesian coordinate type contains four columns, each pair defining the coordinates of a vector node. The columns 1 and 2 are the values of the initial node, while columns 3 and 4 are the coordinates of the final node. If necessary, we can used the inverse order to adapt the direction to our data. The calculations are performed subtracting the coordinates of the final node to the initial node; each row corresponds to one set of data.

The incremental data contains two columns, the first column is the increase of X coordinate, and the second is the increase of Y coordinate; each row corresponds to one set of data.

The polar coordinates contains two columns. The first column represents the module, and the second column represents the azimuth; each row corresponds to one set of data.

Typical usages are

```
LoadData(FileName, ...)
LoadData(FileName, Type=2, ...)
.....
```

Value

The function returns a nx9 matrix size, where n is the number of data. Column 1 represents the module; column 2 represents the azimuth; column 3 represents the increase of X coordinate; the

column 4 represents the increase of Y coordinate; columns 5 and 6 represent the X and Y coordinates, respectively, of the initial node, and columns 7 and 8 represent the X and Y coordinates, respectively, of the final node.

Columns 5, 6, 7 and 8 will have value only if the input data are of type 1.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawAzimuthDensity](#), [DrawHistogram](#), [DrawModuleAndAzimuthDistribution](#), [DrawDensityMap](#), [AllAzimuthStatistics](#), [AllModuleStatistics](#), [DrawQQPlot](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

```
FileName<-system.file("data/casiunifor.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

```
FileName<-system.file("data/casiuniforpolar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)
```

```
FileName<-system.file("data/concentra.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

```
FileName<-system.file("data/concentrapolar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)
```

```
FileName<-system.file("data/datos1.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

```
FileName<-system.file("data/datos1polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)
```

```
FileName<-system.file("data/datos2.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

```
FileName<-system.file("data/datos2polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)
```

```
FileName<-system.file("data/datos3.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

```
FileName<-system.file("data/datos3polar.txt", package="VecStatGraphs2D")
```

```
LoadData(FileName, Type=3)

FileName<-system.file("data/datos4.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)

FileName<-system.file("data/datos4polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)

FileName<-system.file("data/datos4polar1.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)

FileName<-system.file("data/datos1050.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)

FileName<-system.file("data/datos1050polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)

FileName<-system.file("data/mabel51polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)

FileName<-system.file("data/mabel61polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)

FileName<-system.file("data/masdatos.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)

FileName<-system.file("data/masdatos1polar.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=3)

FileName<-system.file("data/muchocero.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)

FileName<-system.file("data/muchocero1.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)

FileName<-system.file("data/vient.txt", package="VecStatGraphs2D")
LoadData(FileName, Type=2)
```

mabel51polar

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

mabel51polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

mabel61polar

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

mabel61polar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

masdatos	<i>Data Set</i>
----------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

masdatos

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

masdatos.1	<i>Data Set</i>
------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

masdatos.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

masdatospolar	<i>Data Set</i>
---------------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

masdatospolar

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

MeanAzimuth	<i>Calculation of the mean azimuth of the azimuths</i>
-------------	--

Description

This function calculates the mean azimuth of a set of input azimuths.

Usage

MeanAzimuth(azimuths)

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value mean azimuth of all input azimuths. The value is expressed in sexagesimal.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.
Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [CircularVariance](#), [CircularStandardDeviation](#),
[CircularDispersion](#), [KurtosisAzimuthCoefficient](#), [VonMisesParameter](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
MeanAzimuth(azimuths)
```

MeanModule

Calculation of the mean module of the azimuths

Description

This function calculates the mean module from a set of input azimuths.

Usage

```
MeanModule(azimuths)
```

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value mean module of all input azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanAzimuth](#), [CircularVariance](#), [CircularStandardDeviation](#),
[CircularDispersion](#), [KurtosisAzimuthCoefficient](#), [VonMisesParameter](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
MeanModule(azimuths)
```

MeasuredRealData.1 *GPS Data Set*

Description

Dataset obtained with a GPS, UNEX Merida.

Usage

MeasuredRealData.1

Format

A matrix containing 53 observations.

References

Website <http://gim.unex.es/VecStatGraphs2D/>

MedianAzimuth*Calculation of the median azimuth of the azimuths*

Description

This function calculates the median azimuth of a set of input azimuths.

Usage

```
MedianAzimuth(azimuths)
```

Arguments

`azimuths` Vector containing the values of the azimuths

Details

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value median azimuth of all input azimuths. The value is expressed in sexagesimal.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.
Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [CircularVariance](#), [CircularStandardDeviation](#),
[CircularDispersion](#), [KurtosisAzimuthCoefficient](#), [VonMisesParameter](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")  
dat<-LoadData(FileName, Type=2)  
azimuths<-dat[,2]  
MedianAzimuth(azimuths)
```

ModulePopulationStandardDeviation

Calculation of the population standard deviation of the modules

Description

This function calculates the population standard deviation of a set of input modules.

Usage

```
ModulePopulationStandardDeviation(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The population standard deviation of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#),
[ModuleStandardDeviation](#), [ModuleVariance](#), [ModulePopulationVariance](#),
[SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
ModulePopulationStandardDeviation(modules)
```

ModulePopulationVariance

Calculation of the population variance of the modules

Description

This function calculates the population variance of a set of input modules.

Usage

```
ModulePopulationVariance(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The population variance of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#),
[ModuleStandardDeviation](#), [ModuleVariance](#),
[ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
ModulePopulationVariance(modules)
```

ModuleStandardDeviation

Calculation of the standard deviation of the modules

Description

This function calculates the standard deviation of a set of input modules.

Usage

```
ModuleStandardDeviation(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The standard deviation of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#),
[ModuleVariance](#), [ModulePopulationVariance](#),
[ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
ModuleStandardDeviation(modules)
```

ModuleVariance	<i>Calculation of the variance of the modules</i>
----------------	---

Description

This function calculates the variance of a set of input modules.

Usage

```
ModuleVariance(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The variance of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#),
[ModuleStandardDeviation](#), [ModulePopulationVariance](#),
[ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
ModuleVariance(modules)
```

muchocero

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

muchocero

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

muchocero1

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

muchocero1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

NumberOfElements	<i>Calculation of the number of elements of the modules</i>
------------------	---

Description

This function calculates the number of elements of a set of modules

Usage

```
NumberOfElements(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The number of elements of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicisimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodriguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#),
[ModuleStandardDeviation](#), [ModuleVariance](#), [ModulePopulationVariance](#),
[ModulePopulationStandardDeviation](#), [SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
NumberOfElements(modules)
```

RaoTest	<i>Rao test. Formal test of uniformity</i>
---------	--

Description

This function performs the Rao test of uniformity.

Usage

```
RaoTest(azimuths, Alpha = 0.01)
```

Arguments

azimuths	Vector containing the values of the azimuths
Alpha	Significance level. Value used to obtain the Rao Value of the Rao Table. The values can be 0.001, 0.005, 0.01, 0.05, 0.1, 0.5, or 0.9. The default is 0.01.

Details

For a uniform distribution, the space between points should be approximately $360/n$. If the space deviates much from this value, then the probability that the data belong to a uniform distribution is reduced.

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Typical usages are

```
RaoTest(azimuths, ...)  
.....
```

Value

Returns the p-value and indicates whether the hypothesis of uniformity can be accepted.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

- Bachelet E. (1981) Circular statistics in biology. London. London Academic Press.
- Jammalamadaka S.R., Sengupta A. (2001) Topic in circular statistics. Singapore. World Scientific Publishing.
- Mardia K.V. , Jupp, P.E. (2000) Directional statistics. Chichester. Wiley.

Russell G.S. , Levitin D.J. (1995) An expanded table of probability values for Rao spacing test. Communications in Statistics: Simulation and Computation, 24(4), 879-888.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawQQPlot](#), [RayleighTest](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
RaoTest(azimuths, Alpha = 0.01)
```

RayleighTest	<i>Rayleigh test. Formal test of uniformity</i>
--------------	---

Description

This function performs the Rayleigh test of uniformity.

Usage

```
RayleighTest(azimuths)
```

Arguments

azimuths Vector containing the values of the azimuths

Details

This test detects a single modal direction in a sample of azimuths when the mean azimuth is unspecified. The hypothesis of uniformity is rejected if the mean module is very large. This test assumes that a large mean module implies a high concentration around the mean and, therefore, less probability that the data are uniformly distributed.

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

Returns the value of the probability of accepting the hypothesis of uniformity.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[DrawQQPlot](#), [RaoTest](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
RayleighTest(azimuths)
```

RectangularData

GPS Data Set

Description

Dataset obtained with a GPS, UNEX Merida.

Usage

RectangularData

Format

A matrix containing 100 observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

simple.1

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

simple.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

SkewnessAzimuthCoefficient

Calculation of the skewness coefficient of the azimuths

Description

This function calculates the skewness coefficient from a set of input azimuths.

Usage

SkewnessAzimuthCoefficient(azimuths)

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The value skewness coefficient of all input azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.
Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [MeanAzimuth](#), [CircularVariance](#), [CircularStandardDeviation](#), [CircularDispersion](#), [KurtosisAzimuthCoefficient](#), [VonMisesParameter](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
SkewnessAzimuthCoefficient(azimuths)
```

SkewnessModuleCoefficient

Calculation of the skewness coefficient of the modules

Description

This function calculates the skewness coefficient and indicates the symmetry of the distribution from a set of input modules.

Usage

```
SkewnessModuleCoefficient(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

A normal data distribution presents a skewness coefficient equal to 0.

Value

The value skewness coefficient of all input modules

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [StandardError](#),
[ModuleStandardDeviation](#), [ModuleVariance](#), [ModulePopulationVariance](#),
[ModulePopulationStandardDeviation](#), [KurtosisModuleCoefficient](#),
[AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
SkewnessModuleCoefficient(modules)
```

StandardError	<i>Calculation of the standard error of the modules</i>
---------------	---

Description

This function calculates the standard error of the arithmetic mean of a set of input modules.

Usage

```
StandardError(modules)
```

Arguments

modules Vector containing the values of the modules

Details

One way to obtain a set of modules from X and Y coordinates of the vectors is to use the [LoadData](#) function.

Value

The standard error of all input modules.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[ArithmeticMean](#), [ModuleStandardDeviation](#), [ModuleVariance](#),
[ModulePopulationVariance](#), [ModulePopulationStandardDeviation](#),
[SkewnessModuleCoefficient](#), [KurtosisModuleCoefficient](#), [AllModuleStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
modules<-dat[,1]
StandardError(modules)
```

vectores.1

Data Set

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

vectores.1

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

vient	<i>Data Set</i>
-------	-----------------

Description

Dataset obtained at UNEX Merida. Maria Eugenia Polo

Usage

vient

Format

A matrix containing multiples observations.

Source

UNEX Merida

References

Website <http://gim.unex.es/VecStatGraphs2D/>

VonMisesParameter	<i>Calculation of von Mises concentration parameter of the azimuths</i>
-------------------	---

Description

This function calculates the von Mises concentration parameter from a set of input azimuths.

Usage

VonMisesParameter(azimuths)

Arguments

azimuths Vector containing the values of the azimuths

Details

One way to obtain a set of azimuths from X and Y coordinates of the vectors is to use the [LoadData](#) function.

The von Mises concentration parameter measures the departure of the distribution from the uniform distribution. If this parameter tends to 0, then the distribution converges to the uniform distribution. If it tends to infinity, then the distribution is concentrated around the mean azimuth.

Value

The von Mises concentration parameter of all input azimuths.

Author(s)

Ruiz-Cuetos, J.C., <jcruizcue@gmail.com>, Felicísimo, A.M., <amfeli@unex.es>, Cuartero, A., <acuartero@unex.es>, Polo, M.E., <mepolo@unex.es>, Rodríguez, P.G. <pablogr@unex.es>

References

Fisher N.I. (1995) Statistical analysis of circular data. Cambridge. Cambridge University Press.

Website <http://gim.unex.es/VecStatGraphs2D/>

See Also

[MeanModule](#), [MeanAzimuth](#), [CircularVariance](#), [CircularStandardDeviation](#),
[CircularDispersion](#), [KurtosisAzimuthCoefficient](#),
[SkewnessAzimuthCoefficient](#), [AllAzimuthStatistics](#).

Examples

```
FileName<-system.file("data/RectangularData.txt", package="VecStatGraphs2D")
dat<-LoadData(FileName, Type=2)
azimuths<-dat[,2]
VonMisesParameter(azimuths)
```

Index

*Topic **azimuth**

- AllAzimuthStatistics, 4
- CircularDispersal, 9
- CircularStandardDeviation, 10
- CircularVariance, 11
- KurtosisAzimuthCoefficient, 32
- MeanAzimuth, 40
- MeanModule, 41
- MedianAzimuth, 43
- SkewnessAzimuthCoefficient, 53
- VonMisesParameter, 57

*Topic **datasets**

- casiunifor, 8
- casiuniforpolar, 8
- casiuniforpolar1, 9
- concentra, 12
- concentrapolar, 13
- datos1, 13
- datos1.1, 14
- datos1050, 14
- datos1050.1, 15
- datos1050polar, 15
- datos1polar, 16
- datos2, 16
- datos2.1, 17
- datos2polar, 17
- datos3, 18
- datos3.1, 18
- datos3polar, 19
- datos4, 19
- datos4.1, 20
- datos4polar, 20
- datos4polar1, 21
- mabel51polar, 37
- mabel61polar, 38
- masdatos, 39
- masdatos.1, 39
- masdatospolar, 40
- MeasuredRealData.1, 42

- muchocero, 48
- muchocero1, 48
- RectangularData, 52
- simple.1, 53
- vectores.1, 56
- vient, 57

*Topic **file**

- LoadData, 35

*Topic **graphics**

- DrawAzimuthDensity, 21
- DrawDensityMap, 22
- DrawDistribution, 24
- DrawHistogram, 26
- DrawModuleAndAzimuthDistribution, 27
- DrawPoints, 28
- DrawVectors, 31

*Topic **module**

- AllModuleStatistics, 6
- ArithmeticMean, 7
- KurtosisModuleCoefficient, 33
- ModulePopulationStandardDeviation, 44
- ModulePopulationVariance, 45
- ModuleStandardDeviation, 46
- ModuleVariance, 47
- NumberOfElements, 49
- SkewnessModuleCoefficient, 54
- StandardError, 55

*Topic **package**

- VecStatGraphs2D-package, 3

*Topic **test**

- DrawQQPlot, 29
- RaoTest, 50
- RayleighTest, 51

AllAzimuthStatistics, 4, 4, 10–12, 33, 36, 41–43, 54, 58

AllModuleStatistics, 4, 6, 7, 34, 36, 44–47, 49, 55, 56

- ArithmeticMean, [7](#), [34](#), [44–47](#), [49](#), [55](#), [56](#)
- casiunifor, [8](#)
- casiuniforpolar, [8](#)
- casiuniforpolar1, [9](#)
- CircularDispersion, [5](#), [9](#), [11](#), [12](#), [33](#), [41–43](#), [54](#), [58](#)
- CircularStandardDeviation, [5](#), [10](#), [10](#), [12](#), [33](#), [41–43](#), [54](#), [58](#)
- CircularVariance, [5](#), [10](#), [11](#), [11](#), [33](#), [41–43](#), [54](#), [58](#)
- concentra, [12](#)
- concentrapolar, [13](#)
- datos1, [13](#)
- datos1.1, [14](#)
- datos1050, [14](#)
- datos1050.1, [15](#)
- datos1050polar, [15](#)
- datos1polar, [16](#)
- datos2, [16](#)
- datos2.1, [17](#)
- datos2polar, [17](#)
- datos3, [18](#)
- datos3.1, [18](#)
- datos3polar, [19](#)
- datos4, [19](#)
- datos4.1, [20](#)
- datos4polar, [20](#)
- datos4polar1, [21](#)
- DrawAzimuthDensity, [4](#), [21](#), [24](#), [25](#), [28](#), [29](#), [31](#), [36](#)
- DrawDensityMap, [4](#), [22](#), [22](#), [25](#), [27–29](#), [31](#), [36](#)
- DrawDistribution, [4](#), [22](#), [24](#), [24](#), [27–29](#), [31](#)
- DrawHistogram, [4](#), [22](#), [24](#), [25](#), [26](#), [28](#), [29](#), [31](#), [36](#)
- DrawModuleAndAzimuthDistribution, [4](#), [22](#), [24](#), [25](#), [27](#), [27](#), [29](#), [31](#), [36](#)
- DrawPoints, [4](#), [22](#), [24](#), [25](#), [27](#), [28](#), [28](#), [31](#)
- DrawQQPlot, [4](#), [29](#), [36](#), [51](#), [52](#)
- DrawVectors, [4](#), [22](#), [24](#), [25](#), [27–29](#), [31](#)
- KurtosisAzimuthCoefficient, [5](#), [10–12](#), [32](#), [41–43](#), [54](#), [58](#)
- KurtosisModuleCoefficient, [6](#), [7](#), [33](#), [44–47](#), [49](#), [55](#), [56](#)
- LoadData, [5–7](#), [9–11](#), [23](#), [25–27](#), [29–31](#), [33](#), [34](#), [35](#), [40](#), [41](#), [43–47](#), [49–51](#), [53–55](#), [57](#)
- mabel51polar, [37](#)
- mabel61polar, [38](#)
- masdatos, [39](#)
- masdatos.1, [39](#)
- masdatospolar, [40](#)
- MeanAzimuth, [5](#), [10–12](#), [33](#), [40](#), [42](#), [54](#), [58](#)
- MeanModule, [5](#), [10–12](#), [33](#), [41](#), [41](#), [43](#), [54](#), [58](#)
- MeasuredRealData.1, [42](#)
- MedianAzimuth, [33](#), [43](#)
- ModulePopulationStandardDeviation, [6](#), [7](#), [34](#), [44](#), [45–47](#), [49](#), [55](#), [56](#)
- ModulePopulationVariance, [6](#), [7](#), [34](#), [44](#), [45](#), [46](#), [47](#), [49](#), [55](#), [56](#)
- ModuleStandardDeviation, [6](#), [7](#), [34](#), [44](#), [45](#), [46](#), [47](#), [49](#), [55](#), [56](#)
- ModuleVariance, [6](#), [7](#), [34](#), [44–46](#), [47](#), [49](#), [55](#), [56](#)
- muchocero, [48](#)
- muchocero1, [48](#)
- NumberOfElements, [7](#), [49](#)
- RaoTest, [4](#), [30](#), [50](#), [52](#)
- RayleighTest, [4](#), [30](#), [51](#), [51](#)
- RectangularData, [52](#)
- simple.1, [53](#)
- SkewnessAzimuthCoefficient, [5](#), [10–12](#), [33](#), [41–43](#), [53](#), [58](#)
- SkewnessModuleCoefficient, [6](#), [7](#), [34](#), [44–47](#), [49](#), [54](#), [56](#)
- StandardError, [6](#), [7](#), [34](#), [44–47](#), [49](#), [55](#), [55](#)
- VecStatGraphs2D
(VecStatGraphs2D-package), [3](#)
- VecStatGraphs2D-package, [3](#)
- vectores.1, [56](#)
- vient, [57](#)
- VonMisesParameter, [5](#), [10–12](#), [33](#), [41–43](#), [54](#), [57](#)