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Type Package

Title Boxplots for Directional Data

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Description Functions for drawing boxplots for data on (the boundary of) a unit circle (i.e., circular and axial data), from Buttarazzi D., Pandolfo G., Porzio G.C. (2018) <[doi:10.1111/biom.12889](https://doi.org/10.1111/biom.12889)>.

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 AxialBoxplot

AxialBoxplot

Description

Draw a boxplot for axial data

Usage

```
AxialBoxplot(A, template = "degrees", place = "none", marg =
             "large", stack = FALSE, H = FALSE, shrink = 1.5, units
             = "degrees", constant = "optimal", mirror = TRUE)
```

Arguments

A	numeric; a vector of class circular in units=c("degrees", "radians")
template	character; graphical parameter to set the template to be used in the plot. Options are "degrees"(default), "radians" and "geographics". If NULL, a generic template can be defined, with angles displayed according to the graphical parameter place.
place	character; graphical parameter. Active only when template = NULL to add an additional generic template either "outside" or "inside" the circle. If place = "none"(default), no additional template is plotted.
marg	character; graphical parameter to set the plot region to either "large"(default) or "small", expressed in number of lines of text.
stack	If TRUE and H=FALSE, then far out values are stacked on the circumference.
H	logical; graphical parameter to specify if observations between the hinges and the whiskers are plotted. Default is FALSE.
shrink	numeric; graphical parameter to control the size of the plotted circle. Default is 1.5. Larger values shrink the circle, while smaller values enlarge the circle.
units	character; graphical parameter to select the unit of measure to be displayed on the axes when template = NULL and place=c("inside", "outside"). Options are "degrees"(default) or "radians".
constant	numeric; the boxplot multiplying factor (or "constant") that determines how far the fences extend out from the box. When "optimal"(default), it ensures the probability that an observation falls outside the fences (i.e., it will be a far out value) is 0,7% under a von Mises distribution (see Web Appendix A in Buttarazzi et al., 2018).
mirror	If TRUE, then a second axial boxplot will be plotted on the opposite semi-circle.

Details

The arguments stack, shrink are parameters passed to plot.circular.

Value

farout	a vector of class circular in radians, containing the values of the points lying outside the whiskers.
constant	the value of the constant used to draw the boxplot.

Author(s)

Davide Buttarazzi

References

Buttarazzi D., Pandolfo G., Porzio G.C. (2018). A boxplot for circular data, *Biometrics*.

Examples

```
set.seed(1)
#install.packages("circular")
require(circular)
#install.packages("plotrix")
require(plotrix)
theta <- circular::rvonmises(100, circular(pi/2), 3, control.circular=list(units="radians"))
axialTheta <- circular(theta, modulo = "pi")
AxialBoxplot(axialTheta, template = "radians", mirror = FALSE)
```

CircularBoxplot

Circular Box-and-Wisker Plot

Description

The CircularBoxplot function produces a box-and-whisker-plot for circular data.

Usage

```
CircularBoxplot ( A, template="degrees", place="none", units="degrees", marg=
  "large", shrink = 1.5, H=FALSE, stack=FALSE, constant=
  "optimal")
```

Arguments

A	numeric; a vector of class circular in units=c("degrees", "radians")
template	character; graphical parameter to set the template to be used in the plot. Options are "degrees"(default), "radians" and "geographics". If NULL, a generic template can be defined, with angles displayed according to the graphical parameter place.
place	character; graphical parameter. Active only when template = NULL to add an additional generic template either "outside" or "inside" the circle. If place = "none"(default), no additional template is plotted.

units	character; graphical parameter to select the unit of measure to be displayed on the axes when <code>template = NULL</code> and <code>place=c("inside", "outside")</code> . Options are "degrees"(default) or "radians".
marg	character; graphical parameter to set the plot region to either "large"(default) or "small", expressed in number of lines of text.
shrink	numeric; graphical parameter to control the size of the plotted circle. Default is 1.5. Larger values shrink the circle, while smaller values enlarge the circle.
H	logical; graphical parameter to specify if observations between the hinges and the whiskers are plotted. Default is FALSE.
stack	If TRUE and H=FALSE, then far out values are stacked on the circumference.
constant	numeric; the boxplot multiplying factor (or "constant") that determines how far the fences extend out from the box. When "optimal"(default), it ensures the probability that an observation falls outside the fences (i.e., it will be a far out value) is 0,7% under a von Mises distribution (see Web Appendix A in Buttarazzi et al., 2018).

Details

The arguments `stack`, `shrink` are parameters passed to `plot.circular`.

Value

farout	a vector of class <code>circular</code> in radians, containing the values of the points lying outside the whiskers.
statistics	a dataframe of summary statistics in degrees: circular median, hinges and whiskers.
constant	the value of the constant used to draw the boxplot.

Author(s)

Davide Buttarazzi

References

Buttarazzi D., Pandolfo G., Porzio G.C. (2018). A boxplot for circular data, *Biometrics*.

Examples

```
# Circular Boxplot on Vanishing directions of homing pigeons
#install.packages("circular")
#install.packages("plotrix")
require(circular)
require(plotrix)
#help(fisherB12c)
data(fisherB12c)
CircularBoxplot(fisherB12c, template="geographics")
```

CircularTukeyDepth *Circular Tukey Depth*

Description

Empirical depth ranking based on Tukey's ranking procedure (Tukey, 1977) adapted to the circular setting (Buttarazzi et al, 2018).

Usage

```
CircularTukeyDepth(x)
```

Arguments

x numeric; a vector of class `circular` in `units=c("degrees", "radians")`

Value

depth a two column matrix of circular observations with corresponding depth value
median the depth-based circular median as an object of class `circular`
iqr the depth-based circular inter-quartile range as an object of class `circular`

Author(s)

Davide Buttarazzi

References

Buttarazzi D., Pandolfo G., Porzio G.C. (2018). A boxplot for circular data, *Biometrics*.
Tukey, J. W. (1977). *Exploratory Data Analysis*. MA: AddisonWesley, Reading (UK).

See Also

`CircularBoxplot`

Examples

```
#install.packages("circular")  
require(circular)  
data1 <- rvonmises(50, circular(pi/2), 5)  
CircularTukeyDepth(data1)
```

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