Package ‘PlotsR’

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Title Plots with R
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Description Makes it possible to perform many different plots using graphical functions of R.
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adworld

Geographical coordinates

Description

Latitude and longitude of all administrative areas.

Usage

data(adworld)

Format

A matrix of many rows and 3 columns (Latitude, Longitude and name of the administrative area)

Source

Latitude and longitude coordinates of the administrative areas were obtained from the web page https://www.openstreetmap.org.
**SIMPLE SCATTER PLOT FOR VARIABLE X QUANTITATIVE**

**Description**

It performs a simple scatter plot with or without text labels and a regression model.

**Usage**

```r
F1(data, varY, varX, textlabel=NULL, label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2=0.95, ci=TRUE, level=0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR="black", COLORR="red", PCH=16, lty=1, ltyci=2, lwd=2.5, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, dec=",", file="Output.txt")
```

**Arguments**

- `data`: Data file.
- `varY`: Dependent variable.
- `varX`: Quantitative independent variable.
- `textlabel`: Variable with the text labels.
- `label`: It allows to specify the characteristics of the text labels with the function text.
- `reg`: If TRUE a regression model is performed.
- `model`: One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
- `outliers`: If it is TRUE, the outliers are removed using the selected regression model.
- `quant1`: Quantile of the lower end to the elimination of outliers.
- `quant2`: Quantile of the upper end to the elimination of outliers.
- `ci`: If it is TRUE the confidence interval is depicted, but only for the linear regression model.
- `level`: Tolerance/confidence level.
- `ResetPAR`: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- `PAR`: It accesses the function PAR that allows to modify many different aspects of the graph.
- `XLAB`: Legend of the X axis.
- `YLAB`: Legend of the Y axis.
- `COLOR`: Color of the symbols.
- `COLORR`: Color of the line of the regression model.
- `PCH`: Graphic symbol (see the figure below).
\texttt{lty} \hspace{1cm} \text{Type of the regression line (see the figure below).}

\texttt{ltyci} \hspace{1cm} \text{Type of the confidence interval line (see above figure).}

\texttt{lwd} \hspace{1cm} \text{Line width of the regression line.}

\texttt{R2.pos} \hspace{1cm} \text{If it is not NULL, with this argument is possible to specify the position of the } r^2 \text{ of the regression in the scatter plot.}

\texttt{PLOT} \hspace{1cm} \text{It allows to specify the characteristics of the function } \texttt{plot.default}.\texttt{.}

\texttt{LEGEND} \hspace{1cm} \text{It allows to include a legend to the graph.}

\texttt{AXIS} \hspace{1cm} \text{It allows to add axes to the graph.}

\texttt{MTEXT} \hspace{1cm} \text{It allows to add text on the margins of the graph.}
TEXT  It allows to add text in any area of the inner part of the graph.
dec  It defines if the comma "," is used as decimal separator or the dot ".".
file  TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.

Details

FUNCTIONS
The plot is performed with the function plot.default of base graphics package and the linear regression with the function lm of base stats package. The function lillie.test of the package nortest (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors' correction, the function dwtest of the package lmtest (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function bptest of the package lmtest (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

EXAMPLES
Example 1 The data are scores of a Principal Component Analysis (PCA) performed to physico-chemical parameters from lakes in Colombia. In this example, text labels are assigned to the points with the argument textlabel="Lake".
Example 2 For the examples, morphometric data of several fish species of Characiforms, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all species.
Example 3 A linear regression line is added to the example 2 with the argument `reg=TRUE`.

In the TXT file that generates the function, the regression model linear is shown, where the variable M11 is significant (p < 0.001, see `Pr(>|t|)`)) and, therefore, the model as a whole was also significant (p < 0.001, see `p-value` at the end of the results).

The $r^2$ (see Multiple R-squared) shows that the M11 explains a 89.4% of the observed variance.
in the M13. The $r^2$ adjusted (see Adjusted R-squared) takes into account the size of the sample to determine the proportion above and, in this case, it is the same. The $r^2$ adjusted should be used to compare models with different numbers of observations or independent variables. The equation of the potential regression model must be expressed in this way: $M_{13} = -0.024 + 1.069 \times M_{11}$

In the following table, the results of the test of Kolmogorov-Smirnov normality with Lilliefors’ correction are shown, the test for autocorrelation of Durbin-Watson statistic and the Breusch-Pagan test of homoscedasticity.

**Normality** The residuals do not have a Normal distribution with $p = 0.073$. Although it is not complied with the assumption of normality, this does not invalidate the model as it is very predictive with a $r^2$ very high. The problem resulting from these residuals are not Normal is that there can be no assurance that the degree of significance, probability value that shows the model, is the correct one.

**Autocorrelation** The requirement that there should be no autocorrelation is no longer met the test of Durbin-Watson statistic $p < 0.001$. This means that the value of $r^2$ of the 89.4% is not all due to the dependent variable, the M11, but it is also in part due to the own dependent variable that is autocorrelated and, therefore, it is not possible to know exactly how much is the variance explained by the independent variable. Anyway it is necessary to mention that the probability value of the test of Durbin-Watson statistic can be less than 0.05 easily when there are many data. The statistical DW, whose value is 0.39 in this example, is a better indicator of the autocorrelation when the number of data is very large. According to Durbin & Watson (1951), a DW less than 1 means a strong positive autocorrelation, a DW greater than 4 a strong negative autocorrelation, values between 1 and 3 a moderate autocorrelation, and a value close to 2 means that there is no autocorrelation. Therefore, it can be concluded that there is a strong positive autocorrelation in this example.

**Homoscedasticity** Finally, the requirement of homoscedasticity of the residuals is not satisfied, because the likelihood of the Breusch-Pagan test is $p < 0.001$. The fact of not fulfilled this requirement means that the model is not as predictive for the entire range of values of the dependent variable.
Value

A simple scatter plot with or without linear regression is obtained. Moreover, a TXT file is saved with the results of the regression model.

References


Examples

## Not run:

#Example 1

data(Z6)
F1(data=Z6, varY="Dimension2", varX="Dimension1", textlabel="Lake", XLAB="Dimension 1", YLAB="Dimension 2", PLOT = c("xlim=c(-1,1)", "xlab=xlab", "ylab=ylab", "col=COLOR", "pch=PCH"))

#Example 2

data(Z1)

F1(data=Z1, varY="M13", varX="M11")

#Example 3

F1(data=Z1, varY="M13", varX="M11", reg=TRUE)

## End(Not run)

---

**F10**

**2D PIE CHARTS**

---

**Description**

It performs 2D pie charts.

**Usage**

F10(data, var, labels, order=NULL, percut=NULL, per=FALSE, ResetPAR=TRUE, PAR=NULL, PIE=NULL, COLOR=NULL, MTEXT= NULL, TEXT=NULL)

**Arguments**

- **data**: Data file.
- **var**: Variable with non-negative data.
- **labels**: Variable with the categories for the slices or a vector with the names.
- **order**: If it is NULL the categories are ordered as found in the variable var, if it is "increasing" are ordered from lesser to greater, if it is "decreasing" are ordered from greater to lesser, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
- **percut**: It is possible to select a percentage threshold and only the categories above the threshold are shown.
- **per**: If it is TRUE the percentage of each category is also shown.
- **ResetPAR**: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function PAR that allows to modify many different aspects of the graph.
- **PIE**: It allows to specify the characteristics of the function pie.
- **COLOR**: Vector with the color of the categories.
- **MTEXT**: It allows to add text on the margins of the graph.
- **TEXT**: It allows to add text in any area of the inner part of the graph.
Details

FUNCTIONS

The plot is performed with the function `pie` of base graphics package. For further details see the help of the function `pie` and/or Guisande & Vammonde (2012).

EXAMPLES

The data are the human population density by sex and age group in Spain for the years 1900 and 1991. Data were obtained from the Spanish Statistical Office [http://www.ine.es](http://www.ine.es).

Example 1. The percentage of males in 1991 by age group is shown.

Example 2. As in the example 1 but showing the percentages of each category in the labels with the argument `per=TRUE`.

![Percentage of males in 1991 by age group in Spain](image)

![Percentage of males in 1991 by age group in Spain](image)
Value

A 2D pie charts is obtained.

References


Examples

```r
## Not run:
data(Z7)
#Example 1
F10(data=Z7, var="M.1991", labels="Age",
 MTEXT = c("text = 'Percentage of males in 1991\n by age group in Spain'",
 "font = 2", "cex=1.5"))
#Example 2
F10(data=Z7, var="M.1991", labels="Age",
 MTEXT = c("text = 'Percentage of males in 1991\n by age group in Spain'",
 "font = 2", "cex=1.5"), per=TRUE)
## End(Not run)
```

---

**F11**

**FAN PLOTS**

Description

It performs fan plots.

Usage

`F11(data, var, labels, percut=NULL, per=FALSE, ResetPAR=TRUE, PAR=NULL,
 FAN=NULL, COLOR=NULL, MTEXT= NULL, TEXT=NULL)`

Arguments

- **data**
  - Data file.
- **var**
  - Variable with non-negative data.
- **labels**
  - Variable with the categories for the slices or a vector with the names for the slices.
- **percut**
  - It is possible to select a percentage threshold and only the categories above the threshold are shown.
per  If it is TRUE the percentage of each category is also shown.

ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and main-
tained those defined by the user in previous graphics.

PAR  It accesses the function PAR that allows to modify many different aspects of the
graph.

FAN  It allows to specify the characteristics of the function fan.plot.

COLOR  Vector with the color of the categories.

MTEXT  It allows to add text on the margins of the graph.

TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the function fan.plot of the package plotrix (Lemon et al., 2015). For
further details see the help of the function fan.plot and/or Guisande & Vammonde (2012).

EXAMPLES
The data are the human population density by sex and age group in Spain for the years 1900 and
1991. Data were obtained from the Spanish Statistical Office http://www.ine.es.

Example 1. The percentage of males by age group in 1900 is shown.

Example 2. As in the example 1 but showing the percentages of each category in the labels with
the argument `per=TRUE` and only the categories with a percentage above 3% with the argument `perct=3`.

Value
A fan plot is obtained.

References


Examples
```r
## Not run:
data(Z7)
#Example 1
```
F12

F12(data=Z7, var="M.1900", labels="Age",
MTEXT = c("text = 'Percentage of males in 1900\nby age group in Spain'",
"font = 2", "cex=1.5"))

#Example 2

F12(data=Z7, var="M.1900", labels="Age",
MTEXT = c("text = 'Percentage of males in 1900\nby age group in Spain'",
"font = 2", "cex=1.5"), percut=3, per=TRUE)

## End(Not run)

---

### 3D PIE CHARTS

**Description**

It performs 3D pie charts.

**Usage**

```r
F12(data, var, labels, percut=NULL, per=FALSE, explode=0.05, ResetPAR=TRUE,
PAR=NULL, PIE3D=NULL, COLOR=NULL, MTEXT=NULL, TEXT=NULL)
```

**Arguments**

- **data**: Data file.
- **var**: Variable with non-negative data.
- **labels**: Variable with the categories for the slices or a vector with the names for the slices.
- **percut**: It is possible to select a percentage threshold and only the categories above the threshold are shown.
- **per**: If it is TRUE the percentage of each category is also shown.
- **explode**: Gap among slices.
- **ResetPAR**: If it is FALSE, the default condition of the function **PAR** is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function **PAR** that allows to modify many different aspects of the graph.
- **PIE3D**: It allows to specify the characteristics of the function **pie3D**.
- **COLOR**: Vector with the color of the categories.
- **MTEXT**: It allows to add text on the margins of the graph.
- **TEXT**: It allows to add text in any area of the inner part of the graph.
Details

FUNCTIONS
The plot is performed with the function `pie3D` of the package plotrix (Lemon et al., 2015). For further details see the help of the function `pie3D` and/or Guisande & Vammonde (2012).

EXAMPLES
The data are the human population density by sex and age group in Spain for the years 1900 and 1991. Data were obtained from the Spanish Statistical Office [http://www.ine.es](http://www.ine.es).

Example 1. The percentage of females by age group in 1900 is shown.

![Image 1](image1.png)

Example 2. As in the example 1 but without gap among slices with the argument `explode=0` and showing the percentages of each category in the labels with the argument `per=TRUE`.

![Image 2](image2.png)

Value
A 3D pie chart is obtained.
References


Examples

## Not run:
data(Z7)

#Example 1

F13(data=Z7, var="F.1900", labels="Age",
MTEXT=c("text = 'Percentage of females in 1900\nby age group in Spain'",
"font = 2", "cex=1.5", "line=-5"))

#Example 2

F13(data=Z7, var="F.1900", labels="Age", explode=0,
MTEXT=c("text = 'Percentage of females in 1900\nby age group in Spain'",
"font = 2", "cex=1.5", "line=-5"), per=TRUE)

## End(Not run)

MULTIPLE SCATTER PLOT FOR VARIABLE X QUANTITATIVE

Description

It performs a multiple scatter plot with or without text labels and a regression model for each category.

Usage

F13(data, varY, varX, group, textlabel=NULL, label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR=NULL, COLORR=NULL, PCH=NULL, CEX=1, lty=NULL, lwd=2.5, PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, dec="", file="Output.txt")
Arguments

data  Data file.
varY  Dependent variable.
varX  Quantitative independent variable.
group  Variable with the categories to be grouped.
textlabel  Variable with the text labels.
label  It allows to specify the characteristics of the text labels with the function text.
reg  If TRUE a regression model is performed.
model  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers  If it is TRUE, the outliers are removed using the selected regression model.
quant1  Quantile of the lower end to the elimination of outliers.
quant2  Quantile of the upper end to the elimination of outliers.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
COLOR  Color of the symbols. It must be as many as different categories of the variable group.
COLORR  Color of the line of the regression model. It must be as many as different categories of the variable group.
PCH  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.
CEX  Size of the symbols.
lty  Type of the regression line (see the description of the same argument in the function F1).
lwd  Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
PLOT  It allows to specify the characteristics of the function plot.default.
LEGEND  It allows to modify the legend of the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
dec  It defines if the comma "," is used as decimal separator or the dot ".".
file  TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.
Details

FUNCTIONS

The plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package. The function `lillie.test` of the package `nortest` (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function `dwtest` of the package `lmtest` (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function `bptest` of the package `lmtest` (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

EXAMPLES

Example 1 The data are scores of a Principal Component Analysis (PCA) performed to physicochemical parameters from lakes in Colombia. In this example, text labels are assigned to the points with the argument `textlabel="Lake"`, and the different regions are identified with the argument `group="Region"`.

Example 2 For the examples, morphometric data of several fish species of Characiforms, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for each genera.
Example 3  A linear regression line is added to the example 2 with the argument `reg=TRUE`.
In the TXT file that generates the function, the regression model of each genera is shown. For the explanation of the regression models, normality, autocorrelation and homoscedasticity see the details section of the function F1.

Value

A multiple scatter plot with or without text labels and regression models for different categories is obtained.

References


Examples

## Not run:

#Example 1

data(Z6)

F13(data=Z6, varY="Dimension2", varX="Dimension1", group="Region", textlabel="Lake", XLAB="Dimension 1", YLAB="Dimension 2", PLOT=c("xlim=c(-1,1)", "xlab=xlab", "ylab=ylab", "col=COLOR", "pch=PCH")

#Example 2

data(Z1)

F13(data=Z1, varY="M13", varX="M11", group="Genus")

#Example 3

F13(data=Z1, varY="M13", varX="M11", group="Genus", reg=TRUE)

## End(Not run)
MULTIPLE MEAN WITH ERROR BARS SCATTER PLOT FOR VARIABLE X QUANTITATIVE WITH TEXT LABELS AND REGRESSION

Description

It performs a multiple mean with error bars scatter plot for variable X quantitative with text labels and a regression model.

Usage

F14(data, varY, varX, Factor, group, method="mean", dev="sd", barY=TRUE, barX=FALSE, textlabel=FALSE, label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLM=NULL, YLM=NULL, COLOR=black, COLORR=NULL, PCH=NULL, CEX=1, lty=1, lwd=2.5, PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, file1="Output.txt", file2="Average and error bars.csv", na=NA, dec=".", row.names=FALSE)

Arguments

data
varY
varX
Factor
group
method
dev
barY
barX
textlabel
label
reg
model

Data file.
Dependent variable.
Quantitative independent variable.
Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.
Variable with the categories to be grouped.
The average of each category of the grouped variable Factor is estimated with the "mean" or the "median".
The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
If it is TRUE the bar error of the variable Y is depicted.
If it is TRUE the bar error of the variable X is depicted.
If TRUE the text labels of the categories of the variable Factor are added to the plot.
It allows to specify the characteristics of the text labels with the function text.
If it is TRUE a regression model is performed for each set of data defined with the argument group.
One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers
If it is TRUE, the outliers are removed using the selected regression model.

quant1
Quantile of the lower end to the elimination of outliers.

quant2
Quantile of the upper end to the elimination of outliers.

ResetPAR
If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB
Legend of the X axis.

YLAB
Legend of the Y axis.

XLIM
Vector with the limits of the X axis.

YLIM
Vector with the limits of the Y axis.

COLOR
Color of the symbols. It must be as many as different categories of the variable group.

COLORI
Color of the error bars.

COLORR
Color of the line of the regression model. It must be as many as different categories of the variable group.

PCH
Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.

CEX
Size of the symbols.

lty
Type of the regression line (see the description of the same argument in the function F1).

lwd
Line width of the regression line relative to the default (default=1), so 2 is twice as wide.

PLOT
It allows to specify the characteristics of the function plot.default.

LEGEND
It allows to modify the legend of the graph.

AXIS
It allows to add axes to the graph.

MTEXT
It allows to add text on the margins of the graph.

TEXT
It allows to add text in any area of the inner part of the graph.

file1
TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.

file2
CSV FILE. File name with the mean, median, standard error and standard deviation for each category of the variable Factor

na
CSV FILES. Text that is used in the cells without data.

dec
CSV FILES. It defines if the comma "," is used as decimal separator or the dot ".".

row.names
CSV FILES. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.
Details

See the equations of all regression models in the section details of the function XI1 of the package StatR.

FUNCTIONS

The plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package. The function `lillie.test` of the package nortest (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors' correction, the function `dwtest` of the package lmtest (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function `bptest` of the package lmtest (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

EXAMPLES

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all genera grouped by families.

Example 1. Relationship between the mean values of M13 and M11 for each genera with the standard deviation of the M11, and grouped by families.

Example 2. As in the example 1 but adding the text labels of the genera with the argument `textlabel=TRUE`. 
Example 3. As in the example 1 but a linear regression line is added for each family with the argument `reg=TRUE`. 
In the TXT file that generates the function, the regression model of each family is shown. For the explanation of the regression models, normality, autocorrelation and homoscedasticity see the details section of the function F1.

Value

A multiple scatter plot with mean error bars, with or without linear regression and with or without text labels is obtained. A CVS file with the mean, median, standard error and standard deviation for each category of the variable Factor is also obtained.

References


Examples

```r
## Not run:
#Example 1

data(Z8)
F14(data=Z8, varY="M11", varX="M13", Factor="Genus", group="Family")

#Example 2

F14(data=Z8, varY="M11", varX="M13", Factor="Genus", group="Family", 
textlabel=TRUE, XLIM=c(0.2,0.8))

#Example 3

F14(data=Z8, varY="M11", varX="M13", Factor="Genus", group="Family", 
reg=TRUE)

## End(Not run)
```
**F15**

**MULTIPLE DOT OR MEAN WITH ERROR BARS SCATTER PLOTS FOR VARIABLE X QUALITATIVE**

---

**Description**

It performs a multiple dot or mean with error bars scatter plots for variable X qualitative.

**Usage**

```R
F15(data, varY, FactorX, group, method="mean", dev="sd", ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORI="black", PCH=NULL, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)
```

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **FactorX**: Qualitative independent variable.
- **group**: Variable with the categories to be grouped.
- **method**: If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".
- **dev**: If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
- **ResetPAR**: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function PAR that allows to modify many different aspects of the graph.
- **order**: If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
- **OrderCat**: It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.
- **LabelCat**: It allows to specify a vector with the names of the categories.
- **XLAB**: Legend of the X axis.
- **YLAB**: Legend of the Y axis.
- **XLIM**: Vector with the limits of the X axis.
- **YLIM**: Vector with the limits of the Y axis.
- **COLOR**: Color of the symbols. It must be as many as different categories of the variable group.
<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLORI</td>
<td>Color of the error bars.</td>
</tr>
<tr>
<td>PCH</td>
<td>Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.</td>
</tr>
<tr>
<td>CEX</td>
<td>Size of the symbols.</td>
</tr>
<tr>
<td>LEGEND</td>
<td>It allows to modify the legend of the graph.</td>
</tr>
<tr>
<td>AXIS</td>
<td>It allows to add axes to the graph.</td>
</tr>
<tr>
<td>MTEXT</td>
<td>It allows to add text on the margins of the graph.</td>
</tr>
<tr>
<td>TEXT</td>
<td>It allows to add text in any area of the inner part of the graph.</td>
</tr>
</tbody>
</table>

**Details**

**FUNCTIONS**

The plot is performed with the functions `boxplot`, `points` and `arrows` of base graphics package. For further details see Guisande & Vammonde (2012).

**EXAMPLES**

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

**Example 1** A dot plot is depicted with the argument `method=NULL` of the variable M11 for all genera of fishes grouped by families. The different genera are ordered from greater to lesser with the argument `order="increasing"`. The legend of the axis X is removed with the argument `XLAB=""`. In the argument `PAR` the argument `las=2` means that the legend of the axis are perpendicular to the axis and the size of the axis labels are modified with the argument `cex.axis=0.62`.

![Graph example](image-url)
Example 2 The mean and the standard deviation of the variable M11 is obtained for each genus.

Value

A multiple dot or mean scatter plots are obtained.

References


Examples

```r
## Not run:

#Example 1
data(Z8)
F15(data=Z8, varY="M11", FactorX="Genus", group="Order", method=NULL, PAR = c("cex.lab = 1.5", "font.lab = 2", "las = 2", "mar = c(5,5,3,2)", "cex.axis=0.62"), order="decreasing", XLAB="", LEGEND = c("x = 'topright'",
```
"legend = dati", "col = COLOR", "pch = PCH", "bty = 'n'")

#Example 2
F15(data=Z8, varY="M11", FactorX="Genus", group="Family", PAR = c("cex.lab = 1.5",
"font.lab = 2", "las = 2", "mar = c(5,5,3,2)", "cex.axis=0.62"), XLAB="",
order="increasing")

## End(Not run)

---

**MULTIPLE DOT OR MEAN WITH ERROR BARS SCATTER PLOT FOR VARIABLE X QUALITATIVE WITH TEXT LABELS**

**Description**

It performs a multiple dot and mean with error bars scatter plots for variable X qualitative with text labels.

**Usage**

F16(data, varY, FactorX, group, label=NULL, method="mean", dev="sd",
ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, 
XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORI="black", 
PCH=NULL, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)

**Arguments**

- **data**
  Data file.
- **varY**
  Dependent variable.
- **FactorX**
  Qualitative independent variable.
- **group**
  Variable with the categories to be grouped.
- **label**
  It allows to specify the characteristics of the text labels with the function text.
- **method**
  If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".
- **dev**
  If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
- **ResetPAR**
  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- **PAR**
  It accesses the function PAR that allows to modify many different aspects of the graph.
- **order**
  If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alhaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
OrderCat: It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

LabelCat: It allows to specify a vector with the names of the categories.

XLAB: Legend of the X axis.

YLAB: Legend of the Y axis.

XLIM: Vector with the limits of the X axis.

YLIM: Vector with the limits of the Y axis.

COLOR: Color of the symbols. It must be as many as different categories of the variable group.

COLORI: Color of the error bars.

PCH: Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.

CEX: Size of the symbols.

LEGEND: It allows to modify the legend of the graph.

AXIS: It allows to add axes to the graph.

MTEXT: It allows to add text on the margins of the graph.

TEXT: It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The plot is performed with the functions boxplot, points and arrows of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

A filter is included to select only the Perciformes.

Example 1 A dot plot is depicted with the argument method=NULL of the variable M11 for all genera of Perciformes grouped by families.
Example 2 The mean and the standard deviation of the variable M11 is obtained for each genus.

Value

A multiple dot or mean scatter plots with text labels are obtained.

References


Examples

```r
## Not run:

data(28)
```
Z8<-subset(Z8,(Order == "Perciformes"))

#Example 1
F16(data=Z8, varY="M11", FactorX="Genus", group="Family", method=NULL)

#Example 2
F16(data=Z8, varY="M11", FactorX="Genus", group="Family")

## End(Not run)

---

**DENSITY PLOT FOR ONE OR SEVERAL VARIABLES**

**Description**

It performs a density plot for one or several variables and the overlap of the area under de curve among variables is also estimated.

**Usage**

```r
F17(data, var, kernel="gaussian", PLOT=NULL, overlap=TRUE, lty=1, lwd=2.5, 
    ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, 
    COLOR=NULL, COLORB=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL, 
    file="Output.csv", na="NA", dec=" ", row.names=FALSE)
```

**Arguments**

- `data` : Data file.
- `var` : Variables.
- `kernel` : A character string giving the smoothing kernel to be used. This must be one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". For further details about the estimation of the density curve see the details section of the function `density` of base stats package.
- `PLOT` : It allows to specify the characteristics of the function `plot.default`.
- `overlap` : If it is TRUE the overlap of the area under the curve among variables is estimated. For further details about the estimation of the area under the curve see the details section of the function `auc` of the package kulife (Ekstrom et al., 2015).
- `lty` : Type of line of the density curve for each variable. If it is a vector, it must be as many as different variables. See the description of the same argument in the function `F1`.
- `lwd` : Line width relative to the default (default=1), so 2 is twice as wide.
<table>
<thead>
<tr>
<th>ResetPAR</th>
<th>If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR</td>
<td>It accesses the function PAR that allows to modify many different aspects of the graph.</td>
</tr>
<tr>
<td>XLAB</td>
<td>Legend of the X axis.</td>
</tr>
<tr>
<td>YLAB</td>
<td>Legend of the Y axis.</td>
</tr>
<tr>
<td>XLIM</td>
<td>Vector with the limits of the X axis.</td>
</tr>
<tr>
<td>YLIM</td>
<td>Vector with the limits of the Y axis.</td>
</tr>
<tr>
<td>COLOR</td>
<td>Color of the density curves. It must be as many as different variables. As the color has transparency, the plot must be copy as bitmap and not metafile.</td>
</tr>
<tr>
<td>COLORB</td>
<td>Color of the lines. It must be as many as different variables.</td>
</tr>
<tr>
<td>LEGEND</td>
<td>It allows to modify the legend of the graph. If it is FALSE the legend is not shown.</td>
</tr>
<tr>
<td>AXIS</td>
<td>It allows to add axes to the graph.</td>
</tr>
<tr>
<td>MTEXT</td>
<td>It allows to add text on the margins of the graph.</td>
</tr>
<tr>
<td>TEXT</td>
<td>It allows to add text in any area of the inner part of the graph.</td>
</tr>
<tr>
<td>file</td>
<td>CSV FILE. File name with the overlap of the area under the curve among variables.</td>
</tr>
<tr>
<td>na</td>
<td>CSV FILE. Text that is used in the cells without data.</td>
</tr>
<tr>
<td>dec</td>
<td>CSV FILE. It defines if the comma &quot;,&quot; is used as decimal separator or the dot &quot;.&quot;.</td>
</tr>
<tr>
<td>row.names</td>
<td>CSV FILE. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.</td>
</tr>
</tbody>
</table>

Details

**FUNCTIONS**

The plot is performed with the function `plot.default` of base graphics package. The density curve is estimated with the function `density` of base stats package. The area under the curve is estimated with the function `auc` of the package kulife (Ekstrom et al., 2015).

**EXAMPLES**

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

**Example 1** A density plot is depicted with the variables M19, M15 and M16.
The overlap of the area under the curve among variables is obtained. The 42.02% of the area of the variable M9 overlaps with the variable M15, the 31.72% of the area of the variable M9 overlaps with the variable M16, the 42.06% of the area of the variable M15 overlaps with the variable M9, etc.

Example 2 A density plot is depicted with the variables M15. The legend is not shown using the argument \texttt{LEGEND=FALSE}.
Value

A density plot for one or several variables and a CSV file with the overlap of the area under the curve among variables are obtained.

References


Examples

```r
## Not run:
data(Z8)

#Example 1
F17(data=Z8, var=c("M9","M15","M16"))

#Example 2
```
Description

It performs a density plot of one variable with different groups and the overlap of the area under the curve among groups is also estimated.

Usage

```r
F18(data, var, group, kernel="gaussian", PLOT=NULL, overlap=TRUE, lty=1, lwd=2.5, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORB=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, file="Output.csv", na="NA", dec="", row.names=FALSE)
```

Arguments

data  Data file.
var   Variables.
group Variable with the categories to be grouped.
kernel A character string giving the smoothing kernel to be used. This must be one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". For further details about the estimation of the density curve see the details section of the function density of base stats package.
PLOT  It allows to specify the characteristics of the function plot.default.
overlap If it is TRUE the overlap of the area under the curve among categories of the variable group is estimated. For further details about the estimation of the area under the curve see the details section of the function auc of the package kulife (Ekstrom et al., 2015).
lty  Type of line of the density curve for each group. If it is a vector, it must be as many as different categories of the variable group. See the description of the same argument in the function F1.
lwd  Line width relative to the default (default=1), so 2 is twice as wide.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
XLAB Legend of the X axis.
YLAB Legend of the Y axis.
XLIM Vector with the limits of the X axis.
YLIM Vector with the limits of the Y axis.
COLOR Color of the density curves. It must be as many as different categories of the variable group. As the color has transparency, the plot must be copy as bitmap and not metafile.
COLORB Color of the lines. It must be as many as different categories of the variable group.
LEGEND It allows to modify the legend of the graph. If it is FALSE the legend is not shown.
AXIS It allows to add axes to the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT It allows to add text in any area of the inner part of the graph.
file CSV FILE. Filename with the overlap of the area under the curve among categories of the variable group.
na CSV FILE. Text that is used in the cells without data.
dec CSV FILE. It defines if the comma "," is used as decimal separator or the dot ".".
row.names CSV FILE. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.

Details

FUNCTIONS
The plot is performed with the function plot.default of base graphics package. The density curve is estimated with the function density of base stats package. The area under the curve is estimated with the function auc of the package kulife (Ekstrom et al., 2015).

EXAMPLES
For the example, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

Example 1 A density plot is depicted for the variable M6 for each family.
The overlap of the area under the curve among families is obtained. The 87.87% of the area of the family Cichlidae overlaps with the family Sparidae, the 9.74% of the area of the family Cichlidae overlaps with the family Characidae, 87.69% of the area of the family Sparidae overlaps with the family Cichlidae, etc.

<table>
<thead>
<tr>
<th>Group1</th>
<th>Overlap</th>
<th>Group2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cichlida</td>
<td>87.872105</td>
<td>Sparidae</td>
</tr>
<tr>
<td>Cichlida</td>
<td>9.738575</td>
<td>Characidae</td>
</tr>
<tr>
<td>Sparidae</td>
<td>87.687612</td>
<td>Cichlidae</td>
</tr>
<tr>
<td>Sparidae</td>
<td>3.569197</td>
<td>Characidae</td>
</tr>
<tr>
<td>Characida</td>
<td>9.733061</td>
<td>Cichlidae</td>
</tr>
<tr>
<td>Characida</td>
<td>3.574681</td>
<td>Sparidae</td>
</tr>
</tbody>
</table>

Value

A density plot for one variable with different groups and a CSV file with the overlap of the area under de curve among groups are obtained.

References


Examples

```r
## Not run:
data(Z8)
F18(data=Z8, var="M6", group="Family")
## End(Not run)
```

**HISTOGRAM WITH ONE OR SEVERAL VARIABLES**

**Description**

It performs a histogram with one or several variables.

**Usage**

```r
F19(data, var, HIST=NULL, HISTh=NULL, breaks=20, varbreak=FALSE, horiz=FALSE, line=FALSE, lty=1, lwd=2.5, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORb="transparent", LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)
```

**Arguments**

- `data`: Data file.
- `var`: Variables.
- `HIST`: It allows to specify the characteristics of the vertical histogram with the function `hist`.
- `HISTh`: It allows to specify the characteristics of the horizontal histogram with the function `barplot`.
- `breaks`: Number of intervals.
- `varbreak`: If it is TRUE the intervals are defined by the variables.
- `horiz`: If it is FALSE, the bars are drawn vertically with the first bar to the left. If it is TRUE, the bars are drawn horizontally with the first at the bottom.
- `line`: If it is TRUE a density line is depicted only if the arguments `varbreak=FALSE` and `horiz=FALSE`.
- `lty`: Type of line of the density curve for each variable. If it is a vector, it must be as many as different variables. See the description of the same argument in the function `F1`.
- `lwd`: Line width relative to the default (default=1), so 2 is twice as wide.
ResetPAR

If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR

It accesses the function PAR that modifies many different aspects of the graph.

XLAB

Legend of the X axis.

YLAB

Legend of the Y axis.

XLIM

Vector with the limits of the X axis.

YLIM

Vector with the limits of the Y axis.

COLOR

Color of the borders. It must be as many as different variables.

COLORb

Color of the bars. It must be as many as different variables.

LEGEND

It modifies the legend of the graph. If it is FALSE the legend is not shown.

AXIS

It allows to add axes to the graph.

MTEXT

It allows to add text on the margins of the graph.

TEXT

It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The histograms are performed with the functions hist and barplot of base graphics package.

EXAMPLES

For the examples, morphometric data of three families of freshwater fishes are used. For details see Guisande et al. (2010).

Example 1 A histogram with the intervals defined by the variables with the argument varbreak=TRUE.
Example 2 A histogram with the intervals defined by the user. The number of intervals may be modified with the argument `breaks`.

Example 3 A density line is added with the argument `line=TRUE`. 
Example 4 A histogram with one variable. The legend is not shown using the argument `LEGEND=FALSE` and the bars are horizontal with the argument `horiz=TRUE`.
Value

A histogram for one or several variables is obtained.

References


Examples

```r
## Not run:
data(Z8)
#Example 1
F19(data=Z8, var=c("M15","M16"), varbreak=TRUE)
#Example 2
F19(data=Z8, var=c("M15","M16"))
```
# Example 3

F19(data=Z8, var=c("M15","M16"), line=TRUE)

# Example 4

F19(data=Z8, var=c("M15"), horiz=TRUE, XLAB="M15", LEGEND=FALSE)

## End(Not run)

---

**HISTOGRAM OF ONE VARIABLE WITH DIFFERENT GROUPS**

**Description**

It performs a histogram of one variable with different groups.

**Usage**

```r
F2(data, var, group, HIST=NULL, HISTh=NULL, breaks=20, varbreak=FALSE, horiz=FALSE, line=FALSE, lty=1, lwd=2.5, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORb="transparent", LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)
```

**Arguments**

- **data**: Data file.
- **var**: Variable.
- **group**: Variable with the categories to be grouped.
- **HIST**: It allows to specify the characteristics of the vertical histogram with the function `hist`.
- **HISTh**: It allows to specify the characteristics of the horizontal histogram with the function `barplot`.
- **breaks**: Number of intervals.
- **varbreak**: If it is TRUE the intervals are defined by different categories of the variable `group`.
- **horiz**: If it is FALSE, the bars are drawn vertically with the first bar to the left. If it is TRUE, the bars are drawn horizontally with the first at the bottom.
- **line**: If it is TRUE a density line is depicted only if the arguments `varbreak=FALSE` and `horiz=FALSE`.
- **lty**: Type of line of the density curve for each variable. If it is a vector, it must be as many as different categories of the variable `group`. See the description of the same argument in the function F1.
- **lwd**: Line width relative to the default (default=1), so 2 is twice as wide.
ResetPAR

If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR

It accesses the function PAR that modifies many different aspects of the graph.

XLAB

Legend of the X axis.

YLAB

Legend of the Y axis.

XLIM

Vector with the limits of the X axis.

YLIM

Vector with the limits of the Y axis.

COLOR

Color of the borders. It must be as many as different categories of the variable group.

COLORb

Color of the bars. It must be as many as different variables.

LEGEND

It modifies the legend of the graph. If it is FALSE the legend is not shown.

AXIS

It allows to add axes to the graph.

MTEXT

It allows to add text on the margins of the graph.

TEXT

It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The histograms are performed with the functions hist and barplot of base graphics package.

EXAMPLES

For the examples, morphometric data of three families of freshwater fishes are used. For details see Guisande et al. (2010).

Example 1 A histogram with the intervals defined by the variables with the argument varbreak=TRUE.
Example 2 An horizontal histogram \((\text{horiz}=\text{TRUE})\) with the intervals defined by the user. The number of intervals may be modified with the argument \text{breaks}.

Example 3 A line is added with the argument \text{line}=\text{TRUE} and the type of line for each group is defined with the argument \text{lty}=c(1,2)
Value

A histogram for one variable with different groups is obtained.

References


Examples

```r
## Not run:

data(Z8)

#Example 1
F2(data=Z8, var="M12", group="Order", varbreak=TRUE)

#Example 2
F2(data=Z8, var="M12", group="Order", horiz=TRUE)

#Example 3
F2(data=Z8, var="M12", group="Order", line=TRUE, lty=c(1,2))
```
**Description**

It performs a dot histogram with one or several variables.

**Usage**

```r
F20(data, var, ResetPAR=TRUE, PAR=NULL, YLAB=NULL, XLIM=NULL,
COLOR=NULL, PCH=16, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)
```

**Arguments**

- `data`: Data file.
- `var`: Variables.
- `ResetPAR`: If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
- `PAR`: It accesses the function `PAR` that allows to modify many different aspects of the graph.
- `YLAB`: Legend of the Y axis.
- `XLIM`: Vector with the limits of the X axis.
- `COLOR`: Color of the dots.
- `PCH`: Graphic symbol (see the description of the same argument in the function `F1`).
- `LEGEND`: It allows to add a legend to the graph.
- `AXIS`: It allows to add axes to the graph.
- `MTEXT`: It allows to add text on the margins of the graph.
- `TEXT`: It allows to add text in any area of the inner part of the graph.

**Details**

**FUNCTIONS**

The dot histogram is performed with the function `dotplot` of the package `epicalc` (Chongsuvivath-wong, 2012).

**EXAMPLES**

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

A dot histogram is depicted for three variables: M11, M15 and M12.
A dot histogram for one or several variables is obtained.

References


Chongsuvivatwong, V. (2012) Epidemiological calculator. R package version 2.15.1.0. Available at: [https://cran.r-project.org/src/contrib/Archive/epicalc/](https://cran.r-project.org/src/contrib/Archive/epicalc/).

Examples

```r
## Not run:
data(Z8)
F20(data=Z8, var=c("M11", "M15", "M16"))

## End(Not run)
```
**DOT HISTOGRAM OF ONE VARIABLE WITH DIFFERENT GROUPS**

**Description**

It performs a dot histogram of one variable with different groups.

**Usage**

```r
F21(data, var, group, ResetPAR=TRUE, PAR=NULL, YLAB=NULL, XLIM=NULL, COLOR=NULL, PCH=16, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)
```

**Arguments**

- `data`: Data file.
- `var`: Variable.
- `group`: Variable with the categories to be grouped.
- `ResetPAR`: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- `PAR`: It accesses the function PAR that allows to modify many different aspects of the graph.
- `YLAB`: Legend of the Y axis.
- `XLIM`: Vector with the limits of the X axis.
- `COLOR`: Color of the dots.
- `PCH`: Graphic symbol (see the description of the same argument in the function F1).
- `LEGEND`: It allows to add a legend to the graph.
- `AXIS`: It allows to add axes to the graph.
- `MTEXT`: It allows to add text on the margins of the graph.
- `TEXT`: It allows to add text in any area of the inner part of the graph.

**Details**

**FUNCTIONS**

The dot histogram is performed with the function dotplot of the package epicalc (Chongsuvivath-wong, 2012).

**EXAMPLES**

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

A dot histogram is depicted for the variable M12 grouping by families.
Value

A dot histogram of one variable with different groups is obtained.

References


Chongsuvivatwong, V. (2012) Epidemiological calculator. R package version 2.15.1.0. Available at: [https://cran.r-project.org/src/contrib/Archive/epicalc/](https://cran.r-project.org/src/contrib/Archive/epicalc/).

Examples

```r
## Not run:
data(Z8)
F21(data=Z8, var="M12", group="Family")
## End(Not run)
```
F22

SIMPLE MEAN WITH ERROR BARS SCATTER PLOT FOR VARIABLE X QUANTITATIVE WITH TEXT LABELS AND REGRESSION

Description

It performs a simple mean with error bars scatter plot for variable X quantitative with text labels and a regression model.

Usage

F22(data, varY, varX, Factor, method="mean", dev="sd", barY=TRUE, barX=FALSE, textlabel=FALSE, label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR="black", COLORI="black", COLORR="red", PCH=16, lty=3, lwd=2.5, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL, file1="Output.txt", file2="Average and error bars.csv", na="NA", dec=".", row.names=FALSE)

Arguments

data Data file.
varY Dependent variable.
varX Quantitative independent variable.
Factor Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.
method The average of each category of the grouped variable Factor is estimated with the "mean" or the "median".
dev The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
barY If it is TRUE the bar error of the variable Y is depicted.
barX If it is TRUE the bar error of the variable X is depicted.
textlabel If TRUE the text labels of the categories of the variable Factor are added to the plot.
label It allows to specify the characteristics of the text labels with the function text.
reg If it is TRUE a regression model is performed.
model One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers If it is TRUE, the outliers are removed using the selected regression model.
quant1  Quantile of the lower end to the elimination of outliers.
quant2  Quantile of the upper end to the elimination of outliers.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and main-
tained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the
       graph.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
XLIM  Vector with the limits of the X axis.
YLIM  Vector with the limits of the Y axis.
COLOR  Color of the symbols.
COLORI  Color of the error bars.
COLORR  Color of the line of the regression model.
PCH  Graphic symbol (see the description of the same argument in the function F1).
lty  Type of the regression line (see the description of the same argument in the
     function F1).
lwd  Line width of the regression line relative to the default (default=1), so 2 is twice
     as wide.
R2.pos  If it is not NULL, with this argument is possible to specify the position of the $r^2$
of the regression in the scatter plot.
PLOT  It allows to specify the characteristics of the function plot.default.
LEGEND  It allows to include a legend to the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
file1  TXT FILE. If the argument reg=TRUE a TXT file is saved with the information
       of the regression.
file2  CSV FILE. File name with the mean, median, standard error and standard devi-
       ation for each category of the variable Factor.
na  CSV FILES. Text that is used in the cells without data.
dec  CSV FILES. It defines if the comma "," is used as decimal separator or the dot
       ".".
row.names  CSV FILES. Logical value that defines if identifiers are put in rows or a vector
            with a text for each of the rows.

Details

See the equations of all regression models in the section details of the function XII of the package StatR.

FUNCTIONS
The plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package. The function `lillie.test` of the package `nortest` (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function `dwtest` of the package `lmtest` (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function `bptest` of the package `lmtest` (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

**EXAMPLES**

For the examples, morphometric data of several fish species of Characiforms are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all genera.

**Example 1** Relationship between the mean values of M13 and M11 for each genera with the standard deviation of the M11.

![Graph showing relationship between M13 and M11](image)

**Example 2** As in the example 1 but adding the text labels of the genera with the argument `textlabel=TRUE`.
Example 3 As in the example 1 but a linear regression line is added with the argument `reg=TRUE` and also is shown the standard deviation on the variable M13 with the argument `barX=TRUE`.

In the TXT file that generates the function, the linear regression linear is shown, where the variable
M13 is significant \((p < 0.001, \text{ see } Pr(>|t|))\) and, therefore, the model as a whole was also significant \((p < 0.001, \text{ see } p\text{-value} \text{ at the end of the results})\).

The \(r^2\) (see Multiple R-squared) shows that the M13 explains a 95.6% of the observed variance in the M11. The \(r^2\) adjusted (see Adjusted R-squared) takes into account the size of the sample to determine the proportion above and, in this case, it shows a lower value 94.9%. The \(r^2\) adjusted should be used to compare models with different numbers of observations or independent variables.

The equation of the potential regression model must be expressed in this way: \(M11 = 0.061 + 0.847 \times M13\)

In the following table, the results of the test of Kolmogorov-Smirnov normality with Lilliefors’ correction, the test for autocorrelation of Durbin-Watson statistic and the Breusch-Pagan test of homoscedasticity are shown.

**Normality** The residuals do have a Normal distribution with \(p = 0.485\). If the assumption of normality is not complied, this would not invalidate the model as it is very predictive with a \(r^2\) very high. The problem resulting from not Normal residuals is that there can be no assurance that the degree of significance, probability value that shows the model, is the correct one.

**Autocorrelation** The requirement that there should be no autocorrelation is also met because in the test of Durbin-Watson statistic \(p = 0.532\). This means that the value of \(r^2\) of the 95.6% is all due to the dependent variable, the M13, so it is not in part due to the own dependent variable that is auto explained. If there is autocorrelation, it is not possible to know exactly how much is the variance explained by the independent variable. Anyway it is necessary to mention that the probability value of the test of Durbin-Watson statistic can be less than 0.05 easily when there are many data. The statistical DW, whose value is 1.97 in this example, is a better indicator of the autocorrelation when the number of data is very large. According to Durbin & Watson (1951), a DW less than 1 means a strong positive autocorrelation, a DW greater than 4 a strong negative autocorrelation, values between 1 and 3 a moderate autocorrelation, and a value close to 2 means that there is no autocorrelation.

**Homoscedasticity** Finally, the requirement of homoscedasticity of the residuals is also satisfied, because the likelihood of the Breusch-Pagan test is \(p = 0.173\). If this requirement is not fulfilled, it means that the model is not as predictive for the entire range of values of the dependent variable.
A simple scatter plot with mean error bars, with or without linear regression and with or without text labels is obtained. A CSV file with the mean, median, standard error and standard deviation for each category of the variable *Factor* is also obtained.

References


Examples

```r
## Not run:

#Example 1

data(Z1)
```

[1] "Normality"

[[4]]

Lilliefors (Kolmogorov-Smirnov) normality test
data:  res
D = 0.1961, p-value = 0.4855

[[5]]
[1] "Autocorrelation"

[[6]]

Durbin-Watson test
data:  reg
DW = 1.9771, p-value = 0.532
alternative hypothesis: true autocorrelation is greater than 0

[[7]]
[1] "Homoscedasticity"

[[8]]

studentized Breusch-Pagan test
data:  reg
BF = 1.8712, df = 1, p-value = 0.1713

Value

A simple scatter plot with mean error bars, with or without linear regression and with or without text labels is obtained. A CSV file with the mean, median, standard error and standard deviation for each category of the variable *Factor* is also obtained.
F22(data=Z1, varY="M11", varX="M13", Factor="Genus")

#Example 2
F22(data=Z1, varY="M11", varX="M13", Factor="Genus", textlabel=TRUE, XLIM=c(0.2,0.8))

#Example 3
F22(data=Z1, varY="M11", varX="M13", Factor="Genus", barX=TRUE, reg=TRUE)

## End(Not run)

---

**F23**  
**SIMPLE DOT AND SCATTER PLOTS FOR VARIABLE X QUALITATIVE**

**Description**

It performs a simple dot or mean with error bars scatter plots for variable X qualitative.

**Usage**

F23(data, varY, FactorX, method="mean", dev="sd", ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR="black", COLORI="black", PCH=16, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)

**Arguments**

- **data**  
  Data file.

- **varY**  
  Dependent variable.

- **FactorX**  
  Qualitative independent variable.

- **method**  
  If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".

- **dev**  
  If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

- **ResetPAR**  
  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

- **PAR**  
  It accesses the function PAR that allows to modify many different aspects of the graph.

- **order**  
  If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
OrderCat It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.
LabelCat It allows to specify a vector with the names of the categories.
XLAB Legend of the X axis.
YLAB Legend of the Y axis.
XLIM Vector with the limits of the X axis.
YLIM Vector with the limits of the Y axis.
COLOR Color of the symbols.
COLORI Color of the error bars.
PCH Graphic symbol (see the description of the same argument in the function F1).
CEX Size of the symbols.
LEGEND It allows to include a legend to the graph.
AXIS It allows to add axes to the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions boxplot, points and arrows of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES
For the examples, morphometric data of several fish species of Characiforms, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

Example 1 A dot plot is depicted with the argument method=NULL of the variable M11 for all genera of fishes.
**Example 2** The mean and the standard deviation of the variable M11 is obtained for each genus.

![Dot or mean scatter plots](image1.png)

**Value**

A dot or mean scatter plots are obtained.

**References**


Examples

## Not run:

#Example 1

data(Z1)

F23(data=Z1, varY="M11", Factor="Genus", method=NULL)

#Example 2

F23(data=Z1, varY="M11", Factor="Genus")

## End(Not run)

---

**F24**  
*SIMPLE MEAN WITH ERROR BARS SCATTER PLOT FOR VARIABLE X QUALITATIVE WITH TEXT LABELS*

**Description**

It performs a simple mean with error bars scatter plot for variable X qualitative with text labels.

**Usage**

F24(data, varY, FactorX, label=NULL, method="mean", dev="sd", ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR="black", COLORI="black", PCH=16, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)

**Arguments**

- **data**  
  Data file.

- **varY**  
  Dependent variable.

- **FactorX**  
  Qualitative independent variable.

- **label**  
  It allows to specify the characteristics of the text labels with the function `text`.

- **method**  
  The average of each category of the independent variable `FactorX` is estimated with the "mean" or the "median".

- **dev**  
  The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

- **ResetPAR**  
  If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.

- **PAR**  
  It accesses the function `PAR` that allows to modify many different aspects of the graph.
order If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alhaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.

OrderCat It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

LabelCat It allows to specify a vector with the names of the categories.

XLAB Legend of the X axis.

YLAB Legend of the Y axis.

XLIM Vector with the limits of the X axis.

YLIM Vector with the limits of the Y axis.

COLOR Color of the symbols.

COLORI Color of the error bars.

PCH Graphic symbol (see the description of the same argument in the function F1).

CEX Size of the symbols.

LEGEND It allows to include a legend to the graph.

AXIS It allows to add axes to the graph.

MTEXT It allows to add text on the margins of the graph.

TEXT It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The plot is performed with the functions boxplot, points and arrows, and the text labels with the function text, all of them of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES

For the examples, morphometric data of several fish species of Characiforms, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

A scatter plot is depicted with the mean value and standar deviation of the variable M11 for all species, showing the species with text labels.
A mean with error bars scatter plot with text labels is obtained.

References


Examples

```r
## Not run:
data(Z1)
F24(data=Z1, varY="M11", FactorX="Species")
## End(Not run)
```

Description

It performs box and whisker plots.
Usage

F25(data, varY, varX, order=NULL, jitter=FALSE, ResetPAR=TRUE, PAR=NULL, OrderCat=NULL, LabelCat=NULL, COLOR=NULL, BOXPLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)

Arguments

data  Data file.
varY   Dependent variable.
varX   Variable with the categories.
order  If it is NULL the categories are ordered as found in the variable varX, if it is "increasing" are ordered from lesser to greater median, if it is "decreasing" are ordered from greater to lesser median, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
jitter If it is TRUE points are added with the function jitter of the base package.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR    It accesses the function PAR that allows to modify many different aspects of the graph.
OrderCat It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.
LabelCat It allows to specify a vector with the names of the categories.
COLOR  Vector with the color of the categories or just one color for all categories.
BOXPLOT It allows to specify the characteristics of the function boxplot.
LEGEND It allows to include a legend to the graph.
AXIS   It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT   It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The plot is performed with the functions boxplot of the graphics package and jitter of the base package.

EXAMPLES

For the examples, morphometric data of several fish species of Characiforms, as the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the length of the dorsal fin base (M12) for all genera.

Example 1. Genera are ordered as found in the varX.
Example 2. Genera are ordered from lesser to greater median with the argument \( \text{order = "increasing"} \) and outliers are removed (in the argument \text{BOXPLOT select outline=FALSE}).

Example 3. Genera are plotted in alphabetical order from A to Z with the argument \( \text{order = "alphaAZ"} \) and a notch is included (in the argument \text{BOXPLOT select notch=TRUE}). If the notches of two plots do not overlap this is an evidence that the two medians differ (Chambers et al, 1983, p. 62). See \text{boxplot.stats} for the calculations used.
Example 4. Genera are ordered from greater to lesser median with the argument (order="decreasing") and the boxes are drawn with widths proportional to the square-roots of the number of observations in the groups (in the argument `BOXPLOT` select `varwidth=TRUE`).

Example 5. As in the example 1 but with the argument `jitter=TRUE`.

Value

A box or whisker plot is obtained.

References


Examples

```r
## Not run:
```
F26(data=Z1, varY="M12", varX="Genus")

F25(data=Z1, varY="M12", varX="Genus", order="increasing",
BOXPLOT = c("outline=FALSE", "col=color", "xlab=varX", "ylab=varY"))

F25(data=Z1, varY="M12", varX="Genus", order="alphaAZ",
BOXPLOT = c("notch=TRUE", "col=color", "xlab=varX", "ylab=varY"))

F25(data=Z1, varY="M12", varX="Genus", order="decreasing",
BOXPLOT = c("varwidth=TRUE", "col=color", "xlab=varX", "ylab=varY"))

F25(data=Z1, varY="M12", varX="Genus", jitter=TRUE)

## End(Not run)

**BEANPLOTS AND STRIPCHARTS**

### Description

It performs beanplots and stripcharts.

### Usage

```
F26(data, varY, varX, order=NULL, side="no", beanlines="median", what=c(1,1,1,1),
border="black", ResetPAR=TRUE, PAR=NULL, OrderCat=NULL, LabelCat=NULL,
COLOR=NULL, BEANPLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)
```

### Arguments

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Variable with the categories.
- **order**: If it is NULL the categories are ordered as found in the variable `varX`, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument `beanlines`, if it is "decreasing" are ordered from
greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A. If the method selected in beanlines="quantiles", it is used the median for both "increasing" and "decreasing".

side
The side on which the beans are plot. Default is "no", for symmetric beans. The options "first", "second" and "both" are also supported.

beanlines
The method used for determining the average bean lines. Default is value "median", and other options are "mean" and "quantiles".

what
A vector of four booleans describing what to plot. In the following order, these booleans stand for the total average line, the beans, the bean average, and the beanlines. For example, what=c(0,0,0,1) produces a stripchart.

border
Color of the border around the bean.

ResetPAR
If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
It accesses the function PAR, allowing to modify different aspects of the graph.

OrderCat
It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

LabelCat
It allows to specify a vector with the names of the categories.

COLOR
Vector with the color of the categories or just one color for all categories.

BEANPLOT
It allows to specify the characteristics of the function beanplot.

LEGEND
It allows to include a legend to the graph.

AXIS
It allows to add axes to the graph.

MTEXT
It allows to add text on the margins of the graph.

TEXT
It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The graph is performed with the function beanplot of the beanplot package (Kampstra, 2008; Kampstra, 2015). For further details see the help of the function beanplot and/or Guisande & Vammonde (2012).

EXAMPLES
For the examples, morphometric data of several fish species of Characiforms, as the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the length of the dorsal fin base (M12) for all genera.

Example 1. Genera are ordered as found in the varX.
**Example 2.** One color for all categories just modifying the argument `COLOR="green"`.

**Example 3.** Genera are ordered from lesser to greater median with the argument `order="increasing"`.

**Example 4.** Genera are plotted in alphabetical order from A to Z with the argument `order="alphaAZ"`. 
Example 5. Genera are depicted in pairs with the argument \( \text{side} = \text{"both"} \).

Example 6. Naked beanplots are depicted modifying the argument \( \text{what} = c(0, 1, 1, 0) \) and \( \text{border} = \text{"transparent"} \).

Example 7. A stripchart is depicted modifying the argument \( \text{what} = c(0, 0, 1, 1) \).
Example 8. With the argument \textit{BEANPLOT} is possible to access the function \texttt{beanplot}, where the argument \texttt{col} is a list with four values: the colors of the area of the beans (without the border, use \texttt{border} for that color), the lines inside the bean, the lines outside the bean and the average line per bean. Therefore, it is possible to modify the color of any of these items, just changing the colors. Moreover, the size of the lines inside the beans, which shows where there are more data within the distribution, it may be modified to a smaller value with the argument \texttt{ll=0.05}, which means that the line width is thinner when there is overlap of data.

Value

A beanplot and stripchart plot is obtained.
References


Examples

```r
## Not run:
data(Z1)

#Example 1.
F26(data=Z1, varY="M12", varX="Genus")

#Example 2.
F26(data=Z1, varY="M12", varX="Genus", COLOR="green")

#Example 3.
F26(data=Z1, varY="M12", varX="Genus", order="increasing")

#Example 4.
F26(data=Z1, varY="M12", varX="Genus", order="alphaAZ")

#Example 5.
F26(data=Z1, varY="M12", varX="Genus", side="both")

#Example 6.
F26(data=Z1, varY="M12", varX="Genus", what=c(0,1,1,0), border="transparent")

#Example 7.
F26(data=Z1, varY="M12", varX="Genus", what=c(0,0,1,1))

#Example 8.
F26(data=Z1, varY="M12", varX="Genus", order="alphaAZ", BEANPLOT = c("col = list(c("red","green","black","black"))", "ll=0.05","
```
"ylab = varY", "xlab = varX", "beanlines=beanlines")

## End(Not run)

---

**GOOGLE GEO MAPS**

**Description**

A geo map is a map of a country, continent, or region map, with colors and values assigned to specific regions.

**Usage**

```r
F27(data, locationvar, numvar, hovervar, region="world",
    showLegend=TRUE, width=1000, height=500, dataMode="regions",
    colors=c("#E0FFD400", "#A5EF6300", "#50AA0000", "#26711400"), chartid)
```

**Arguments**

- **data**
  - Data file.

- **locationvar**
  - Variable with the geo locations to be analyzed. The locations can be provide in two formats:
    - Format 1 "latitude:longitude". See the example 1 below.
    - Format 2 (see example 2 below). Address, country name, region name locations, or US metropolitan area codes, see [http://code.google.com/apis/adwords/docs/developer/adwords_api_us_metros.html](http://code.google.com/apis/adwords/docs/developer/adwords_api_us_metros.html). This format works with the dataMode option set to either "markers" or "regions". The following formats are accepted: A specific address (for example, "1600 Pennsylvania Ave"). A country name as a string (for example, "England"), or an uppercase ISO-3166 code or its English text equivalent (for example, "GB" or "United Kingdom"). An uppercase ISO-3166-2 region code name or its English text equivalent (for example, "US-NJ" or "New Jersey").

- **numvar**
  - Variable with the numeric value displayed when the user hovers over this region.

- **hovervar**
  - Variable with the additional string text displayed when the user hovers over this region.

- **region**
  - The area to display on the map (surrounding areas will be displayed as well). Can be either a country code (in uppercase ISO-3166 format), or one of the following strings described in [https://developers.google.com/chart/interactive/docs/gallery/geomap#Configuration_Options](https://developers.google.com/chart/interactive/docs/gallery/geomap#Configuration_Options):
    - "world" (Whole world)
    - "us_metro" (United States, metro areas)
    - "005" (South America)
    - "013" (Central America)
    - "021" (North America)
"002" (All of Africa)
"017" (Central Africa)
"015" (Northern Africa)
"018" (Southern Africa)
"030" (Eastern Asia)
"034" (Southern Asia)
"035" (Asia/Pacific region)
"143" (Central Asia)
"145" (Middle East)
"151" (Northern Asia)
"154" (Northern Europe)
"155" (Western Europe)
"039" (Southern Europe)

showLegend: If TRUE, display a legend for the map.
width: Width of the visualization.
height: Height of the visualization.
dataMode: How to display values on the map. Two values are supported: "regions" that colors a whole region with the appropriate color, and "markers" that displays a dot over a region, with the color and size indicating the value.
colors: Color gradient to assign to values in the visualization. You must have at least two values.
chartid: Character. If missing (default) a random chart id will be generated based on chart type and tempfile.

Details

The plot obtained is shown as a web page, so internet connection is required. This web page may be saved as complete web page and the HTML file obtained may be used, for instance, in a PowerPoint presentation with a hyperlink. For further information see details section of the function gvisGeoMap.

FUNCTIONS

The plot is performed with the function gvisGeoMap of the package googleVis (Gesmann & de Castillo, 2011; 2015). For further details see the help of the function gvisGeoMap and/or Guisande & Vammonde (2012).

EXAMPLES

Example 1

Magnitude and depth of several earthquakes which have happened around the world. The data were obtained from the web site http://earthquake.usgs.gov/earthquakes/.

In the example the magnitude of the earthquake is shown in a gradient and the depth in km is displayed when the user hovers over the circle.
Example 2

The data are the population size, growth rate and annual population growth of several countries obtained from the web site world gazetter.

In the example the population size of each country is shown in a gradient, and the country and population size is displayed when the user hovers over the country.

Value

See the value section of the function `gvisGeoMap`. 
References


Examples

```r
## Not run:
#Example 1
data(Z4)
F27(data=Z4, locationvar="LatLong", numvar="Magnitude", hovervar="Depth", dataMode="markers")
#Example 2
data(Z5)
F27(data=Z5, locationvar="Country", numvar="Population", hovervar="Country")
## End(Not run)
```

GOOGLE MOTION CHART

Description

A motion chart is a dynamic chart to explore several indicators over time.

Usage

```r
F28(data, idvar, timevar, xvar, yvar, colorvar="", sizevar="", MOTION=NULL)
```

Arguments

- **data**: Data file.
- **idvar**: Variable with the subject to be analysed.
- **timevar**: Variable which shows the time dimension. The information has to be either numeric, of class Date or a character which follows the pattern "YYYYWww" (e.g. "2010W04" for weekly data) or "YYYYQq" (e.g. "2010Q1" for quarterly data).
xvar Variable of X-axis.
yvar Variable of Y-axis.
colorvar The color is assigned according to this variable.
sizevar The size of bubbles is assigned according to this variable.
MOTION It accesses the function `gvisMotionChart` that allows to modify many different aspects of the motion chart.

Details

The plot obtained is shown as a web page, so internet connection is required. For further information see `details` section of the function `gvisMotionChart`.

FUNCTIONS

The plot is performed with the function `gvisMotionChart` of the package `googleVis` (Gesmann & de Castillo, 2011; 2015). For further details see the help of the function `gvisMotionChart` and/or Guisande & Vammonde (2012).

EXAMPLES

Annual demographic parameters from several continents: region, year, percentage of people with an age range from 0 to 14, percentage of people with an age range from 15 to 64, percentage of people older than 65, unemployment older than 65, unemployment younger than 15, growth rate, population size and percentage of women.

The data were obtained from The World Bank (http://www.worldbank.org/).
In the example, the variables are `idvar = "Region"`, `timevar = "Year"`, `xvar = "Population"` and `yvar = "Older65"`.

The bubble plot, barplot and line plot showed in the above figures may be obtained just clicking on the tabs available on the top right corner of the menu (see blue arrow).

In the case of bubble and bar plots, the animation begins playing when you press the Play button.

**Value**

See the value section of the function `gvisMotionChart`.

**References**


**Examples**

```r
## Not run:
```
data(Z3)

F28(data=Z3, idvar="Region", timevar="Year", xvar="Population", yvar="Older65")

## End(Not run)

---

**F29 TAYLOR DIAGRAM**

**Description**

Display a Taylor diagram, which is used to determine the quality of model predictions against the reference values, typically direct observations.

**Usage**

F29(data, ref, models, pos.cor=TRUE, TAYLOR=NULL, ResetPAR=TRUE, PAR=NULL,
COLOR=NULL, PCH=NULL, CEXPCH=1.4, LEGEND=NULL, MTEXT= NULL, TEXT=NULL)

**Arguments**

- **data**
  Data file.
- **ref**
  The reference values, typically observed values.
- **models**
  The predicted values by the models.
- **pos.cor**
  Whether to display only positive (TRUE) or all values of correlation (FALSE).
- **TAYLOR**
  It allows to specify the characteristics of the function taylor.diagram.
- **ResetPAR**
  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- **PAR**
  It accesses the function PAR that allows to modify many different aspects of the graph.
- **COLOR**
  Vector with the color symbol of the models.
- **PCH**
  Vector with the symbols of the graphic. If NULL, they are automatically calculated starting with the symbol 15.
- **CEXPCH**
  Size of the graphic symbols.
- **LEGEND**
  It allows to include a legend to the graph.
- **MTEXT**
  It allows to add text on the margins of the graph.
- **TEXT**
  It allows to add text in any area of the inner part of the graph.
Details

This plot allows to select the best model by plotting all models against a reference values (Taylor, 2011), which are typically the observed values.

Two displays are available. One displays the entire range of correlations from -1 to 1 by setting the argument pos.cor=FALSE. When pos.cor=TRUE, only the range from 0 to 1 will be displayed.

FUNCTIONS

The plot is performed with the function taylor.diagram of the package plotrix (Lemon et al., 2015). For further details see the help of the function taylor.diagram and/or Guisande & Vammonde (2012).

EXAMPLES

The data are monthly values of temperature and temperature predicted by different models. The aim is to determine which is the best model using the Taylor diagram (Taylor, 2001).

In the Taylor diagram, the models are compared based on correlation coefficient, amplitude variation (standard deviation) and the Root-mean-square error (RMS).

The correlation coefficient is shown in the right graph outer arc (values range from -1 to 1 with the argument pos.cor=FALSE and from 0 to 1 with the argument pos.cor=FALSE).

The dotted arcs show the values of the standard deviation (values from 0 to 10 in this example). The arc that is not dotted with an approximate value of 6.35 shows the standard deviation of the observed values and is used as reference. Finally, the arcs with values of 10 and 5, are the RMS.

The best model is the one with a higher coefficient of correlation, a value of RMS smaller and standard deviation closer to the standard deviation of the observed values, which in this example is a line showing a standard deviation of 6.35. Therefore, the model with the blue triangle symbol, model 3, is the most predictive.

Example 1. The first diagram displays the entire range of correlations from -1 to 1 with the argument pos.cor=FALSE).
Example 2. The second diagram displays only the range from 0 to 1 (default option).
Value

A Taylor diagram is obtained.

References


Examples

```r
## Not run:

data(Z2)

#Example 1.
F29(data=Z2, ref="Observed", models=c("Model1","Model2","Model3","Model4"), pos.cor=FALSE)

#Example 2.
F29(data=Z2, ref="Observed", models=c("Model1","Model2","Model3","Model4"))

## End(Not run)
```

### F3 FUNCTION SURFACE PLOTS

Description

Display a function surface plot.

Usage

F3(data, X, Y, func, theta=120, phi=15, ticktype="detailed", PERSP=NULL, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, ZLAB=NULL, XLIM=NULL, YLIM=NULL, ZLIM=NULL, COLOR="red", LEGEND=NULL, MTEXT=NULL, TEXT=NULL)
Arguments

- **data** Data file.
- **X** Variable X.
- **Y** Variable Y.
- **func** Function of the response surface plot.
- **theta** Angle defining the azimuthal direction.
- **phi** Angle defining the colatitude direction.
- **ticktype** Character: "simple" draws just an arrow parallel to the axis to indicate direction of increase and "detailed" draws normal ticks as per 2D plots.
- **PERSP** It allows to specify the characteristics of the function *persp*.
- **ResetPAR** If it is FALSE, the default condition of the function *PAR* is not placed and maintained those defined by the user in previous graphics.
- **PAR** It accesses the function *PAR* that allows to modify many different aspects of the graph.
- **XLAB** Legend of the X axis.
- **YLAB** Legend of the Y axis.
- **ZLAB** Legend of the Z axis.
- **XLIM** Vector with the limits of the X axis.
- **YLIM** Vector with the limits of the Y axis.
- **ZLIM** Vector with the limits of the Z axis.
- **COLOR** Color of the surface.
- **LEGEND** It allows to include a legend to the graph.
- **MTEXT** It allows to add text on the margins of the graph.
- **TEXT** It allows to add text in any area of the inner part of the graph.

Details

**FUNCTIONS**

The plot is performed with the function *persp* of the base package graphics. For further details see the help of the function *persp* and/or Guisande & Vammonde (2012).

**EXAMPLES**

Example 1. Function $x^2 + y^2 + 1$. 


Example 2. Function $x^2 - y^2$. 

$\begin{align*}
x^2 - y^2 &= 3.0 \\
x \in [-1.0, 1.0] \\
y \in [-1.0, 1.0] \\
z \in [0.0, 3.0]
\end{align*}$
Example 3. Function $x^3 - y^2$.

Example 4. Function $x^3 + y^3$ and the azimuthal direction is modified with the argument $\theta=150$. 
**Value**

A function surface plot is obtained.

**References**


**Examples**

```r
## Not run:
data(Z9)
#Example 1
F3(data=Z9, X="x", Y="y", func="x^2 + y^2 + 1")
#Example 2
F3(data=Z9, X="x", Y="y", func="x^2 - y^2", COLOR="green")
#Example 3
F3(data=Z9, X="x", Y="y", func="x^3 - y^2", COLOR="orange")
#Example 4
F3(data=Z9, X="x", Y="y", func="x^3 + y^3", theta=150, COLOR="grey80")
## End(Not run)
```

**Description**

Display a 3D surface plot.

**Usage**

`F30(data, X, Y, Z, matrix=FALSE, theta=120, phi=20, ticktype="detailed", shade=0.5, scale=TRUE, PERSP=NULL, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, ZLAB=NULL, XLIM=NULL, YLIM=NULL, ZLIM=NULL, COLOR="white", LEGEND=NULL, MTEXT= NULL, TEXT=NULL)`
Arguments

- **data**:
  Data file.

- **X**:
  Variable X.

- **Y**:
  Variable Y.

- **Z**:
  Variable Z.

- **matrix**:
  If it is TRUE the variable Z has the format of a matrix and if it is FALSE (default) the variable Z has the format of a column.

- **theta**:
  Angle defining the azimuthal direction.

- **phi**:
  Angle defining the colatitude direction.

- **ticktype**:
  Character: "simple" draws just an arrow parallel to the axis to indicate direction of increase and "detailed" draws normal ticks as per 2D plots.

- **shade**:
  Values of shade close to one yield shading similar to a point light source model and values close to zero produce no shading. Values in the range 0.5 to 0.75 provide an approximation to daylight illumination.

- **scale**:
  If it is TRUE the X, Y and Z variables are transformed separately. If scale is FALSE the coordinates are scaled so that aspect ratios are retained.

- **PERSP**:
  It allows to specify the characteristics of the function `persp`.

- **ResetPAR**:
  If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.

- **PAR**:
  It accesses the function `PAR` that allows to modify many different aspects of the graph.

- **XLAB**:
  Legend of the X axis.

- **YLAB**:
  Legend of the Y axis.

- **ZLAB**:
  Legend of the Z axis.

- **XLIM**:
  Vector with the limits of the X axis.

- **YLIM**:
  Vector with the limits of the Y axis.

- **ZLIM**:
  Vector with the limits of the Z axis.

- **COLOR**:
  Color of the surface.

- **LEGEND**:
  It allows to include a legend to the graph.

- **MTEXT**:
  It allows to add text on the margins of the graph.

- **TEXT**:
  It allows to add text in any area of the inner part of the graph.

Details

**FUNCTIONS**

The plot is performed with the function `persp` of the base package graphics. In the case of the variable Z with a column format, the matrix is obtained using the function `interp` of the package akima (Akima et al., 2015). For further details see the help of the functions `persp`, `link[akima]interp` and/or Guisande & Vammonde (2012).

**EXAMPLES**

**Example 1.** Altitude in the Himalayan region, with the altitude (variable Z) in a matrix format.
**Example 2.** Depth in a coastal area close to Japan, with the depth (variable Z) in a column format (argument `matrix=TRUE`).

**Value**

A 3D surface plot is obtained.

**References**


Examples

## Not run:

# Example 1

```r
data(Z10)
matrix=TRUE, scale=FALSE, ZLAB="Altitude (km)"
```
# Example 2

data(Z11)

F30(data=Z11, X="Latitude", Y="Longitude", Z="Depth", shade=1)

## End(Not run)

---

**F31**

**3D SURFACE GRADIENT PLOTS**

**Description**

Display a 3D surface gradient plot with variable Z as a column.

**Usage**

```r
F31(data, X, Y, Z, theta=120, phi=20, ticktype="detailed", scale=TRUE,
type="mgcv", DPlot=NULL, ResetPAR=TRUE, PAR=NULL, Xlab=NULL, Ylab=NULL,
Zlab=NULL, Xlim=NULL, Ylim=NULL, Zlim=NULL, Color=rainbow, Legend=NULL,
Mtext=NULL, Text=NULL)
```

**Arguments**

- **data**: Data file.
- **X**: Variable X.
- **Y**: Variable Y.
- **Z**: Variable Z.
- **theta**: Angle defining the azimuthal direction.
- **phi**: Angle defining the colatitude direction.
- **ticktype**: Character: "simple" draws just an arrow parallel to the axis to indicate direction of increase and "detailed" draws normal ticks as per 2D plots.
- **scale**: If it is TRUE the X, Y and Z variables are transformed separately. If scale is FALSE the coordinates are scaled so that aspect ratios are retained.
- **type**: Type of interpolation method. The options are "akima", "mba" and "mgcv". For details see the same argument of the plot3d.
- **DPlot**: It allows to specify the characteristics of the function plot3d.
- **ResetPAR**: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function PAR that allows to modify many different aspects of the graph.
- **Xlab**: Legend of the X axis.
- **Ylab**: Legend of the Y axis.
ZLAB       Legend of the Z axis.
XLIM       Vector with the limits of the X axis.
YLIM       Vector with the limits of the Y axis.
ZLIM       Vector with the limits of the Z axis.
COLOR      Color of the surface.
LEGEND     It allows to include a legend to the graph.
MTEXT      It allows to add text on the margins of the graph.
TEXT       It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the function plot3d of the base package graphics R2BayesX (Umlauf et al., 2015a; 2015b).

EXAMPLES
Example 1. Geographical records and altitude of fish freshwater species of the genus Cyphocharax.
**Example 2.** Depth in a coastal area close to Japan.

![Depth Surface Plot](image)

**Value**

A 3D surface gradient plot is obtained.

**References**


**Examples**

```r
## Not run:

#Example 1
```
data(Z12)

F31(data=Z12, X="Latitude", Y="Longitude", Z="Altitude")

#Example 2

data(Z11)

F31(data=Z11, X="Latitude", Y="Longitude", Z="Depth")

## End(Not run)

---

**LINE CHARTS FOR VARIABLE X QUANTITATIVE**

**Description**

It performs a simple line chart with or without text labels and a regression model.

**Usage**

F32(data, varY, varX, textlabel=NULL, type="b", label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ci=TRUE, level=0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR="black", COLORR="red", PCH=16, lty=1, ltyci=2, ltyL=1, lwd=2.5, lwdL=1, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL, dec=",", file="Output.txt")

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Quantitative independent variable.
- **textlabel**: Variable with the text labels.
- **type**: Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
- **label**: It allows to specify the characteristics of the text labels with the function text.
- **reg**: If TRUE a regression model is performed.
- **model**: One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers If it is TRUE, the outliers are removed using the selected regression model.
quant1 Quantile of the lower end to the elimination of outliers.
quant2 Quantile of the upper end to the elimination of outliers.
ci If it is TRUE the confidence interval is depicted, but only for the linear regression model.
level Tolerance/confidence level.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR It accesses the function PAR that allows to modify many different aspects of the graph.
XLAB Legend of the X axis.
YLAB Legend of the Y axis.
COLOR Color of the symbols.
COLORR Color of the line of the regression model.
PCH Graphic symbol (see the description of the same argument in the function F1).
lty Type of the regression line (see the description of the same argument in the function F1).
ltyci Type of the confidence interval line (see figure of the argument lty in the function F1).
ltyL Type of the line chart (see figure of the argument lty in the function F1).
lwd Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
lwdL Line width of the chart relative to the default (default=1), so 2 is twice as wide.
R2.pos If it is not NULL, with this argument is possible to specify the position of the $r^2$ of the regression in the scatter plot.
PLOT It allows to specify the characteristics of the function plot.default.
LEGEND It allows to include a legend to the graph.
AXIS It allows to add axes to the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT It allows to add text in any area of the inner part of the graph.
dec It defines if the comma "," is used as decimal separator or the dot ".".
file TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.

Details

FUNCTIONS

The plot is performed with the function plot.default of base graphics package and the linear regression with the function lm of base stats package. The function lillie.test of the package nortest (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function dwtest of the package lmtest (Hothorn et al., 2013) to analyze the autocorrelation with the
test and the Durbin-Watson statistic function `bptest` of the package lmtest (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

**EXAMPLES** The data are monthly mean temperature for 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo. They were obtained from the Agencia Estatal de Meteorología of Spain [http://www.aemet.es/es/portada](http://www.aemet.es/es/portada).

**Example 1** Monthly temperature in Palma de Mallorca in the year 2000. Text labels are assigned to the points with the argument `textlabel="Season"`. Moreover, a different color is assigned to each text label using a variable with colors.

![Example 1](image1.png)

**Example 2** Monthly temperature in Huelva in the year 2000 without text labels.

![Example 2](image2.png)
Example 3 A linear regression line is added with the argument `reg=TRUE`.
A simple line chart with or without linear regression is obtained.

References


Examples

```r
## Not run:

#Example 1
```
data(Z13)

data<-subset(Z13,(City == "Palma de Mallorca") & (Year == 2000))

color<-as.character(data[,"Color"])

F32(data=data, varY="Temperature", varX="Month", textlabel="Season", label = c("pos = 3", "col = color"), TEXT = c("x = 3", "y=25", "labels = 'Palma de Mallorca\n2000'", "font=2", "cex=1.3"))

#Example 2

data(Z13)

data<-subset(Z13,(City == "Huelva") & (Year == 2000))

F32(data=data, varY="Temperature", varX="Month", COLOR="red", ltyL=2, TEXT = c("x = 2", "y=25", "labels = 'Huelva\n2000'", "font=2", "cex=1.3"))

#Example 3

data(Z13)

data<-subset(Z13,(City == "Vigo") & (Year == 1990))

F32(data=data, varY="Temperature", varX="Month", reg=TRUE, model="Cubic", COLOR="red", COLORR="black", ltyL=2, TEXT=c("x=11.5", "y=20", "labels = 'Vigo\n1990'", "font=2", "cex=1.3"))

## End(Not run)

F33

SIMPLE LINE CHARTS WITH ERROR BARS, TEXT LABELS AND REGRESSION FOR VARIABLE X QUANTITATIVE

Description

It performs a simple mean with error bars line chart for variable X quantitative with text labels and a regression model.

Usage

F33(data, varY, varX, Factor, method="mean", type="b", dev="sd", barY=TRUE, barX=FALSE, textlabel=FALSE, label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR="black", COLORR="black", COLORR="red", PCH=16, lty=3, ltyL=1, lwd=2.5, lwdL=1, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL, file1="Output.txt", file2="Average and error bars.csv", na="NA", dec=",", row.names=FALSE)
Arguments

data  Data file.
varY  Dependent variable.
varX  Quantitative independent variable.
Factor  Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.
method  The average of each category of the grouped variable Factor is estimated with the "mean" or the "median".
type  Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
dev  The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
barY  If it is TRUE the bar error of the variable Y is depicted.
barX  If it is TRUE the bar error of the variable X is depicted.
textlabel  If TRUE the text labels of the categories of the variable Factor are added to the plot.
label  It allows to specify the characteristics of the text labels with the function text.
reg  If it is TRUE a regression model is performed.
model  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers  If it is TRUE, the outliers are removed using the selected regression model.
quant1  Quantile of the lower end to the elimination of outliers.
quant2  Quantile of the upper end to the elimination of outliers.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
XLIM  Vector with the limits of the X axis.
YLIM  Vector with the limits of the Y axis.
COLOR  Color of the symbols.
COLORI  Color of the error bars.
COLORR  Color of the line of the regression model.
PCH    Graphic symbol (see the description of the same argument in the function F1).
1ty    Type of the regression line (see the description of the same argument in the function F1).
1tyL   Type of the line chart (see figure of the argument lty in the function F1).
lwd   Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
lwdL  Line width of the chart relative to the default (default=1), so 2 is twice as wide.
R2.pos If it is not NULL, with this argument is possible to specify the position of the $r^2$ of the regression in the scatter plot.
PLOT   It allows to specify the characteristics of the function plot.default.
LEGEND It allows to include a legend to the graph.
AXIS   It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT   It allows to add text in any area of the inner part of the graph.
file1 TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.
file2 CSV FILE. File name with the mean, median, standard error and standard deviation for each category of the variable Factor.
na    CSV FILES. Text that is used in the cells without data.
dec   CSV FILES. It defines if the comma "," is used as decimal separator or the dot ".".
row.names CSV FILES. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.

Details

See the equations of all regression models in the section details of the function XI1 of the package StatR.

FUNCTIONS

The plot is performed with the function plot.default of base graphics package
The linear regression with the function lm of base stats package.
The function lillie.test of the package nortest (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction
The function dwtest of the package lmtest (Hothorn et al., 2013) to analyze the autocorrelation with the test
The Durbin-Watson statistic function bptest of the package lmtest (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

EXAMPLES

For the examples, weight and height of children aged 2-5 years are used.

Example 1 Relationship between the mean values of weight and height for each age.
Example 2 As in the example 1 but adding the text labels of the age with the argument `textlabel=TRUE`.

Example 3 As in the example 1 but a linear regression line is added with the argument `reg=TRUE` and also is shown the standard deviation on the variable height with the argument `barX=TRUE`. 
In the TXT file that generates the function, the linear regression linear is shown, where the variable height is significant (p < 0.001, see Pr(>|t|)) and, therefore, the model as a whole was also significant (p < 0.001, see p-value at the end of the results).

The $r^2$ (see Multiple R-squared) shows that height explains a 99.6% of the observed variance in the weight. The $r^2$ adjusted (see Adjusted R-squared) takes into account the size of the sample to determine the proportion above and, in this case, it shows a lower value 99.4%. The $r^2$ adjusted should be used to compare models with different numbers of observations or independent variables.

The equation of the potential regression model must be expressed in this way: $\text{Weight} = -10.97 + 0.2698 \times \text{Height}$

```
[1] "LINEAR REGRESSION"
[[2]]
Call:
  lm(formula = fo, data = datos2)

Residuals:
          1          2          3          4
-0.0003744 -0.1482920  0.2569195 -0.1082531

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)  -10.97154   1.17979  -9.300   0.01137 *
Height         0.26980   0.01217   22.167  0.000203 **
---
Signif. codes:  0 '****' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2233 on 2 degrees of freedom
Multiple R-squared:  0.9959,    Adjusted R-squared:  0.9939
F-statistic: 491.7 on 1 and 2 DF,  p-value: 0.002028
```
In the following table, the results of the test of Kolmogorov-Smirnov normality with Lilliefors’ correction, the test for autocorrelation of Durbin-Watson statistic and the Breusch-Pagan test of homoscedasticity are shown.

**Normality** The test of Kolmogorov-Smirnov normality with Lilliefors’ correction is not shown because the number of values is lower than 5.

**Autocorrelation** The requirement that there should be no autocorrelation is met because in the test of Durbin-Watson statistic $p = 0.7697$. This means that the value of $r^2$ of the 99.6% is all due to the dependent variable, the height, so it is not in part due to the own dependent variable that is auto explained. If there is autocorrelation, it is not possible to know exactly how much is the variance explained by the independent variable. Anyway it is necessary to mention that the probability value of the test of Durbin-Watson statistic can be less than 0.05 easily when there are many data. The statistical DW, whose value is 3.2 in this example, is a better indicator of the autocorrelation when the number of data is very large. According to Durbin & Watson (1951), a DW less than 1 means a strong positive autocorrelation, a DW greater than 4 a strong negative autocorrelation, values between 1 and 3 a moderate autocorrelation, and a value close to 2 means that there is no autocorrelation.

**Homoscedasticity** Finally, the requirement of homoscedasticity of the residuals is also satisfied, because the likelihood of the Breusch-Pagan test is $p = 0.553$. If this requirement is not fulfilled, it means that the model is not as predictive for the entire range of values of the dependent variable.

Value

A simple line chart with mean error bars, with or without linear regression and with or without text labels is obtained. A CVS file with the mean, median, standard error and standard deviation for each category of the variable *Factor* is also obtained.

References

Examples

## Not run:

#Example 1

data(Z14)

F33(data=Z14, varY="Weight", varX="Height", Factor="Age", XLAB="Height (cm)",
YLAB="Weight (kg)")

#Example 2

data(Z14)

F33(data=Z14, varY="Weight", varX="Height", Factor="Age", xlabel=TRUE,
XLAB="Height (cm)", YLAB="Weight (kg)")

#Example 3

data(Z14)

F33(data=Z14, varY="Weight", varX="Height", Factor="Age", barX=TRUE,
reg=TRUE, XLAB="Height (cm)", YLAB="Weight (kg)")

## End(Not run)

Description

It performs a simple dot line chart with mean and error bars for variable X qualitative.

Usage

F34(data, varY, FactorX, method="mean", dev="sd", type="b", ResetPAR=TRUE,
PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL,
XLIM=NULL, YLIM=NULL, COLOR="black", COLORI="black", PCH=16, ltyL=1,
lwdL=1, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)
Arguments

data  Data file.
varY  Dependent variable.
FactorX  Qualitative independent variable.
method  If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".
dev  If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

type  Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
order  If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
OrderCat  It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.
LabelCat  It allows to specify a vector with the names of the categories.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
XLIM  Vector with the limits of the X axis.
YLIM  Vector with the limits of the Y axis.
COLOR  Color of the symbols.
COLORI  Color of the error bars.
PCH  Graphic symbol (see the description of the same argument in the function F1).
ltyL  Type of the line chart (see figure of the argument lty in the function F1).
lwdL  Line width of the chart relative to the default (default=1), so 2 is twice as wide.
CEX  Size of the symbols.
LEGEND  It allows to include a legend to the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
Details

FUNCTIONS

The plot is performed with the functions `boxplot`, `points` and `arrows` of base graphics package.

EXAMPLES

In an experiment conducted with expert tasters and people who had no experience tasting, they were taught to identify 15 types of wines from different regions.

Variations in ability to ascertain the wine provenance over time (after one hour, one day, one week and one month) was measured between experts and non-experts.

For every time, each person assessed a large number of samples and the degree of success was recorded on a scale of 0 to 12.

Example 1 A dot plot is depicted with the argument `method=NULL` of the variable `Success` over time.

Example 2 The mean and the standard deviation of the variable `Success` is obtained for each time.
Value

A dot or mean error bar line charts are obtained.

Examples

## Not run:

#Example 1

data(Z15)

F34(data=Z15, varY="Success", FactorX="Time", method=NULL)

#Example 2

F34(data=Z15, varY="Success", FactorX="Time")

## End(Not run)
**Description**

It performs a simple mean with error bars line chart for variable X qualitative with text labels.

**Usage**

\[
\text{F35}(\text{data}, \text{varY}, \text{FactorX}, \text{label}=\text{NULL}, \text{method}="\text{mean}" , \text{dev}="\text{sd}" , \text{type}="\text{b}" ,
\text{ResetPAR}=\text{TRUE}, \text{PAR}=\text{NULL}, \text{order}=\text{NULL}, \text{OrderCat}=\text{NULL}, \text{LabelCat}=\text{NULL},
\text{XLAB}=\text{NULL}, \text{YLAB}=\text{NULL}, \text{XLIM}=\text{NULL}, \text{YLIM}=\text{NULL}, \text{COLOR}="\text{black}" , \text{COLORI}="\text{black}" ,
\text{PCH}=16, \text{ltyL}=1, \text{lwdL}=1, \text{CEX}=1, \text{LEGEND}=\text{NULL}, \text{AXIS}=\text{NULL}, \text{MTEXT}=\text{NULL}, \text{TEXT}=\text{NULL})
\]

**Arguments**

- **data** Data file.
- **varY** Dependent variable.
- **FactorX** Qualitative independent variable.
- **label** It allows to specify the characteristics of the text labels with the function `text`.
- **method** The average of each category of the independent variable `FactorX` is estimated with the "mean" or the "median".
- **dev** The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
- **type** Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
- **ResetPAR** If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
- **PAR** It accesses the function `PAR` that allows to modify many different aspects of the graph.
- **order** If it is NULL the categories are ordered as found in the variable `FactorX`, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument `method`, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
- **OrderCat** It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument `order` is not taken into account.
- **LabelCat** It allows to specify a vector with the names of the categories.
- **XLAB** Legend of the X axis.
- **YLAB** Legend of the Y axis.
- **XLIM** Vector with the limits of the X axis.
- **YLIM** Vector with the limits of the Y axis.
- **COLOR** Color of the symbols.
- **COLORI** Color of the error bars.
PCH  Graphic symbol (see the description of the same argument in the function F1).

ltyL  Type of the line chart (see figure of the argument lty in the function F1).

lwdL  Line width of the chart relative to the default (default=1), so 2 is twice as wide.

CEX  Size of the symbols.

LEGEND  It allows to include a legend to the graph.

AXIS  It allows to add axes to the graph.

MTEXT  It allows to add text on the margins of the graph.

TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions boxplot, points and arrows, and the text labels with the function text, all of them of base graphics package.

EXAMPLES
In an experiment conducted with expert tasters and people who had no experience tasting, they were taught to identify 15 types of wines from different regions. Variations in ability to ascertain the wine provenance over time (after one hour, one day, one week and one month) was measured between experts and non-experts. For every time, each person assessed a large number of samples and the degree of success was recorded on a scale of 0 to 12.

The mean and the standard deviation of the variable Success is obtained for each time, showing each time with text labels.
Value

A mean with error bars line chart with text labels is obtained.

Examples

```r
## Not run:
data(Z15)
F35(data=Z15, varY="Success", Factor="Time")
## End(Not run)
```

Description

It performs a multiple line chart with or without text labels and a regression model for each category.
Usage

F36(data, varY, varX, group, textlabel=NULL, type="b", label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR=NULL, COLORR=NULL, PCH=NULL, CEX=1, lty=NULL, lwd=2.5, ltyL=NULL, lwdL=1, PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, dec=",", file="Output.txt")

Arguments

data
  Data file.

varY
  Dependent variable.

varX
  Quantitative independent variable.

group
  Variable with the categories to be grouped.

textlabel
  Variable with the text labels.

type
  Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.

label
  It allows to specify the characteristics of the text labels with the function text.

reg
  If TRUE a regression model is performed.

model
  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.

outliers
  If it is TRUE, the outliers are removed using the selected regression model.

quant1
  Quantile of the lower end to the elimination of outliers.

quant2
  Quantile of the upper end to the elimination of outliers.

ResetPAR
  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
  It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB
  Legend of the X axis.

YLAB
  Legend of the Y axis.

COLOR
  Color of the symbols. It must be as many as different categories of the variable group.

COLORR
  Color of the line of the regression model. It must be as many as different categories of the variable group.

PCH
  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.

CEX
  Size of the symbols.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>lty</code></td>
<td>Type of the regression line (see the description of the same argument in the function <code>F1</code>).</td>
</tr>
<tr>
<td><code>lwd</code></td>
<td>Line width of the regression line.</td>
</tr>
<tr>
<td><code>ltyL</code></td>
<td>Type of the line chart (see figure of the argument <code>lty</code> in the function <code>F1</code>).</td>
</tr>
<tr>
<td><code>lwdL</code></td>
<td>Line width of the line chart.</td>
</tr>
</tbody>
</table>

**Details**

**FUNCTIONS**

The plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package. The function `lillie.test` of the package `nortest` (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function `dwtest` of the package `lmtest` (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function `bptest` of the package `lmtest` (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

**EXAMPLES**

The data are monthly mean temperature for 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo. They were obtained from the Agencia Estatal de Meteorologia of Spain [http://www.aemet.es/es/portada](http://www.aemet.es/es/portada).

**Example 1** Monthly temperature in the three cities in the year 2000. Text labels are assigned to the points with the argument `textlabel="SeasonA"`.
Example 2 Monthly temperature in Huelva for the years 1990 and 2000 without text labels.

Example 3 A cubic regression line is added with the argument `reg=TRUE` and `Cubic`. 
In the TXT file that generates the function, the regression model for each city is shown. For the explanation of the regression models, normality, autocorrelation and homoscedasticity see the details section of the function F1.

**Value**

A multiple line chart with or without text labels and regression models for different categories is obtained.

**References**


**Examples**

```r
## Not run:
```
# Example 1

data(Z13)

data<-subset(Z13,(Year == 2000))

F36(data=data, varY="Temperature", varX="Month", group="City", textlabel="SeasonA", TEXT = c("x = 11", "y=25", "labels = 'Year 2000'", "font=2", "cex=1.3"))

# Example 2

data(Z13)

data<-subset(Z13,(City == "Huelva"))

F36(data=data, varY="Temperature", varX="Month", group="Year", TEXT = c("x=11", "y=25", "labels='Huelva'", "font=2", "cex=1.3"))

# Example 3

data(Z13)

data<-subset(Z13,(Year == 1990))

F36(data=data, varY="Temperature", varX="Month", group="City", reg=TRUE, model="Cubic", TEXT = c("x=11", "y=25", "labels='Year 1990'", "font=2", "cex=1.3"))

## End(Not run)

**OPTIMAL ENVIRONMENTAL DIAGRAMS**

Description

This function allows to show in a plot the environmental conditions were there are a higher number of records of one or several species, so it is possible to determine the niche conditions of one or several species and, to create boxplots with the range of environmental variables and list of species in an area of the niche selected by the user.

Usage

F37(data, variables, Level="NULL", Taxon="NULL", cor=TRUE, ResetPAR=TRUE, PAR=NULL, d.main=0.5, xlab="Polar coordinate X in pixels", ylab="Polar coordinate Y in pixels", cex.labS=1.5, font.lab=1, main="", colramp = IDPcolorRamp, cex.main = 2, font.main=2, nlab.xaxis = 5, nlab.yaxis = 5, minL.axis = 3, las = 1, border = FALSE, tcl = -0.3, boxplot=TRUE, outline=FALSE, color="NULL", range = 1.5, width = NULL, varwidth = FALSE, plot = TRUE, pars = list(boxwex = 0.8, staplewex = 0.5, outwex = 0.5), cex.boxplot=1.5,}
cex.labB=1.5, namesB, family="serif", line=1, file1="List of species.csv", file2="Environmental variables.csv", na="NA", dec="", row.names=FALSE, fileEncoding = "")

Arguments

data             A CSV file obtained from ModestR (García-Roselló et al., 2013) with data which show the presence of the species and abiotic and/or biotic factors.
variables         Selection of the variables for the estimation of the niche.
Level             Taxonomic level to be selected, i.e., class, order, family, genus or species.
Taxon             Name of the taxon or taxa selected within the level, i.e., name of the Order, Family, etc. Can be a vector, so several taxa.
cor               If TRUE the variables are ordered according to the correlation between them when estimating the polar coordinates. Therefore, the next variable to another variable is the one that has a greater positive correlation.
ResetPAR          If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR               It accesses the function PAR that allows to modify many different aspects of the graph.
d.main            Scatter plot. Vertical distance between upper border of scatter plots and the title line in multiples of title height.
xlab             Scatter plot. Label for x-axis.
ylab             Scatter plot. Label for y-axis.
cex.labS          Scatter plot. Magnification used for text in axis labels relative to the current setting of cex.
font.lab          Scatter plot. The font to be used for x and y labels.
main             Scatter plot. Title of the plot.
colramp          Scatter plot. Color ramp to encode the number of counts within a pixel.
cex.main          Scatter plot. Magnification used for title relative to the current setting of cex.
font.main         Scatter plot. The font to be used for plot main titles.
nlab.xaxis        Scatter plot. Approximate number of labels on x-axes.
nlab.yaxis        Scatter plot. Approximate number of labels on y-axes.
minL.axis         Scatter plot. The minimum length of the abbreviations of factor levels, used to label the axes ticks.
las              Scatter plot. Orientation of labels on axes.
border           Scatter plot. Logical. When TRUE, a border is drawn around the individual colors in the legend.
tcl              Scatter plot. The length of tick marks as a fraction of the height of a line of text. The default value is -0.5; setting tcl = NA sets tck = -0.01 which is S’ default.
boxplot          If TRUE (the default) then a boxplot with the range of environmental variables in an area of the niche selected by the user is produced.
outline: Boxplot. If outline is not true, the outliers are not drawn (as points whereas S+ uses lines).

color: Boxplot. If col is non-null it is assumed to contain colors to be used to colour the bodies of the box plots.

range: Boxplot. This determines how far the plot whiskers extend out from the box. If the range is positive, the whiskers extend to the most extreme data point which is no more than range times the interquartile range from the box. A value of zero causes the whiskers to extend to the data extremes.

width: Boxplot. A vector giving the relative widths of the boxes making up the plot.

varwidth: Boxplot. If varwidth is TRUE, the boxes are drawn with widths proportional to the square-roots of the number of observations in the groups.

plot: Boxplot. If TRUE (the default) then a boxplot is produced. If not, the summaries which the boxplots are based on are returned.

pars: Boxplot. A list of (potentially many) more graphical parameters, e.g., boxwex or outpch; these are passed to bxp (if plot is true).

cex.boxplot: Boxplot. Magnification used for axis annotation.

cex.labB: Boxplot. Magnification used for group labels which will be printed under each boxplot.

namesB: Boxplot. Group labels which will be printed under each boxplot. It can be a character vector.

family: The name of a font family for drawing text.

line: mtext. On which margin line, starting at 0 counting outwards.

file1: CSV file. A character string naming the file of the list of species.

file2: CSV file. A character string naming the file with the summary of the environmental variables.

na: CSV files. The string to use for missing values in the data.

dec: CSV files. The string to use for decimal points in numeric or complex columns: must be a single character.

row.names: CSV files. Either a logical value indicating whether the row names of x are to be written along with x, or a character vector of row names to be written.

fileEncoding: CSV files. Character string: if non-empty declares the encoding to be used on a file (not a connection) so the character data can be re-encoded as they are written.

Details

The file required in the argument data may be obtained using ModestR (available at the web site www.ipez.es/ModestR), as it is shown in the following screenshot (Export/Export maps of the select branch/To RWizard Applications/To EnvNicheR). It is better do not include duplicates, i.e., records with the same longitude and latitude.
The menu shown in the following screenshot is obtained, where it is possible to select several environmental variables. There is the option of exporting the data with the format of pseudosamples or all the valid samples. If the maps are areas, the proper way of exporting these data is to create a raster with grid cell for instance of 5° x 5°, 30° x 30°, 1° x 1°, etc. Therefore, the output of ModestR is a list of species within each of the grid cells with the size defined by the user. If the maps are records, it is possible to use pseudosamples or to select the option valid samples.

The format of the CSV file obtained is shown in the following screenshot, and this CSV file is the one required in this argument data. The first only five columns must be taxonomic levels as class, order, family, subfamily, tribe, genus, subgenus, species, etc. The columns 6 and 7 must be longitude and latitude of the record, respectively. The rest of columns are the abiotic/biotic factors.
All variables are transformed to a scale ranged between -1 and 1. For each record the X and Y polar coordinates are estimated using the following equations:

\[ X = \sum_{i=1}^{n} |z_j| \cos(\alpha) \]

\[ Y = \sum_{i=1}^{n} |z_j| \sin(\alpha) \]

where \( z \) is the record of the variable \( j \) and \( n \) the number of variables.

Each variable is assigned an angle (\( \alpha \)). The increment value of the angle is always \( \frac{360}{n} \). If for instance the number of variables are 5, the increment angle is 36. Therefore, for the first variable if the value is \( \geq 0 \) the \( \alpha \) is 36 and if the value is \( < 0 \) the \( \alpha \) is 36+180, for the second variable if the value is \( \geq 0 \) the \( \alpha \) is 36+36 and if the value is \( < 0 \) the \( \alpha \) is 36+36+180, etc. Degrees to radians angle conversion is carried out assuming that 1 degree = 0.0174532925 radians.

Therefore, the order of the variables is important because a different \( \alpha \) is assigned. If the argument \( cor=TRUE \), the order is established calculating the correlation matrix of the variables, and ordering them in the way that each variable will be followed by the variable to which is highly correlated. The goal is to favor a larger dispersion of the data in the resulting polar coordinates system.

**FUNCTIONS**

The scatter plot is performed with the function \texttt{iplot} of the package IDPmisc (Locher & Ruckstuhl, 2014).

**EXAMPLE**

The dataset is a matrix of the presence of the wolf and the mean altitude, mean annual temperature (BIO1), mean diurnal range (BIO2), isothermality (BIO3), temperature seasonality (BIO4), maximum temperature of the warmest month (BIO5), mean annual precipitation (BIO12), primary terrestrial production (PP), slope and vegetation index (VI) in cells of 1 degree x 1 degree around the world.

The first plot shows the polar coordinates using the environmental variables selected by the user in the file obtained from ModestR (in the example altitude, BIO1, BIO12, BIO2, BIO3, BIO4, BIO5, PP, slope and VI). In this first plot, a darker color of the square indicates a higher number of records of the wolf in the cell. In this plot it is necessary to click four times with the mouse to select one or several pixels.
The second plot shows a boxplot with the median and range of the environmental variables in the pixels selected with the mouse in the first plot.

Value

A list of the species present in the cells selected by the user with the mouse and a summary of the environmental variables are saved in two CSV files.

References


Examples

## Not run:
data(Z16)
F37(data=Z16, variables=c("Altitude", "BIO1", "BIO12", "BIO2", "BIO3", "BIO4", "BIO5", "PP", "Slope", "VI"))

## End(Not run)

MULTIPLE MEAN WITH ERROR BARS LINE CHART FOR VARIABLE X QUANTITATIVE WITH TEXT LABELS AND REGRESSION

Description

It performs a multiple mean with error bars line chart for variable X quantitative with text labels and a regression model.

Usage

F38(data, varY, varX, Factor, group, type="b", method="mean", dev="sd", barY=TRUE, barX=FALSE, textlabel=FALSE, label=NULL, reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORI="black", COLORR=NULL, PCH=NULL, CEX=1, lty=NULL, lwd=2.5, ltyL=NULL, lwdL=1, PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, file1="Output.txt", file2="Average and error bars.csv", na="NA", dec=".", row.names=FALSE)

Arguments

data Data file.
varY Dependent variable.
varX Quantitative independent variable.
Factor Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.
group Variable with the categories to be grouped.
**type**  Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.

**method**  The average of each category of the grouped variable *Factor* is estimated with the "mean" or the "median".

**dev**  The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

**barY**  If it is TRUE the bar error of the variable Y is depicted.

**barX**  If it is TRUE the bar error of the variable X is depicted.

**textlabel**  If TRUE the text labels of the categories of the variable *Factor* are added to the plot.

**label**  It allows to specify the characteristics of the text labels with the function text.

**reg**  If it is TRUE a regression model is performed for each set of data defined with the argument *group*.

**model**  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.

**outliers**  If it is TRUE, the outliers are removed using the selected regression model.

**quant1**  Quantile of the lower end to the elimination of outliers.

**quant2**  Quantile of the upper end to the elimination of outliers.

**ResetPAR**  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

**PAR**  It accesses the function PAR that allows to modify many different aspects of the graph.

**XLAB**  Legend of the X axis.

**YLAB**  Legend of the Y axis.

**XLIM**  Vector with the limits of the X axis.

**YLIM**  Vector with the limits of the Y axis.

**COLOR**  Color of the symbols. It must be as many as different categories of the variable *group*.

**COLORI**  Color of the error bars.

**COLORR**  Color of the line of the regression model. It must be as many as different categories of the variable *group*.

**PCH**  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable *group*.

**CEX**  Size of the symbols.

**lty**  Type of the regression line (see the description of the same argument in the function F1).
lwd Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
ltyL Type of the line chart (see figure of the argument lty in the function F1).
lwdL Line width of the line chart.
PLOT It allows to specify the characteristics of the function plot.default.
LEGEND It allows to modify the legend of the graph.
AXIS It allows to add axes to the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT It allows to add text in any area of the inner part of the graph.
file1 TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.
file2 CSV FILE. File name with the mean, median, standard error and standard deviation for each category of the variable Factor
na CSV FILES. Text that is used in the cells without data.
dec CSV FILES. It defines if the comma "," is used as decimal separator or the dot ".".
row.names CSV FILES. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.

Details

See the equations of all regression models in the section details of the function XII of the package StatR.

FUNCTIONS

The plot is performed with the function plot.default of base graphics package and the linear regression with the function lm of base stats package. The function lillie.test of the package nortest (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function dwtest of the package lmtest (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function bptest of the package lmtest (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

EXAMPLES

The data are monthly mean temperature for 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo. They were obtained from the Agencia Estatal de Meteorologia of Spain http://www.aemet.es/es/portada.

Example 1 Monthly mean temperature in each city.
Example 2 Relationship between mean temperature and mean precipitation for each city in the years 1990 and 2000.
Example 3 Monthly mean temperature in each city and a cubic regression line is added with the argument `reg=TRUE` and `Cubic`. 
In the TXT file that generates the function, the regression model for each city is shown. For the explanation of the regression models, normality, autocorrelation and homoscedasticity see the details section of the function F1.

**Value**

A multiple line chart with mean error bars, with or without linear regression and with or without text labels is obtained. A CVS file with the mean, median, standard error and standard deviation for each category of the variable *Factor* is also obtained.

**References**


Examples

### Not run:

#Example 1
data(Z13)
F38(data=Z13, varY="Temperature", varX="Month", Factor="Month", group="City")

#Example 2
data(Z13)
F38(data=Z13, varY="Precipitation", varX="Temperature", Factor="City", group="Year", textlabel=TRUE, XLIM=c(13,21))

#Example 3
data(Z13)
F38(data=Z13, varY="Temperature", varX="Month", Factor="Month", group="City", reg=TRUE, model="Cubic")

### End(Not run)

---

**F39**

**MULTIPLE DOT OR MEAN WITH ERROR BARS LINE CHARTS FOR VARIABLE X QUALITATIVE**

---

**Description**

It performs a multiple dot or mean with error bars line charts for variable X qualitative.

**Usage**

\[
\text{F39(data, varY, FactorX, group, type="b", method="mean", dev="sd",}
\]

ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORI="black", ltyL=NULL, lwdL=1, PCH=NULL, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **FactorX**: Qualitative independent variable.
- **group**: Variable with the categories to be grouped.
**type**  Character string giving the type of plot desired. The possible values are shown in the same argument of function F38.

**method**  If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".

**dev**  If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

**ResetPAR**  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

**PAR**  It accesses the function PAR that allows to modify many different aspects of the graph.

**order**  If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alhaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.

**OrderCat**  It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

**LabelCat**  It allows to specify a vector with the names of the categories.

**XLAB**  Legend of the X axis.

**YLAB**  Legend of the Y axis.

**XLI M**  Vector with the limits of the X axis.

**YLIM**  Vector with the limits of the Y axis.

**COLOR**  Color of the symbols. It must be as many as different categories of the variable group.

**COLORI**  Color of the error bars.

**ltyL**  Type of the line chart (see figure of the argument lty in the function F1).

**lwdL**  Line width of the line chart.

**PCH**  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.

**CEX**  Size of the symbols.

**LEGEND**  It allows to modify the legend of the graph.

**AXIS**  It allows to add axes to the graph.

**MTEXT**  It allows to add text on the margins of the graph.

**TEXT**  It allows to add text in any area of the inner part of the graph.

**Details**

**FUNCTIONS**

The plot is performed with the functions boxplot, points and arrows of base graphics package. For further details see Guisande & Vammonde (2012).

**EXAMPLES**
In an experiment conducted with expert tasters and people who had no experience tasting, they were taught to identify 15 types of wines from different regions. Variations in ability to ascertain the wine provenance over time was measured between experts and non-experts. For every time, each person assessed a large number of samples and the degree of success was recorded on a scale of 0 to 12.

**Example 1** A dot plot is depicted with the argument `method=NULL` of the variable Success for all times grouped by the experience of tasters.

![Dot plot example](image)

**Example 2** The mean and the standard deviation of the variable Success is obtained for each time and group of tasters.
Value

A multiple dot or mean line charts for variable X qualitative are obtained.

References


Examples

```r
## Not run:

#Example 1

data(Z15)

F39(data=Z15, varY="Success", FactorX="Time", group="Experience", method=NULL, YLIM=c(0,14))

#Example 2

data(Z15)

F39(data=Z15, varY="Success", FactorX="Time", group="Experience", YLIM=c(0,14))

## End(Not run)
```
MULTIPLE DOT OR MEAN WITH ERROR BARS LINE CHART FOR VARIABLE X QUALITATIVE WITH TEXT LABELS

Description

It performs a multiple dot and mean with error bars scatter plots for variable X qualitative with text labels.

Usage

F40(data, varY, FactorX, group, type="b", label=NULL, method="mean", dev="sd", ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLORI="black", ltyL=NULL, lwdL=1, PCH=NULL, CEX=1, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)

Arguments

data   Data file.
varY   Dependent variable.
FactorX Qualitative independent variable.
group  Variable with the categories to be grouped.
type   Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
label  It allows to specify the characteristics of the text labels with the function text.
method If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".
dev    If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR    It accesses the function PAR that allows to modify many different aspects of the graph.
order If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
OrderCat It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.
LabelCat It allows to specify a vector with the names of the categories.

XLAB Legend of the X axis.

YLAB Legend of the Y axis.

XLIM Vector with the limits of the X axis.

YLIM Vector with the limits of the Y axis.

COLOR Color of the symbols. It must be as many as different categories of the variable group.

COLORI Color of the error bars.

ltyL Type of the line chart (see figure of the argument lty in the function F1).

lwdL Line width of the line chart.

PCH Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.

CEX Size of the symbols.

LEGEND It allows to modify the legend of the graph.

AXIS It allows to add axes to the graph.

MTEXT It allows to add text on the margins of the graph.

TEXT It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions boxplot, points and arrows of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES
In an experiment conducted with expert tasters and people who had no experience tasting, they were taught to identify 15 types of wines from different regions.

Variations in ability to ascertain the wine provenance over time (after one hour, one day, one week and one month) was measured between experts and non-experts.

For every time, each person assessed a large number of samples and the degree of success was recorded on a scale of 0 to 12.

Example 1 A dot plot is depicted with the argument method=NULL of the variable Success for all times grouped by the experience of tasters.
Example 2 The mean and the standard deviation of the variable Success is obtained for each time and group of tasters.
Value

A multiple dot or mean bars line chart with text labels are obtained.

References


Examples

```r
# Not run:

# Example 1

data(Z15)

F40(data=Z15, varY="Success", FactorX="Time", group="Experience", YLIM=c(0,14), method=NULL)

# Example 2

data(Z15)

F40(data=Z15, varY="Success", FactorX="Time", group="Experience", YLIM=c(0,14))

## End(Not run)
```
3D SCATTER PLOTS

Description

It performs 3D scatter plots in panels, in one plot making the difference among categories and in one plot without distinguishing among categories.

Usage

F41(data, varZ, varY, varX, group=NULL, panel=FALSE, CEX=1.2, PCH=NULL, COLOR=NULL, ZLAB=NULL, YLAB=NULL, XLAB=NULL, ZLIM=NULL, YLIM=NULL, XLIM=NULL, family="serif", cexaxis=1, cexZ=1.2, fontZ=2, rotZ=90, cexY=1.2, fontY=2, rotY=-50, cexX=1.2, fontX=2, rotX=15, sz=20, sx=-70, sy=10, arrows=FALSE, distance=0.8, LEGEND=NULL)

Arguments

data
  Data file.
varZ
  Variable Z.
varY
  Variable Y.
varX
  Variable X.
group
  Variable with the categories to be grouped.
panel
  If it is TRUE each category of the variable group is depicted in one panel.
CEX
  Size of the symbols.
PCH
  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.
COLOR
  Color of the symbols. It must be as many as different categories of the variable group.
ZLAB
  Legend of the Z axis.
YLAB
  Legend of the Y axis.
XLAB
  Legend of the X axis.
ZLIM
  Vector with the limits of the Z axis.
YLIM
  Vector with the limits of the Y axis.
XLIM
  Vector with the limits of the X axis.
family
  It specifies the font of the plot.
cexaxis
  Size of the axis labels.
cexZ
  Size of the Z legend.
fontZ
  A numeric value that defines the font of the Z legend. The value 1 is a normal type, 2 is written in bold, 3 is written in italics and 4 is written in italics and bold.
rotZ  Angle of Z legend.
cexY  Size of the Y legend.
fontY  A numeric value that defines the font of the Y legend. Options as mentioned in the argument fontZ.
rotY  Angle of Y legend.
cexX  Size of the X legend.
fontX  A numeric value that defines the font of the X legend. Options as mentioned in the argument fontZ.
rotX  Angle of X legend.
sz  Perspective of axis Z.
sy  Perspective of axis Y.
sx  Perspective of axis X.
arrows  If it is FALSE, tick marks and labels are used instead of arrows being drawn.
distance  It specifies the relative distance of the axis label from the bounding box.
LEGEND  It allows to modify the legend of the graph with the function grid_legend.

Details

FUNCTIONS

The 3D plot was performed with the function lattice[cloud] of the package lattice (Sarkar, 2008). The function grid_legend of the package vcd (Meyer et al., 2006; 2015) was used to depict the legend. For further details see Guisande & Vammonde (2012).

EXAMPLES

The data are the percentages of three amino acids in different species of rotifiers obtained from ponds of Doñana National Park (Spain) (Guisande et al., 2008).

Example 1 Each species is shown in a panel with the argument panel=TRUE.
Example 2 All data are depicted in one plot but making the difference among species.
Example 3 All data are depicted in one plot without making differences among species.
**Value**

3D scatter plots are obtained.

**References**


**Examples**

```r
## Not run:
#Example 1
data(Z17)
F41(data=Z17, varZ="Aspartate", varY="Glutamate", varX="Serine", group="Species", panel=TRUE, cexaxis=0.8, cexZ=1, cexY=1, cexX=1)
#Example 2
data(Z17)
F41(data=Z17, varZ="Aspartate", varY="Glutamate", varX="Serine", group="Species")
#Example 3
data(Z17)
F41(data=Z17, varZ="Aspartate", varY="Glutamate", varX="Serine", COLOR="blue", PCH=15)
## End(Not run)
```

**Description**

It performs 3D dynamic scatter plots.
Usage

F42(data, varZ, varY, varX, PLOT3D=NULL, CEX=2, COLOR="red", ZLAB=NULL, YLAB=NULL, XLAB=NULL, ZLIM=NULL, YLIM=NULL, XLIM=NULL)

Arguments

data Data file.
varZ Variable Z.
varY Variable Y.
varX Variable X.
PLOT3D It allows to modify the plot using the function plot3d.
CEX Size of the symbols.
COLOR Color of the symbols.
ZLAB Legend of the Z axis.
YLAB Legend of the Y axis.
XLAB Legend of the X axis.
ZLIM Vector with the limits of the Z axis.
YLIM Vector with the limits of the Y axis.
XLIM Vector with the limits of the X axis.

Details

FUNCTIONS
The 3D plot was performed with the function plot3d of the package rgl (Adler et al., 2015).

EXAMPLES
The data are the percentages of three amino acids in different species of rotifers obtained from ponds of Doñana National Park (Spain) (Guisande et al., 2008).
Value

3D dynamic scatter plot is obtained.

References

Adler, D., Murdoch, D. and others (2015) 3D Visualization Using OpenGL. R package version 0.95.1247. Available at: https://CRAN.R-project.org/package=rgl.


Examples

```r
## Not run:
data(Z17)
F42(data=Z17, varZ="Aspartate", varY="Glutamate", varX="Serine")
## End(Not run)
```

### VARIABLE SELECTION TO DISCRIMINATE BETWEEN TWO GROUPS (VARSEDIG)

**Description**

This function performs an algorithm for selecting all variables that significantly discriminate between two groups.
Usage

F43(data, variables, group, group1, group2, method="overlap", stepwise=TRUE, VARSEDIG=TRUE, minimum=TRUE, kernel="gaussian", cor=TRUE, ellipse=TRUE, convex=FALSE, DPlot=NULL, SCATTERPLOT=NULL, BIVTEST12=NULL, BIVTEST21=NULL, Pcol="red", colbiv="lightblue", br=20, sub="", lty=1, lwd=2.5, ResetPAR=TRUE, PAR=NULL, XLABd=NULL, YLABd=NULL, YLIMd=NULL, COLORd=NULL, COLORB=NULL, LEGENDd=NULL, AXISd=NULL, MTEXTd=NULL, TEXTd=NULL, XLABs=NULL, YLABs=NULL, YLIMs=NULL, COLORs=NULL, LEGENDs=NULL, TEXTs=NULL, LEGENDr=NULL, MTEXTr=NULL, TEXTr=NULL, arrows=TRUE, larrow=1, ARROWS=NULL, TEXTa=NULL, model="Model.rda", file1="Overlap.csv", file2="Coefficients.csv", file3="Predictions.csv", file4="Polar coordinates", file="Output.txt", na="NA", dec="," , row.names=FALSE)

Arguments

data Data file.
variables Variables to be selected.
group Variable with the groups to be discriminated.
group1 First group.
group2 Second group.
method Three different methods for prioritizing the variables according to their capacity for discrimination can be used. If the method is "overlap", a density curve is obtained for each variable and the overlap of the area under the curve between the two groups of the variable `group` is estimated for all variables. Those variables with lower overlap should have better discrimination capacities and, hence, all variables are ordered from lowest to highest overlap; in other words from the highest to lowest discrimination capacity. If the method is "Monte-Carlo", a Monte-Carlo test is performed comparing all values of group 1 with group 2, and all values of group 2 with 1. The variables are prioritized from the variable with the lowest mean of all p-values (highest discrimination capacity) to the variable with the highest mean of all p-values (lowest discrimination capacity). If the method is "logistic regression", then a binomial logistic regression is calculated and if the argument stepwise=TRUE (default option), then only significant variables are selected for further analyses with the regression performed by steps using the Akaike Information Criterion (AIC).

stepwise If TRUE, the logistic regression is applied by steps, in order to eliminate those variables that are not significant. The Akaike information criterion (AIC) is used to define what are the variables that are excluded (see section details of the function XI5 of the package StatR for more details).

VARSEDIG If it is TRUE, the variables are added for the estimation of polar coordinates in the priority order according to the method "overlap", "Monte-Carlo", or "logistic regression" and the variable is selected if it significantly contributes to discriminate between both groups. See details section for further information.

minimum If it is TRUE, the algorithm is designed to find a significant discrimination between both groups with the minimum possible number of significant variables. Therefore, only the variables with higher discrimination capacity are selected.
If it is FALSE, the algorithm selects all significant variables, and not only those with higher discrimination capacity. This argument is only valid with the methods "Monte-Carlo" and "overlap" and it is useful in those cases that discrimination between the groups is difficult and requires to include as many as variables as possible.

**kernel**
A character string giving the smoothing kernel to be used for estimating the overlap of the area under the curve between groups. This must be one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". For further details about the estimation of the density curve see the details section of the function density of base stats package.

**cor**
If it is TRUE the variables are ordered according to the correlation between them when estimating the polar coordinates. Therefore, the next variable to another variable is the one that has a greater positive correlation.

**ellipse**
If it is TRUE the ellipses with the levels of significance to the 0.5 (inner ellipse) and 0.95 (outer ellipse) of each category of the variable `group` is depicted. These levels of significance can be modified by entering the function scatterplot using the argument **SCATTERPLOT** and modifying the argument `levels=c(0.5,0.95)`. If it is TRUE the convex hull is depicted for each category.

**DPLOT**
It allows to specify the characteristics of the function plot.default of the density plot.

**SCATTERPLOT**
It accesses the function scatterplot of the car package, with the graph **biplot** that performs the X an Y polar coordinates.

**BIVTEST12**
It accesses the function **biv.test** of the package adehabitatHS, which performs the bivariate plot that displays the results of a bivariate randomisation test. From all values of group 2, it shows the value with higher probability to belong to group 1.

**BIVTEST21**
As in the argument **BIVTEST12**, but from all values of group 1, it shows the value with higher probability to belong to group 2.

**Pcol**
Color or name for the observation of group 2 in the BIVTEST12 plot and for the value of group 1 in the BIVTEST21 plot.

**colbiv**
Color or name of all values of group 1 in the BIVTEST12 plot and all values of group 2 in the BIVTEST21 plot.

**br**
Numbers of breaks of the histograms in the BIVTEST plots.

**sub**
Title in the BIVTEST plots.

**lty**
Type of line of the density curve for each group. If it is a vector, it must be as many as different categories of the variable `group`. See the description of the same argument in the function **F1**.

**lwd**
Line width relative to the default (default=1), so 2 is twice as wide of the density curve.

**ResetPAR**
If it is FALSE, the default condition of the function **PAR** is not placed and maintained those defined by the user in previous graphics.

**PAR**
It accesses the function **PAR** that allows to modify many different aspects of the graph.
XLABd  Legend of the X axis in the density plot.
YLABd  Legend of the Y axis in the density plot.
XLIMd  Vector with the limits of the X axis in the density plot.
YLIMd  Vector with the limits of the Y axis in the density plot.
COLORd Color of the density curves in the density plot. It must be as many as different categories of the variable group. As the color has transparency, the plot must be copy as bitmap and not metafile.
COLORB Color of the lines in the density plot. It must be as many as different categories of the variable group.
LEGENDd It allows to modify the legend of the density plot. If it is FALSE the legend is not shown.
AXISd  It allows to add axes to the density plot.
MTEXTd It allows to add text on the margins of the density plot.
TEXTd  It allows to add text in any area of the inner part of the density plot.
XLABs  Legend of the X axis in the scatterplot.
YLABs  Legend of the Y axis in the scatterplot.
XLIMs  Vector with the limits of the X axis in the scatterplot.
YLIMs  Vector with the limits of the Y axis in the scatterplot.
PCHs   Vector with the symbols of the scatterplot, that should be as many as different groups the variable group has. If NULL, they are automatically calculated starting with the symbol 15.
COLORs It allows to modify the colors of the scatterplot. It must be as many as different categories of the variable group.
LEGENDs It allows to modify the legend of the scatterplot.
MTEXTs It allows to add text on the margins of the scatterplot.
TEXTs  It allows to add text in any area of the inner part of the scatterplot.
LEGENDr It allows to modify the legend of the BIVTEST plot. If it is FALSE the legend is not shown.
MTEXTr It allows to add text on the margins of the BIVTEST plot.
TEXTr  It allows to add text in any area of the inner part of the BIVTEST plot.
arrows If it is TRUE the arrows are shown in the scatterplot with the polar coordinates. These arrows show the vector of the variables selected when calculating the polar coordinates.
larrow It modifies the length of the arrows.
ARROWS It accesses the function Arrows of the package IDPmisc, which performs the arrows.
TEXTa  It allows to modify the labels at the end of the arrows.
model  Filename with the model of the binomial logistic regression.
file1  CSV FILE. Filename with the overlap of the area under the curve between both categories for all variables.
Classification methods such as logistic regression and discriminant analysis are probably the best available methods for the identification of the variables optimally able to predict group membership (Guisande et al. 2011; Guisande & Vaamonde 2012). Classification and Regression Trees (CARTs) are useful for identifying the variables that best discriminate groups, it is impossible using those methods to test the significance of the variables or to predict group membership (Guisande & Vaamonde 2012).

There are three advantages of logistic regression over discriminant analysis (Guisande et al., 2011): 1) the logistic regression is much more relaxed and flexible in its assumptions than the discriminant analysis because, unlike the discriminant analysis, the logistic regression does not have the requirements of the independent variables to be normally distributed, linearly related, nor equal variance within each group; 2) logistic regression may be more powerful and efficient analytic strategy if there are qualitative variables among predictors; 3) it is possible to use a stepwise logistic regression and, therefore, to select only those variables that significantly discriminate between groups. Discriminant analysis, however, does not have a statistical test of the coefficients of individual independent variables comparable to logistic regression, so it is not possible to test significance of variables and, therefore, to select only the variables that significantly predict group membership. Actually, to include variables with low discrimination capacity leads to reduce the identification success of the discriminant analysis.

The disadvantages of logistic regression are mainly also three: 1) the lack of a graphical representation of the results; 2) to evaluate the predictability of the final model chosen from the analysis it is not enough with the information about the percentage of cases correctly identified; 3) when the assumptions mentioned above regarding the distribution of predictors are met, discriminant function analysis may be more powerful and efficient analytic strategy than logistic regression (Tabachnick & Fidell, 1996)

This function performs an algorithm for: 1) prioritizing the variables by their discrimination capacity using three different methods, 2) selecting only those variables that significantly discriminate between two groups, 3) evaluating the predictability of the final model chosen with a Monte-Carlo test and 4) the results are graphically depicted in four different plots.

1. Prioritizing the variables by their discrimination capacity
Three different methods for prioritizing the variables according to their capacity for discrimination can be used.

1. If the argument method="overlap", a density curve is obtained for each variable and the overlap of the area under the curve between the two groups is estimated for all variables. Those variables with lower overlap should have better discrimination capacities and, hence, all variables are ordered from lowest to highest overlap; in other words from the highest to lowest discrimination capacity. This information is saved in file1="Overlap.csv".

2. If the method is "Monte-Carlo", a Monte-Carlo test is performed comparing all values of group 1 with group 2, and all values of group 2 with 1. The variables are prioritized from the variable with the lowest mean of all p-values (highest discrimination capacity) to the variable with the highest mean of all p-values (lowest discrimination capacity).

3. If the argument method="logistic regression", then a binomial logistic regression is calculated and if the argument stepwise=TRUE (default option), then only significant variables are selected for further analyses with the regression performed by steps using the Akaike Information Criterion (AIC). The model of the regression is saved in model="Model.rda", the coefficients in file2="Coefficients.csv" and the predictions of the regression in file3="Predictions.csv".

2. Polar coordinates

All variables are transformed to a scale ranged between -1 and 1. For each value the X and Y polar coordinates are estimated using the following equations:

\[ X = \sum_{i=1}^{n} |z_j| \cos(\alpha) \]
\[ Y = \sum_{i=1}^{n} |z_j| \sin(\alpha) \]

where \( z \) is the value of the variable \( j \) and \( n \) the number of variables.

Each variable is assigned an angle \( \alpha \). The increment value of the angle is always \( \frac{360}{n+2} \). If for instance the number of variables is 5, the increment angle is 36. Therefore, for the first variable if the value is \( \geq 0 \) the \( \alpha \) value is 36 and if the value is \( < 0 \) the value is 36+180, for the second variable if the value is \( \geq 0 \) the \( \alpha \) value is 36+36 and if the value is \( < 0 \) the value is 36+36+180, etc. Conversion of degrees to radians angle is carried out assuming that 1 degree = \( 0.0174532925 \) radians.

The order of the variables is consequently important because a different alpha value is assigned. If the argument cor=TRUE, this order is established calculating the correlation matrix of the variables and by ordering them such that each variable is followed by the variable to which it is highly correlated. The goal is to favor a larger dispersion of the data in the resulting polar coordinates system.

3. Algorithm for variables selection

The variables are added for the estimation of polar coordinates in the priority order according to method="overlap", method="Monte-Carlo" or method="logistic regression".

Mean X and Y polar coordinates are estimated for both groups and via these means the Euclidean distance is calculated between both groups.

In the case of the X and Y polar coordinates, a Monte-Carlo test is used for testing the statistical hypothesis if a value of one group is significantly higher or lower that the values of the other group. The test is performed for both X and Y polar coordinates and compares all values of one group with those of the other group. For instance, when all values of group 1 are compared with group 2, and
the mean X polar coordinate of group 1 is higher than the one of group 2, the alternative hypothesis of the Monte-Carlo test is *greater*, and the p-value is estimated as (number of random values equal to or greater than the observed one + 1)/(number of permutations + 1). The null hypothesis is rejected if the p-value is less than the significance level. If the mean X polar coordinate of group 1 is lower than the one of group 2, the alternative hypothesis is *smaller*, a p-value is estimated as (number of random values equal to or less than the observed one + 1)/(number of permutations + 1). Again, the null hypothesis is rejected if the p-value is less than the significance level. The same process is applied when comparing all values of group 2 with those of group 1.

A variable is selected if it both: 1) contributes to increase Euclidean distance between both groups compared with the Euclidean distance obtained with the set of previously selected variables; and 2) the p-values of the Monte-Carlo test for X and Y coordinates when comparing both group 1 with group 2 and group 2 with group 1 are smaller than the p-values obtained with the set of previous selected variables. Therefore, from the pool of all independent variables, only those variables with the highest significant contribution to discriminating between both groups are selected.

The variables selected are saved in the file="Output.txt" and the polar coordinates of all values of both groups estimated with the variables selected are depicted in a scatterplot and saved in file4="Polar coordinates.csv".

At the end of the process, it is selected the value with the highest p-value. Therefore, if this p-value is close or lower than the significance level of 0.05, it may be concluded that any of the values of one group may be identified as belonging to the other group.

Two plots are obtained with the value of the group 1 with the highest p-value of belonging to group 2 and the value of the group 2 with the highest p-value of belonging to group 1, respectively. In both plots, the x-axis corresponds to the X polar coordinates and the y-axis corresponds to Y polar coordinates.

If p-value is close or lower than 0.05 for X or Y polar coordinates, but in both cases when comparing group 1 with group 2 and group 2 with 1, it may be concluded that the variables selected are significantly contributing to discriminate between both groups, so with these variables is possible to achieve a 100% of identification success when predicting group membership.

**FUNCTIONS**

The density plot is performed with the function `plot.default` of base graphics package. The density curve is estimated with the function `density` of base stats package. The area under the curve is estimated with the function `auc` of the packagekulife (Ekstrom et al., 2015). The random test was performed with the function `as.randtest` of the package ade4 (Chessel et al., 2004; Dray et al., 2007; 2015). The bivariate plot that displays the results of a bivariate randomisation test, for which the p-values are computed with the function `as.randtest` (one-sided tests), was performed with the function `biv.test` of the package adehabitatHS (Calenge, 2006; 2015). The arrows are depicted with the function `Arrows` of the package IDPmisc (Locher & Ruckstuhl, 2014). The scatterplot is performed with the function `scatterplot` of the car package (Fox & Weisberg, 2011; Fox et al., 2014). The convex hull is estimated with the function `chull` of the package grDevices.

**EXAMPLES**

For the example, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

Figure shows the plots obtained with VARSEDIG, in an example comparing the species *Moenkhausia dichroura* and *Moenkhausia oligolepis*.
The variables that better discriminate between both species are the M26 (interorbital width) and M11 (distance from the dorsal-fin origin to the dorsal limit of the pelvic-fin base). Between these two variables, a density plot is depicted for the quantitative variable with lower overlap between both groups and, thus, the highest discrimination capacity: in this example M26 (Figure 1A). A density plot for other variables may be depicted using the function F18 of PlotsR.

Figure 1B shows the scatterplot of the polar coordinates obtained for both species using variables M26 and M11. The arrows show the vector of the variables with both of these variables higher in *M. oligolepis*.

This example illustrates that the VARESDIG algorithm is not only useful for identifying the variables that better discriminate between two taxa, but also may be informative when it comes to finding misidentified individuals. In the example, it appears that two individuals identified as *M. oligolepis* are *M. dichrous* (Figure 1B).

Figure 1C displays the results of a bivariate randomisation test. From all individuals of the species *M. dichrous*, the figure shows the individual of *M. dichrous* (red point) with higher probability to be identified as belonging to the *M. oligolepis*. Kernel density is estimated to indicate the contours of the distribution of randomised values. The two marginal histograms correspond to the univariate tests on each axis, for which the p-values (one-sided tests) are computed. As p-value is lower than 0.05 for X axis (p = 0.04), the null hypothesis is rejected. Consequently the X polar coordinates of all individuals of the of the species *M. dichrous* are significantly different than those of the species *M. oligolepis* and, therefore, none of the individuals designated as *M. dichrous* may be identified as belonging to the species *M. oligolepis*.

Figure 1D also displays the results of a bivariate randomisation test but, in this case, from all individuals of the species *M. oligolepis*, the figure shows the individual (red point) with higher probability to belong to the species *M. dichrous*. Both p-values are higher than 0.05, so null hypothesis is accepted for both X and Y polar coordinates. This that some individuals of the species *M. oligolepis* may be identified as belonging to the species *M. dichrous*.

**Example 1**
It is not necessary a p-value lower than 0.05 for both X and Y, but it is just necessary and p-value lower than 0.05 for X or Y when comparing both group 1 with 2 and group 2 with 1. Therefore, if p-value is close or lower than the significance level of 0.05 for X or Y polar coordinates in both cases comparing group 1 with 2 and group 2 with 1, it would mean a 100% of identification success between both groups. In this example, however, with the variables M16 and M11 is not possible to predict group membership with a 100% of accuracy because, although none of the individuals of the species *M. dichrous* may be identified as belonging to the species *M. oligolepis*, some individuals of the species *M. oligolepis* may be identified as belonging to the species *M. dichrous*. The failure to reach 100% may be due to the possible misidentification of two individuals of *M. dichrous* as *M. oligolepis*.

**Value**

It is depicted 4 plots: 1) a density plot with the overlap of the area under de curve between the two groups for the variable that better discriminates between both groups, 2) a scatter plot with the polar coordinates for both groups, 3) a bivariate plot that shows from all values of group 2 the value with higher probability to belong to group 1, and 4) a bivariate plot that shows from all values of group 1 the value with higher probability to belong to group 2. Moreover, 5 files are saved: 1) overlap of
the area under the curve between both categories for all variables, 2) regression coefficients of the binomial logistic regression, 3) predictions of the binomial logistic regression, 4) polar coordinates for both categories of the variable group, and 5) a TXT file with the results of the binomial logistic regression, the variables that better discriminate between the two groups and the Euclidean distance between groups considering the polar coordinates.

References


Examples

```r
## Not run:

data(Z1)

  group2="Moenkhausia dichroura", LEGENDd=c("x='topright'", "legend = dati", 
  "col = COLORB", "lty=1", "bty='n'", "cex=1.2", "text.font= 3"), 
  LEGENDs=c("x='topright'", "legend=unique(datosF[, 'Group'])", "col = color1", 
  "pch = pcht", "bty='n'", "cex=1.2", "text.font=3"), LEGENDr=c("x='topright'", 
  "legend = dati", "col=col", "pch= c(16,16)", "bty='n'", "cex=1.2", "text.font=3"), 
  XLIMs=c(-1.2,1.2), YLIMs=c(-1.3,1.3), BIVTEST12=c("br=br", "cex=1.1", 
  "col=colbiv", "sub=sub", "Pcol=Pcol"), BIVTEST21=c("br=br", "cex=1.1", 
  "col=colbiv", "sub=sub", "Pcol=Pcol"), colbiv="blue")

## End(Not run)
```

---

**MONTE-CARLO TEST FOR ONE VARIABLE**

Description

A Monte-Carlo test is performed for testing the hypothesis, in one variable, if an observation is significantly greater or lower than a set of values belonging to a group.

Usage

```r
F44(data, variable, group, group1, row, ResetPAR=TRUE, PAR=NULL, HIST=NULL, 
  colorp="red", pch=18, cex=2, colorb="lightblue", breaks=10, LEGEND=NULL, 
  AXIS=NULL, MTEXT= NULL, TEXT=NULL, file="Output.txt")
```

Arguments

- **data**: Data file.
- **variable**: Variable to be selected.
- **group**: Variable with the groups to be compared.
- **group1**: Group to be selected within the variable `group`.
- **row**: Row number of the observation to be compared with the `group1`.
- **ResetPAR**: If it is `FALSE`, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function `PAR` that allows to modify many different aspects of the graph.
- **HIST**: It allows to specify the characteristics of the function `hist`.
- **colorp**: Color of the point of the observation.
pch Graphic symbol of the observation (see the description of the same argument in the function \text{F1}).
cex Size of the symbol of the observation.
colorb Color of the bars in the histogram.
breaks Number of bars of the histogram.
LEGEND It allows to modify the legend of the histogram.
AXIS It allows to add axes to the histogram.
MTEXT It allows to add text on the margins of the histogram.
TEXT It allows to add text in any area of the inner part of the histogram.
file TXT FILE. Name of the output file with the results of the Monte-Carlo test.

\textbf{Details}

In the Monte-Carlo test, if the alternative hypothesis is \textit{greater}, a p-value is estimated as: (number of random values equal to or greater than the observed one + 1)/(number of permutations + 1). The null hypothesis is rejected if the p-value is less than the significance level.

If the alternative hypothesis is \textit{smaller}, a pvalue is estimated as: (number of random values equal to or less than the observed one + 1)/(number of permutations + 1). Again, the null hypothesis is rejected if the p-value is less than the significance level.

\textbf{FUNCTIONS}

The histogram is performed with the function \text{hist} of base graphics package.

The Monte-Carlo test was performed with the function \text{as.randtest} of the package ade4 (Chessel et al., 2004; Dray et al., 2007; 2015).

\textbf{EXAMPLES}

For the example, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

In the example the morphometric variable M12 is compared between the observation of the row number 54, a individual of the species \textit{Triportheus magdalenae}, and all values of the species \textit{Triportheus angulatus}.

In the histogram, the bars are the frequency of the variable M12 for the species \textit{Triportheus angulatus} and the red point is the observation of the species \textit{Triportheus magdalenae}. 


When the alternative hypothesis is being smaller, the p-value is 0.055 and, therefore, it may be concluded that the observation of the species *Triportheus magdalenae* is significantly smaller than the individuals of the species *Triportheus angulatus* for the variable M12. However, when the alternative hypothesis is being greater, the p-value is 1 and, therefore, it may be concluded that the observation of the species *Triportheus magdalenae* is not significantly greater than the individuals of the species *Triportheus angulatus* for the variable M12.

Value

It is depicted a histogram with the frequencies of the *group1* and the point of the observation. It is saved a TXT file with the results of the Monte-Carlo test.

References


**Examples**

```r
## Not run:
data(Z1)

F44(data=Z1, variable="M12", group="Species", group1="Triportheus angulatus", row=54)

## End(Not run)
```

---

**MONTE-CARLO TEST FOR TWO VARIABLES**

**Description**

A Monte-Carlo test is performed for testing the hypothesis, in two variable, if an observation is significantly greater or lower than a set of values belonging to a group.

**Usage**

```r
F45(data, variable1, variable2, group, group1, row, ResetPAR=TRUE,
    PAR=NULL, BIVTEST=NULL, Pcol="red", colbiv="lightblue", br=20, sub="", LEGEND=NULL,
    AXIS=NULL, MTEXT= NULL, TEXT=NULL, TEXTX=NULL, TEXTY=NULL)
```

**Arguments**

- `data` Data file.
- `variable1` Variable 1 to be selected.
- `variable2` Variable 2 to be selected.
- `group` Variable with the groups to be compared.
- `group1` Group to be selected within the variable `group`.
- `row` Row number of the observation to be compared with the `group1`.
- `ResetPAR` If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
PAR
It accesses the function \texttt{PAR} that allows to modify many different aspects of the graph.

BIVTEST
It accesses the function \texttt{biv.test} of the package adehabitatHS, which performs the bivariate plot that displays the results of a bivariate Monte-Carlo test.

\texttt{Pcol}
Color or name for the observation in the BIVTEST plot.

\texttt{colbiv}
Color or name of all values of group 1 in the BIVTEST plot.

\texttt{br}
Numbers of breaks of the histograms in the BIVTEST plot.

\texttt{sub}
Title in the BIVTEST plot.

LEGEND
It allows to modify the legend of the BIVTEST plot.

AXIS
It allows to add axes to the BIVTEST plot.

MTEXT
It allows to add text on the margins of BIVTEST plot.

TEXT
It allows to add text in any area of the inner part of the BIVTEST plot.

TEXTX
It allows to modify the legend of axis X.

TEXTY
It allows to modify the legend of axis Y.

Details
In the Monte-Carlo test, if the alternative hypothesis is \textit{greater}, a p-value is estimated as: \((\text{number of random values equal to or greater than the observed one} + 1)/(\text{number of permutations} + 1)\). The null hypothesis is rejected if the p-value is less than the significance level.

If the alternative hypothesis is \textit{smaller}, a p-value is estimated as: \((\text{number of random values equal to or less than the observed one} + 1)/(\text{number of permutations} + 1)\). Again, the null hypothesis is rejected if the p-value is less than the significance level.

FUNCTIONS
The Monte-Carlo test was performed with the function \texttt{as.randtest} of the package ade4 (Chessel et al., 2004; Dray et al., 2007; 2015). The bivariate plot that displays the results of a bivariate Monte-Carlo test, for which the p-values are computed with the function \texttt{as.randtest} (one-sided tests), was performed with the function \texttt{biv.test} of the package adehabitatHS (Calenge, 2006; 2015).

EXAMPLES
For the example, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

In the example the morphometric variables M12 and M15 are compared between the observation of the row number 54, an individual of the species \textit{Triportheus magdalenae}, and all values of the species \textit{Triportheus angulatus}.

For the variable M15 \(p = 0.278\) and, therefore, there are not significant differences between the observation of the species \textit{Triportheus magdalenae} and the individuals of the species \textit{Triportheus angulatus}.

However, for the variable M12 \(p = 0.056\) and, therefore, it may be concluded that the observation is significantly different than all individuals of the species \textit{Triportheus angulatus}. 
Value

It is depicted a bivariate plot that displays the results of a bivariate Monte-Carlo test.

References


Examples

```r
## Not run:

data(Z1)

F46(data=Z1, variable1="M12", variable2="M15", group="Species",
    group1="Triportheus angulatus", row=54, LEGEND = c("x='
    "quotesingle.Var
topright'", 
    "legend=dati", "col=col", "bty = 'n'", "pch=c(16,16)", "text.font=3"))

## End(Not run)
```

Description

This function calculates the polar coordinates of several variables.

Usage

```r
F46(data, variables, group=NULL, cor=TRUE, ellipse=FALSE, convex=FALSE,
    SCATTERPLOT=NULL, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL,
    YLIM=NULL, PCH=NULL, COLOR=NULL, LEGEND=NULL, MTEXT= NULL, TEXT=NULL,
    arrows=TRUE, larrow=1, ARROWS=NULL, TEXTa=NULL, file="Polar coordinates.csv",
    na="NA", dec="", row.names=FALSE)
```

Arguments

data Data file.

variables Variables to be selected. If qualitative variables are used as independent variables, they must be put into a countable number of categories, i.e., the names of the categories must be numbers.

group Variable with the groups to be discriminated.

cor If it is TRUE the variables are ordered according to the correlation between them when estimating the polar coordinates. Therefore, the next variable to another variable is the one that has a greater positive correlation.

ellipse If it is TRUE the ellipses with the levels of significance to the 0.5 (inner ellipse) and 0.95 (outer ellipse) of each category of the variable group is depicted. These levels of significance can be modified by entering the function `scatterplot` using the argument `SCATTERPLOT` and modifying the argument `levels=c(0.5,0.95)`. 
convex  If it is TRUE the convex hull is depicted for each category.
SCATTERPLOT It accesses the function `scatterplot` of the car package, with the graph `biplot`.
ResetPAR  If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function `PAR` that allows to modify many different aspects of the graph.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
XLIM  Vector with the limits of the X axis.
YLIM  Vector with the limits of the Y axis.
PCH  Vector with the symbols, that should be as many as different groups the variable `group` has. If NULL, they are automatically calculated starting with the symbol 15.
COLOR  It allows to modify the colors of the scatterplot. It must be as many as different categories of the variable `group`.
LEGEND  It allows to modify the legend of the scatterplot.
MTEXT  It allows to add text on the margins of the scatterplot.
TEXT  It allows to add text in any area of the inner part of the scatterplot.
arrows  If it is TRUE the arrows are shown in the scatterplot with the polar coordinates. These arrows show the vector of the variables selected when calculating the polar coordinates.
larrow  It modifies the length of the arrows.
ARROWS  It accesses the function `Arrows` of the package IDPmisc, which performs the arrows.
TEXTa  It allows to modify the labels at the end of the arrows.
file  CSV FILES. Filename with the polar coordinates.
a  CSV FILE. Text that is used in the cells without data.
dec  CSV FILE. It defines if the comma "," is used as decimal separator or the dot ".".
row.names  CSV FILE. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.

Details

**Polar coordinates**

All variables are transformed to a scale ranged between -1 and 1. For each value the X and Y polar coordinates are estimated using the following equations:

\[
    X = \sum_{i=1}^{n} |z_j| \cos(\alpha) \quad Y = \sum_{i=1}^{n} |z_j| \sin(\alpha)
\]
where \( z \) is the value of the variable \( j \) and \( n \) the number of variables.

Each variable is assigned an angle (\( \alpha \)). The increment value of the angle is always \( \frac{360}{n+2} \). If for instance the number of variables are 5, the increment angle is 36. Therefore, for the first variable if the value is \( \geq 0 \) the \( \alpha \) value is 36 and if the value is \( < 0 \) the value is 36+180, for the second variable if the value is \( \geq 0 \) the \( \alpha \) value is 36+36 and if the value is \( < 0 \) the value is 36+36+180, etc. Degrees to radians angle conversion is carried out assuming that 1 degree = 0.0174532925 radians.

Therefore, the order of the variables is important because a different alpha value is assigned. If the argument \( cor=TRUE \), the order is established calculating the correlation matrix of the variables, and ordering them in the way that each variable will be followed by the variable to which is highly correlated. The goal is to favor a larger dispersion of the data in the resulting polar coordinates system.

FUNCTIONS

The arrows are depicted with the function Arrows of the package IDPmisc (Locher & Ruckstuhl, 2014). The scatterplot is performed with the function scatterplot of the car package (Fox & Weisberg, 2011; Fox et al., 2014). The convex hull is estimated with the function chull of the package grDevices.

EXAMPLES

For the example, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

Figure shows the plots obtained in an example comparing the genera Bryconops and Ctenobrycon, with the variables M9, M10 and M6.
Value

It is depicted a scatter plot with the polar coordinates, which are also saved in a CSV file.

References


Examples

```r
## Not run:
data(Z1)
Z1<-subset(Z1,(Genus == "Bryconops") | (Genus == "Ctenobrycon"))
F46(data=Z1, variables=c("M9","M10","M6"), group="Genus", ellipse=TRUE,
LEGEND=c("x=\"topleft\"", "legend=unique(datosF[,\"Group\"])",
"col=color1", "pch=pcht", "bty='n'", "cex=1.2", "text.font=3") )
## End(Not run)
```

F47

**BARPLOTS FOR ONE VARIABLE**

Description

It performs a barplot for one variable, with or without error bars.

Usage

```r
F47(data, varY, varX, method="mean", dev=NULL, horiz=FALSE, BARPLOT=NULL, ResetPAR=TRUE,
PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL,
XLIM=NULL, YLIM=NULL, COLOR=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)
```
Arguments

data  Data file.
varY  Dependent variable.
varX  Qualitative independent variable with the categories.
method  The average of each category of the independent variable varX is estimated with the "mean" or the "median".
dev  If it is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
horiz  If it is FALSE, the bars are drawn vertically with the first bar to the left. If it is TRUE, the bars are drawn horizontally with the first at the bottom.
BARPLOT  It accesses the function barplot that allows to modify the barplot.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
order  If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
OrderCat  It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.
LabelCat  It allows to specify a vector with the names of the categories.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
XLI M  Vector with the limits of the X axis.
YLI M  Vector with the limits of the Y axis.
COLOR  Color of bars. It must be a single color or as many as different categories of the variable varX.
LEGEND  It allows to add a legend to the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The plot is performed with the functions barplot and arrows of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES

For the example, morphometric data of three families of freshwater fishes are used. For details see Guisande et al. (2010).

Example 1 The mean value without standard deviations for the M12 is shown for all genera.
Example 2 The mean value for the M12 is shown for all genera and the standard deviations with the argument `dev="sd"`.

Value

A barplot for one variable, with or without error bars, is obtained.

References


Examples

```r
## Not run:
```
#Example 1

data(Z1)

F47(data=Z1, varY="M12", varX="Genus", order="increasing")

#Example 2

F47(data=Z1, varY="M12", varX="Genus", dev="sd")

## End(Not run)

---

**BARPLOTS FOR SEVERAL VARIABLES**

**Description**

It performs a barplot for several variables, with or without error bars.

**Usage**

F48(data, varY, varX, method="mean", dev=NULL, horiz=FALSE, beside=TRUE, BARPLOT=NULL, ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Qualitative independent variable with the categories.
- **method**: The average of each category of the independent variable varX is estimated with the "mean" or the "median".
- **dev**: If it is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
- **horiz**: If it is FALSE, the bars are drawn vertically with the first bar to the left. If it is TRUE, the bars are drawn horizontally with the first at the bottom.
- **beside**: If it is FALSE, the columns of height are portrayed as stacked bars, and if TRUE the columns are portrayed as juxtaposed bars.
- **BARPLOT**: It accesses the function barplot that allows to modify the barplot.
- **ResetPAR**: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function PAR that allows to modify many different aspects of the graph.
order  If it is NULL the categories are ordered as found in the variable FactorX, if it is
"increasing" are ordered from lesser to greater median or mean according to the
method selected in the argument method, if it is "decreasing" are ordered from
greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and
if it is "alphaZA" from Z to A.
OrderCat  It allows to specify a vector with the order in which the categories are shown. If
this argument is specified, the argument order is not taken into account.
LabelCat  It allows to specify a vector with the names of the categories.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
XLIM  Vector with the limits of the X axis.
YLIM  Vector with the limits of the Y axis.
COLOR  Color of bars. It must be a single color or as many as different variables of varY.
LEGEND  It allows to add a legend to the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions barplot and arrows of base graphics package. For further
details see Guisande & Vammonde (2012).

EXAMPLES
For the example, morphometric data of three families of freshwater fishes, as the distance from the
origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12),
body height (M11), etc., are used. For details see Guisande et al. (2010).

Example 1 The mean value for the M12, M15 and M16 is shown for all genera in alphabetical order
with the argument order="alphaAZ" and without standard deviations.
**Example 2** The mean value for the M12, M15 and M16 is shown for all genera and the standard deviations with the argument `dev="sd"`. The bars are horizontal with the argument `hori=TRUE`.

**Example 3** The columns of height are portrayed as stacked with the argument `beside=FALSE`.
A barplot for several variables, with or without error bars, is obtained.

References


Examples

```r
# Not run:

# Example 1

data(Z1)

F48(data=Z1, varY=c("M12","M15","M16"), varX="Genus", order="alphaAZ")

# Example 2

data(Z1)

F48(data=Z1, varY=c("M12","M15","M16"), varX="Genus", dev="sd", horiz=TRUE)

# Example 3

data(Z1)

F48(data=Z1, varY=c("M12","M15","M16"), varX="Genus", beside=FALSE)
```
**BARPLOTS WITH CYLINDRICAL BARS FOR ONE VARIABLE**

**Description**

It performs a barplot for one variable, with or without error bars.

**Usage**

```r
F49(data, varY, varX, method="mean", dev=NULL, BARPLOT=NULL, ResetPAR=TRUE,
PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL,
XLIM=NULL, YLIM=NULL, COLOR="green", LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL)
```

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Qualitative independent variable with the categories.
- **method**: The average of each category of the independent variable `varX` is estimated with the "mean" or the "median".
- **dev**: If it is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
- **BARPLOT**: It accesses the function `barp` that allows to modify the barplot.
- **ResetPAR**: If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function `PAR` that allows to modify many different aspects of the graph.
- **order**: If it is NULL the categories are ordered as found in the variable `FactorX`, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument `method`, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
- **OrderCat**: It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument `order` is not taken into account.
- **LabelCat**: It allows to specify a vector with the names of the categories.
- **XLAB**: Legend of the X axis.
- **YLAB**: Legend of the Y axis.
- **XLIM**: Vector with the limits of the X axis.
- **YLIM**: Vector with the limits of the Y axis.
- **COLOR**: Color of bars. It must be a single color or as many as different categories of the variable `varX`. 
LEGEND  It allows to add a legend to the graph.
AXIS      It allows to add axes to the graph.
MTEXT     It allows to add text on the margins of the graph.
TEXT      It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions `barp` of the package plotrix (Lemon et al., 2015) and `arrows` of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES
For the example, morphometric data of three families of freshwater fishes are used. For details see Guisande et al. (2010).

Example 1 The mean value without standard deviations for the M12 is shown for all genera.

Example 2 The mean value for the M12 is shown for all genera and the standard deviations with the argument `dev="sd"`. 

![Graph showing mean values and standard deviations for different genera](image)
A barplot for one variable, with or without error bars, is obtained.

References


Examples

```r
## Not run:

# Example 1

data(Z1)

F49(data=Z1, varY="M12", varX="Genus", order="increasing")

# Example 2

F49(data=Z1, varY="M12", varX="Genus", dev="sd")

## End(Not run)
```
F50  

**BARPLOTS WITH CYLINDRICAL BARS FOR SEVERAL VARIABLES**

**Description**

It performs a barplot for several variables, with or without error bars.

**Usage**

F50(data, varY, varX, method=“mean”, dev=NULL, BARPLOT=NULL, ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL)

**Arguments**

data  
Data file.

varY  
Dependent variable.

varX  
Qualitative independent variable with the categories.

method  
The average of each category of the independent variable varX is estimated with the "mean" or the "median".

dev  
If it is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

BARPLOT  
It accesses the function barp that allows to modify the barplot.

ResetPAR  
If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR  
It accesses the function PAR that allows to modify many different aspects of the graph.

order  
If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.

OrderCat  
It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

LabelCat  
It allows to specify a vector with the names of the categories.

XLAB  
Legend of the X axis.

YLAB  
Legend of the Y axis.

XLIM  
Vector with the limits of the X axis.

YLIM  
Vector with the limits of the Y axis.

COLOR  
Color of bars. It must be a single color or as many as different variables of varY.

LEGEND  
It allows to add a legend to the graph.

AXIS  
It allows to add axes to the graph.

MTEXT  
It allows to add text on the margins of the graph.

TEXT  
It allows to add text in any area of the inner part of the graph.
Details

FUNCTIONS

The plot is performed with the functions `barp` of the package `plotrix` (Lemon et al., 2015) and `arrows` of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLES

For the example, morphometric data of three families of freshwater fishes are used. For details see Guisande et al. (2010).

Example 1 The mean value for the M12, M15 and M16 is shown for all genera in alphabetical order with the argument `order="alphaAZ"` and without standard deviations.

Example 2 The mean value for the M12, M15 and M16 is shown for all genera and the standard deviations with the argument `dev="sd"`. 
Value

A barplot for several variables, with or without error bars, is obtained.

References


Examples

```r
## Not run:
data(Z1)
F50(data=Z1, varY=c("M12","M15","M16"), varX="Genus", order="alphaAZ")

#Example 2
data(Z1)
F50(data=Z1, varY=c("M12","M15","M16"), varX="Genus", dev="sd")

## End(Not run)
```

BIPLOTS

Description

It performs biplots with one or two matrices.

Usage

```r
F51(data, varY.1, varX.1, cat.1, varY.2=NULL, varX.2=NULL, cat.2=NULL, labels=NULL, scale=TRUE, ellipse=FALSE, convex=FALSE, SCATTERPLOT=NULL, LABEL=NULL, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM1=NULL, YLIM1=NULL, PCH=NULL, COLOR=NULL, LEGEND=NULL, MTEXT= NULL, TEXT1=NULL, ARROWS=NULL, XLIM2=NULL, YLIM2=NULL, TEXT2=NULL)
```
Arguments

data
variable Y of matrix 1.

varY.1
variable X of matrix 1.

varX.1
variable of matrix 1 with the groups to be discriminated.

cat.1
variable Y of matrix 2, which is depicted with arrows.

varY.2
variable X of matrix 2, which is depicted with arrows.

varX.2
variable of matrix 2 with the text at the end of the arrows.

labels
variable of matrix 1 with the text labels.

cat.2
variable of matrix 1 with the text labels.

scale
if it is TRUE the scale of matrix 2, which is depicted with arrows, it is adjusted to the scale of matrix 1.

ellipse
if it is TRUE the ellipses with the levels of significance to the 0.5 (inner ellipse) and 0.95 (outer ellipse) of each category of the variable cat.1 is depicted. These levels of significance can be modified by entering the function scatterplot using the argument SCATTERPLOT and modifying the argument levels=c(0.5,0.95).

convex
if it is TRUE the convex hull is depicted for each category.

SCATTERPLOT
it accesses the function scatterplot of the car package, with the graph biplot.

LABEL
it allows to specify the characteristics of the text labels of the argument labels, with the function text.

ResetPAR
if it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
it accesses the function PAR that allows to modify many different aspects of the graph.

XLAB
legend of the X axis.

YLAB
legend of the Y axis.

XLM1
vector with the limits of the X axis in the matrix 1.

YLM1
vector with the limits of the Y axis in the matrix 1.

PCH
vector with the symbols, that should be as many as different groups the variable cat.1 has. If NULL, they are automatically calculated starting with the symbol 15.

COLOR
it allows to modify the colors of the scatterplot. It must be as many as different categories of the variable cat.1.

LEGEND
it allows to modify the legend of the scatterplot.

MTEXT
it allows to add text on the margins of the scatterplot.

TEXT1
it allows to add text in any area of the inner part of the scatterplot.

ARROWS
it accesses the function Arrows of the package IDPmisc, which performs the arrows.

XLIM2
vector with the limits of the X axis in the matrix 2.

YLIM2
vector with the limits of the Y axis in the matrix 2.

TEXT2
it allows to modify the labels at the end of the arrows.
Details

FUNCTIONS
The arrows are depicted with the function Arrows of the package IDPmisc (Locher & Ruckstuhl, 2014).
The scatterplot is performed with the function scatterplot of the car package (Fox & Weisberg, 2011; Fox et al., 2014).
The convex hull is estimated with the function chull of the package grDevices.

EXAMPLES
The dataset is the output of a Principal Component Analysis (PCA) of a study carried out with demographic parameters of 57 countries in Europe, Africa and America. The variables used were male and female life expectancy at birth (in years of life), the mortality rates, infant mortality, birth, and fertility, the gross domestic product per capita (in thousands of dollars per year) and the literacy rate for men and women (in percentage) in the year 2000. The data were obtained from The World Bank [http://www.worldbank.org/].

Example 1 Biplot with the scores of the axes 1 and 2 of the PCA, where the categories are the continents and the ellipses are shown with the argument $ellipse=TRUE$.

Example 2 As the example 1 but the scores are labeled with the countries using the argument $labels="Country"$. 
Example 3 As the example 1 but a second matrix is added with the position of the variables in the PCA and the convex hull is depicted for each category with the argument `convex=TRUE`. 
Value

It is depicted a biplot with one or two matrices.

References


Examples

```r
## Not run:

#Example 1

data(Z18)
```
F51(data=Z18, varY.1="PC2.1", varX.1="PC1.1", cat.1="Continent", ellipse=TRUE)

#Example 2
data(Z18)
F51(data=Z18, varY.1="PC2.1", varX.1="PC1.1", cat.1="Continent", ellipse=TRUE, labels="Country")

#Example 3
data(Z18)
F51(data=Z18, varY.1="PC2.1", varX.1="PC1.1", cat.1="Continent", convex=TRUE, varY.2="PC2.2", varX.2="PC1.2", cat.2="Variables")

## End(Not run)

---

**F52 POPULATION PYRAMID PLOT**

**Description**

It performs a population pyramid plot for many variables.

**Usage**

F52(data, lbars, rbars, labels, toplabels=c("Males","Age","Females"), showvalues=0, PYRAMIDPLOT=NULL, ResetPAR=TRUE, PAR=NULL, XLIM=NULL, COLOR=NULL, LEGEND=NULL, MTEXT= NULL, TEXT=NULL)

**Arguments**

- **data** Data file.
- **lbars** Variable or variables to be located in the right bars.
- **rbars** Variable or variables to be located in the left bars. There must be the same number than those of *lbars*.
- **labels** Variable with the labels for the categories represented by each pair of bars.
- **toplabels** The names represented on the left and right sides of the plot and a heading for the labels in the center.
- **showvalues** If it is 0 the values are not represented, if it is 1 the values of the first set *lbars[1]* and *lbars[1]* are shown, if it is 2 the values of the second set *lbars[2]* and *lbars[2]* are shown, etc.
- **PYRAMIDPLOT** It accesses the function pyramid.plot that allows to modify the population plot.
- **ResetPAR** If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.

XLIM  Vector with two values, with the maximum values for left bars and right bars.

COLOR  Color of bars. It must be as many as different variables of lbars and rbars. As the color has transparency, the plot must be copy as bitmap and not metafile.

LEGEND  It allows to modify the legend to the graph.

MTEXT  It allows to add text on the margins of the graph.

TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The plot is performed with the functions pyramid.plot of the package plotrix (Lemon et al., 2015). For further details see Guisande & Vammonde (2012).

EXAMPLES


Example 1 It is depicted the males, females and foreigners in 1991. The colors are modified with the argument COLOR and the legend with the argument LEGEND. With the argument showvalues=1
is indicated to show the values of the first set of data, in this case M.1991 and F.1991, so the first variable for both lbars and rbars.

**Example 2** The default options are used with the exception that, with the argument `showvalues=2`, it is depicted the values of the second set of data, in this case MF.1991 and FF.1991, so the second variable for both lbars and rbars.

A population pyramid plot is obtained.

**References**


Examples

```r
## Not run:
#Example 1
data(Z7)
    labels="Age", showvalues=1, COLOR=c("blue","red","pink","red"),
    LEGEND = c("x = 'topleft'","legend=c('Males', 'Females', 'Foreigners')","col=c('blue','pink','red')","pch = 15","bty = 'n'"))

#Example 2
data(Z7)
    labels="Age", showvalues=2)
## End(Not run)
```

---

**BUBBLE CHART**

**Description**

It performs a bubble chart in which a variable defines the size of the bubble and other variable the color gradient of the bubbles.

**Usage**

```r
F53(data, varY, varX, varSize=NULL, varColor=NULL, palette= "heat.colors",
    size=c(1,5), legSpos="topleft", orientation="vertical", digitsS=0, digitsC=0,
    ncolor=10, transparency=1, ResetPAR=TRUE, PAR=NULL, PLOT=NULL, POINTS=NULL,
    COLEGEND=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, LEGENDS=NULL,
    MTEXT= NULL, TEXT=NULL, AXIS=NULL)
```

**Arguments**

- **data**: Data file.
- **varY**: Variable Y.
- **varX**: Variable X.
- **varSize**: This variable defines the size of the bubble.
- **varColor**: This variable defines the color gradient of the bubbles.
palette
The color gradient may be one of these palettes: "heat.colors", "terrain.colors", "gray.colors", "topo.colors" or "cm.colors".

size
Range of size of the bubbles. Two values: minimum and maximum size.

legSpos
Position of the size legend: "topleft", "topright", "bottomleft" or "bottomright".

orientation
Orientation of the size legend: "vertical" or "horizontal"

digitsS
Number of digits of the bubble size legend.

digitsC
Number of digits of the color legend.

ncolor
Number of breakpoints of the color legend.

transparency
Transparency of the color gradient, from 0 to 1.

ResetPAR
If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
It accesses the function PAR that allows to modify many different aspects of the graph.

PLOT
It allows to modify the plot with the function plot.default.

POINTS
It allows to modify the points of the plot with the function points.

COLEGGEND
It allows to modify the color legend with the function color.legend.

XLAB
Legend of the X axis.

YLAB
Legend of the Y axis.

XLIM
Vector with the limits of the X axis.

YLIM
Vector with the limits of the Y axis.

LEGENDS
It allows to modify the legend of the bubble size.

MTEXT
It allows to add text on the margins of the graph.

TEXT
It allows to add text in any area of the inner part of the graph.

AXIS
It allows to add axes to the graph.

Details

FUNCTIONS
The plot is performed with the function plot.default of base graphics package. The color legend is performed with the function color.legend of the package plotrix (Lemon et al., 2015).

EXAMPLES
The examples use the records of the freshwater fish species Perca fluviatilis in different geographic coordinates, and the temperature and altitude.

Example 1 The size of the bubble is according to the number of records for each latitude and longitude. The position and orientation of the size legend is changed with the arguments legSpos="bottomright" and orientation="horizontal", respectively.
**Example 2** The color gradient is according to the temperature for each latitude and longitude.
Example 3 Both bubble size and color gradient are used.

Value
A bubble chart is obtained.

References

Examples
```r
## Not run:

# Example 1

data(Z19)
F53(data=Z19, varY="Latitude", varX="Longitude", varSize="Records", legSpos="bottomright", orientation="horizontal")

# Example 2
```
data(Z19)

F53(data=Z19, varY="Latitude", varX="Longitude", varColor="Temperature")

#Example 3

data(Z19)

F53(data=Z19, varY="Latitude", varX="Longitude", varSize="Records", varColor="Temperature")

## End(Not run)

---

**F54**  
**TERNARY DIAGRAMS**

**Description**

It performs a ternary diagram for one or several groups.

**Usage**

F54(data, varX, varY, varZ, group=NULL, mean=FALSE, cexpoint=1, cexmean=1, cexaxis=1, cexlab=1.2, segments=TRUE, nseg=5, colseg="grey80", axisd=1, meand=2, XLAB=NULL, YLAB=NULL, ZLAB=NULL, XLIM=NULL, YLIM=NULL, ZLIM=NULL, COLOR=NULL, PCH=NULL, FAMILY="Arial", MAR=c(1,1,3,1), LEGEND=NULL, MTEXT=NULL, TEXT=NULL)

**Arguments**

- **data**: Data file.
- **varX**: Variable X.
- **varY**: Variable Y.
- **varZ**: Variable Z.
- **group**: Variable with the categories to be grouped.
- **mean**: If it is TRUE the mean of all values or the mean of each group (if the argument *group* is not NULL) is plotted.
- **cexpoint**: Size of the symbols.
- **cexmean**: Size of the labels of the means.
- **cexaxis**: Size of the labels of the axes.
- **cexlab**: Size of the legends of the axes.
- **segments**: If it is TRUE, segments into the triangle are drawn.
- **nseg**: Number of inside segments.
- **colseg**: Color of inside segments.
axisd  Number of digits of the labels of the axes.
meand  Number of digits of the labels of the means.
XLAB   Legend of the X axis.
YLAB   Legend of the Y axis.
ZLAB   Legend of the Z axis.
XLIM   Vector with the limits of the X axis.
YLIM   Vector with the limits of the Y axis.
ZLIM   Vector with the limits of the Z axis.
COLOR  Color of the symbols. If the argument \textit{group} is not NULL, it must be as many as different categories of the variable \textit{group}.
PCH    Graphic symbol (see the description of the same argument in the function \texttt{F1}). It the argument \textit{group} is not NULL, it must be as many as different categories of the variable \textit{group}.
FAMILY It specifies the font of the text.
MAR    A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the figure.
LEGEND It allows to modify the legend.
MTEXT  It allows to add text on the margins of the graph.
TEXT   It allows to add text in any area of the inner part of the graph.

Details

The barycenter of the triangle formed by the three variables was used as the centroid of the three variables. For further details see Guisande & Vammonde (2012).

EXAMPLES

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).
**Example 1** The ternary diagram is performed with the variables M12, M23 and M24.

![Ternary Diagram](image)

**Example 2** The mean value is depicted with the argument `mean=TRUE` and the limits are modified.
Example 3 The different families are identified with the argument `group="Family"`.

Example 4 The mean value for each family is depicted with the argument `mean=TRUE`. 
Value

A ternary diagram is obtained.

References


Examples

```r
# Not run:

#Example 1
data(Z8)
F54(data=Z8, varX="M12", varY="M21", varZ="M24")

#Example 2
data(Z8)
F54(data=Z8, varX="M12", varY="M21", varZ="M24", mean=TRUE, XLIM=c(0,1),
```
F55

\textbf{CONDITIONAL DENSITY PLOTS}

\textbf{Description}

It performs a conditional density plot describing how the distribution of a qualitative variable varies over a quantitative variable.

\textbf{Usage}

\[ \text{F55}(\text{data}, \text{varQuali}, \text{varQuanti}, \text{OrderCat=NULL, LabelCat=NULL, font.lab=2, cex.lab=14, ylab_tol=0.05, bw="nrd0", n=512, main=","}, \text{margins=c(5.1, 4.1, 4.1, 3.1), XLAB=NULL, YLAB=NULL, XLIM=NULL, COLOR=NULL}) \]

\textbf{Arguments}

- \texttt{data} \hspace{1cm} Data file.
- \texttt{varQuali} \hspace{1cm} Qualitative variable.
- \texttt{varQuanti} \hspace{1cm} Quantitative variable.
- \texttt{OrderCat} \hspace{1cm} It allows to specify a vector with the order in which the categories of the variable \texttt{varQuali} are shown.
- \texttt{LabelCat} \hspace{1cm} It allows to specify a vector with the names of the categories of the variable \texttt{varQuali}.
- \texttt{font.lab} \hspace{1cm} Font of the legend of the axes.
- \texttt{cex.lab} \hspace{1cm} Size of the legend of the axes.
- \texttt{ylab_tol} \hspace{1cm} Convenience tolerance parameter for y-axis annotation. If the distance between two labels drops under this threshold, they are plotted equidistantly.
- \texttt{bw} \hspace{1cm} The smoothing bandwidth to be used. For details see \texttt{bandwidth}.
- \texttt{n} \hspace{1cm} The number of equally spaced points at which the density is to be estimated.
Details

FUNCTIONS

The graph is performed with the function `cd_plot` of the package vcd (Meyer et al., 2006; 2008; 2015). For further details see Guisande & Vammonde (2012).

EXAMPLES

Smoking behaviour of men and women who smoke in different work centres.

The figure shows the relative proportion the of the persons interviewed in the four work centres according to their age.

Value

A conditional density plot is obtained.
References


Examples

```r
## Not run:
data(Z20)
F55(data=Z20, varQuali="Workplace", varQuanti="Age")
## End(Not run)
```

F56 MOSAIC PLOT

Description

It performs a mosaic plot of a contingency table.

Usage

```r
F56(data, varX, varY, OrderCatX=NULL, LabelCatX=NULL, OrderCatY=NULL, LabelCatY=NULL, shade=TRUE, cex.axis=1, MPLOT=NULL, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR=NULL)
```

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>data</td>
<td>Data file.</td>
</tr>
<tr>
<td>varX</td>
<td>Qualitative variable X.</td>
</tr>
<tr>
<td>varY</td>
<td>Qualitative variable Y.</td>
</tr>
<tr>
<td>OrderCatX</td>
<td>It allows to specify a vector with the order in which the categories of the variable <code>varX</code> are shown.</td>
</tr>
<tr>
<td>LabelCatX</td>
<td>It allows to specify a vector with the names of the categories of the variable <code>varX</code>.</td>
</tr>
<tr>
<td>OrderCatY</td>
<td>It allows to specify a vector with the order in which the categories of the variable <code>varY</code> are shown.</td>
</tr>
<tr>
<td>LabelCatY</td>
<td>It allows to specify a vector with the names of the categories of the variable <code>varY</code>.</td>
</tr>
<tr>
<td>shade</td>
<td>(logical) If <code>TRUE</code> the mosaic plot is shaded.</td>
</tr>
<tr>
<td>cex.axis</td>
<td>(numeric) The size of the axis labels.</td>
</tr>
<tr>
<td>MPLOT</td>
<td>(NULL)</td>
</tr>
<tr>
<td>ResetPAR</td>
<td>(logical) If <code>TRUE</code> the function resets the current display settings.</td>
</tr>
<tr>
<td>PAR</td>
<td>(NULL)</td>
</tr>
<tr>
<td>XLAB</td>
<td>(NULL)</td>
</tr>
<tr>
<td>YLAB</td>
<td>(NULL)</td>
</tr>
<tr>
<td>COLOR</td>
<td>(NULL)</td>
</tr>
</tbody>
</table>
LabelCatY: It allows to specify a vector with the names of the categories of the variable \( varY \).

shade: If it is TRUE a numeric vector of at most 5 distinct positive numbers giving the absolute values of the cut points for the residuals.

cex.axis: Size of the labels of the axes.

MPLT: It accesses the function mosaicplot that allows to modify the mosaic plot.

ResetPAR: If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR: It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB: Legend of the X axis.

YLAB: Legend of the Y axis.

COLOR: Logical or a vector of colors for color shading, used only when shade is FALSE, or NULL (default). By default, grey boxes are drawn. color = TRUE uses a gamma-corrected grey palette. color = FALSE gives white boxes with no shading.

Details

FUNCTIONS

The mosaic plot is performed with the function mosaicplot of the base package graphics. For further details see Guisande & Vammonde (2012).

EXAMPLES

Smoking behaviour of men and women who smoke in different work centres.

Example 1: In the first example, the question is whether there are differences between the group of people with any of the smoking parents and the group that their parents do not smoke, in the proportion of different types of smoker.

The figure shows the graphical representation of the contingency table. The categories of the variable X are ordered with the argument OrderCatX.

This chart also shows the residuals of the test \( \chi^2 \). As there are categories with color, the null hypothesis that the samples are homogeneous is rejected, that is to say, there are significant differences between the group with one of their smoking parents and the group without smoking parents, in the percentage of the different types of smokers. The chart also gives a very important additional information, the categories where the differences are significant and which are contributing to that, as a whole, the test \( \chi^2 \) is significant.

The white color categories are not significantly different, while the categories with color are significantly different. In particular, it notes that under the category of non-smoking parents, for both men and women, there is a significantly higher proportion of people who do not smoke (solid line). On the contrary, the number of people who do not smoke is significantly lower in the group of smoking parents (dashed line). Therefore, the fact that the parents do not smoke appears to foster their children not to smoke. However, once a person smokes, the degree to which smoke does not vary depending on whether the parents smoke or not smoke, as it could be observed that in all the categories of smokers, the color of the bars is white.
Example 2 The question is whether there are significant differences among working places in the proportion of males and females. As the color of all categories is white, there are not significant differences.

Example 3 As in the example 2, but as there are not significant differences, a grey palette is added with the argument \textit{COLOR=TRUE}. To use the argument \textit{COLOR}, it must be \textit{shade=FALSE}. 
Value

A mosaic plot is obtained.

References


Examples

### Not run:

```r
# Example 1

data(Z20)
F56(data=Z20, varX="Smoker", varY="Parents", OrderCatX=c("1 to 10 cigarettes a day", "11 to 20 cigarettes a day", "1 to 2 cigarette packets", "More than 2 cigarette packets", "Non-smoker"), cex.axis=0.8)

# Example 2

data(Z20)
F56(data=Z20, varX="Workplace", varY="Sex")
```
# Example 3

data(Z20)

F56(data = Z20, varX = "Workplace", varY = "Sex", shade = FALSE, COLOR = TRUE)

## End (Not run)

F57

ASSOCIATION PLOT

Description

It performs an association plot.

Usage

F57(data, varX, varY, varZ = NULL, OrderCatX = NULL, LabelCatX = NULL, OrderCatY = NULL, LabelCatY = NULL, OrderCatZ = NULL, LabelCatZ = NULL, APLOT = NULL, shade = TRUE, compress = TRUE, main = "", family = "Arial", cex.axis = 12, cex.lab = 15, cex.main = 17, cex.legend = 12, font.axis = 1, font.lab = 2, font.main = 2, legend.text = "Pearson\nresiduals", XLAB = NULL, YLAB = NULL, ZLAB = NULL)

Arguments

data Data file.

varX Qualitative variable X.

varY Qualitative variable Y.

varZ Qualitative variable Z.

OrderCatX It allows to specify a vector with the order in which the categories of the variable varX are shown.

LabelCatX It allows to specify a vector with the names of the categories of the variable varX.

OrderCatY It allows to specify a vector with the order in which the categories of the variable varY are shown.

LabelCatY It allows to specify a vector with the names of the categories of the variable varY.

OrderCatZ It allows to specify a vector with the order in which the categories of the variable varZ are shown.

LabelCatZ It allows to specify a vector with the names of the categories of the variable varZ.

APLOT It accesses the function assoc that allows to modify the association plot.

shade If it is TRUE the results of the statistical Chi square of Pearson are shown and, in addition, the categories that are significantly different are shaded.
compress  If it is FALSE the space between rows and columns is chosen so that the total of heights and widths of the rows and columns are equal. If TRUE, the space between rows and columns is fixed and, therefore, the graph is more compressed.

main    Title of the plot.

family  It specifies the font of the text.

cex.axis Size of the labels of the axes.

cex.lab  Size of the text of the legends.

cex.main Size of the graph title text.

cex.legend Size of text in the bar legend.

font.axis A numeric value that defines the font of the axis labels. The value 1 is a normal type, 2 is written in bold, 3 is written in italics and 4 is written in italics and bold.

cex.lab  A numeric value that defines the font of the legends.

cex.main A numeric value that defines the font of the title of the graph.

legend.text Text of the bar legend.

XLAB    Legend of the X axis.

YLAB    Legend of the Y axis.

ZLAB    Legend of the Z axis.

Details

FUNCTIONS

The graph is performed with the function assoc of the package vcd (Meyer et al., 2006; 2008; 2015). For further details see Guisande & Vammonde (2012).

EXAMPLES

Smoking behaviour of men and women who smoke in different work centres.

Example 1 In the first example, the question is whether there are differences between the group of people with any of the smoking parents and the group that their parents do not smoke, in the proportion of different types of degrees of smoker.

The figure shows the graphical representation of the contingency table. The categories of the variable X are ordered with the argument OrcerCatX.

This chart also shows the results of the test $\chi^2$ with a $p < 0.001$. As there are categories with color, the null hypothesis that the samples are homogeneous is rejected, that is to say, there are significant differences between the group with one of their smoking parents and the group without smoking parents, in the percentage of the different types of smokers.

The chart also gives a very important additional information, the categories where the differences are significant and which are contributing to that, as a whole, the test $\chi^2$ is significant.

The gray color categories are not significantly different, while the categories with color are significantly different. In particular, it notes that under the category of non-smoking parents, for both men and women, there is a significantly higher proportion of people who do not smoke (the bars are above the dotted line). On the contrary, the number of people who do not smoke is significantly lower in the group of smoking parents (the bar is below the dotted line).
Therefore, the fact that the parents do not smoke appears to foster their children not to smoke. However, once a person smokes, the degree to which smoke does not vary depending on whether the parents smoke or not smoke, as it could be observed that in all the categories of smokers, the color of the bars is gray.

**Example 2** As in the example 1 but adding the variable Sex. The conclusions are the same than in the example 1.

**Value**

A association plot is obtained.

**References**

Examples

## Not run:

#Example 1

data(Z20)

F57(data=Z20, varX="Smoker", varY="Parents", OrderCatX=c("1 to 10 cigarettes a day", "11 to 20 cigarettes a day", "1 to 2 cigarette packets", "More than 2 cigarette packets", "Non-smoker"))

#Example 2

data(Z20)

F57(data=Z20, varX="Smoker", varY="Parents", varZ="Sex", OrderCatX=c("1 to 10 cigarettes a day", "11 to 20 cigarettes a day", "1 to 2 cigarette packets", "More than 2 cigarette packets", "Non-smoker"))

## End(Not run)

Description

A paleoclimatic diagram is performed.

Usage

F58(data, varY, varX, zones=NULL, zoneNames=NULL, STRATIPOLOT=NULL, XLAB=NULL, YLAB=NULL, YLIM=NULL, type=c("poly","g"), pch=16, cex=1, col.line="black", col.symbol="black", col.refline="black", col.smooth="blue", col.poly="red", col.zones="transparent", lty=1, lwd.h=1, lty.smooth=1, lwd.smooth=2, lty.zones=1, lwd.zones=1)
Arguments

data Data file.
varY Variable Y.
varX Variables X.
zones A vector with the limits of the stratum.
zoneNames Character vector with the name of the stratum of the argument zones.
STRATIPLOT It accesses the function Stratiplot that allows to modify many different aspects of the diagram.
XLAB Legend of the X axis.
YLAB Legend of the Y axis.
YLIM Limits of Y axis.
type Type of plot. Character vector consisting of one or more of the following: "l", "p", "o", "b", "h", "g", "smooth" and "poly".
pch Graphic symbol (see the description of the same argument in the function F1).
cex Size of symbols.
col.line Color of line.
col.symbol Color of symbol.
col.refline Color of inner lines.
col.smooth Color of smooth line.
col.poly Color of the polygons.
col.zones Color of inner lines delimiting the zones.
lty Type of line (see the description of the same argument in the function F1).
lwd.h Line width.
lty.smooth Type of smooth line.
lwd.smooth Width of smooth line.
lty.zones Type of inner lines delimiting the zones.
lwd.zones Width of inner lines delimiting the zones.

Details

FUNCTIONS
The plot is performed with the function Stratiplot of the package analogue (Simpson, 2007; Simpson & Oksanen, 2015)

EXAMPLES
The concentration of metals in the sediment of one of the Yahuarkaka lakes (Leticia, Colombia) is used as example.
Example 1. Without stratum.
Example 2. With stratum.
Value

It is depicted a paleoclimatic diagram.

References


Examples

```r
## Not run:
#Example 1. Without stratum

data(Z21)

F58(data=Z21, varY="Depth", varX=c("Cr","Co","Ni","Pb","Al"))
```
Example 2. With stratum data(Z21)

F58(data=Z21, varY="Depth", varX=c("Cr","Co","Ni","Pb","Al"), zones=c(50,10,200,300), zoneNames=c("A","B","C","D"))

## End(Not run)

---

**PLOTS INSIDE ANOTHER PLOT**

**Description**

It allows to embed up to 10 plots inside another plot.

**Usage**

```r
F59(SPLOT, OMA1, SP1, OMA2=NULL, SP2=NULL, OMA3=NULL, SP3=NULL, OMA4=NULL, SP4=NULL, OMA5=NULL, SP5=NULL, OMA6=NULL, SP6=NULL, OMA7=NULL, SP7=NULL, OMA8=NULL, SP8=NULL, OMA9=NULL, SP9=NULL, OMA10=NULL, SP10=NULL)
```

**Arguments**

- **SPLOT**: Name of the script of the main plot. The script must be in the working directory.
- **OMA1**: Position of plot 1 inside the main plot. A vector (bottom, left, top, right) with the number of lines inside the main plot.
- **SP1**: Name of the script of the plot 1 inside the main plot. The script must be in the working directory. If it exists in the script the argument `ResetPAR`, it must be FALSE.
- **OMA2**: As the argument `OMA1` but for the plot 2.
- **SP2**: As the argument `SP1` but for the plot 2.
- **OMA3**: As the argument `OMA1` but for the plot 3.
- **SP3**: As the argument `SP1` but for the plot 3.
- **OMA4**: As the argument `OMA1` but for the plot 4.
- **SP4**: As the argument `SP1` but for the plot 4.
- **OMA5**: As the argument `OMA1` but for the plot 5.
- **SP5**: As the argument `SP1` but for the plot 5.
- **OMA6**: As the argument `OMA1` but for the plot 6.
- **SP6**: As the argument `SP1` but for the plot 6.
- **OMA7**: As the argument `OMA1` but for the plot 7.
- **SP7**: As the argument `SP1` but for the plot 7.
As the argument $OMA1$ but for the plot 8.

As the argument $SP1$ but for the plot 8.

As the argument $OMA1$ but for the plot 9.

As the argument $SP1$ but for the plot 9.

As the argument $OMA1$ but for the plot 10.

As the argument $SP1$ but for the plot 10.

Details

EXAMPLES

The plot shows the relationship between the distance from the origin of the dorsal fin to the origin of the anal fin (M13) and body height (M11) of several species of Characiforms (Guisande et al., 2010), and the plots inside are the frequency histograms for each measurement.
It is just necessary a script for each of the plots to be combined, so one for the main plot and one for each of the plots embedded into the main plot. To obtain the above chart, follows the following steps:

1. Save the following script, which performs the main plot, with the name SPLOT.R in the working directory.

   ```r
data(Z1)
F1(data=Z1, varY="M13", varX="M11", reg=TRUE, R2.pos="right")
```

2. Save the following script, which performs the first plot inside the main plot, with the name S1.R in the working directory.

   ```r
F19(data=Z1, var="M11", line=TRUE, COLOR="#000000FF", HIST=c("xlab=xlab", "main="", "ylab=ylab", "xlim=XLIM", "ylim=YLIM", "border=COLOR[h]", "col="#7FFFD4FF"), Reset-PAR=FALSE, PAR=c("cex.lab=0.9", "font.lab=2", "mar=(5,5,3,2)"), LEGEND=c("x='right'","legend=dati", "col=COLOR", "lty=lty", "bty='n'"))
```

3. Save the following script, which performs the second plot inside the main plot, with the name S2.R in the working directory.

   ```r
F19(data=Z1, var="M13", line=TRUE, COLOR="#000000FF", HIST=c("xlab=xlab", "main="", "ylab=ylab", "xlim=XLIM", "ylim=YLIM", "border=COLOR[h]", "col="#7FFFD4FF"), Reset-PAR=FALSE, PAR=c("cex.lab=0.9", "font.lab=2", "mar=(5,5,3,2)"), LEGEND=c("x='right'","legend=dati", "col=COLOR", "lty=lty", "bty='n'"))
```

4. Finally, you must run the script of the example and the following plot is obtained.

**Value**

It is possible to embed several plots inside another plot.

**References**


**Examples**

```r
## Not run:
F59(SPLOT="SP.R", OMA1=c(2.5,17,14,1), SP1="S1.R", OMA2=c(17,4,1,14), SP2="S2.R")
## End(Not run)
```
SCATTER PLOTS WITH MARGINAL HISTOGRAMS

**Description**

It performs a simple scatter plot with or without text labels and a regression model, and marginal histograms.

**Usage**

```r
F60(data, varY, varX, textlabel=NULL, label=NULL, MAR1=c(5,5,1,1),
    MAR2=c(2,5,1,0), MAR3=c(5,1.5,0,1), reg=FALSE, model="Linear", outliers=FALSE,
    quant1=0.05, quant2 = 0.95, ci=TRUE, level=0.95, ResetPAR=FALSE, PAR=NULL,
    XLAB=NULL, YLAB=NULL, COLOR="black", COLORR="red", PCH=16, lty=1, ltyci=2,
    lwd=2.5, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL,
    TEXT=NULL, dec=",", file="Output.txt", HIST=NULL, HISTh=NULL, breaks=20,
    COLOR1=NULL, COLORb="grey", MTEXTh1= NULL, TEXTh1=NULL, MTEXTh2= NULL, TEXTh2=NULL)
```

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Quantitative independent variable.
- **MAR1**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot.
- **MAR2**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the upper histogram.
- **MAR3**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the right side histogram.
- **textlabel**: Variable with the text labels.
- **label**: It allows to specify the characteristics of the text labels with the function `text`.
- **reg**: If TRUE a regression model is performed.
- **model**: One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
- **outliers**: If it is TRUE, the outliers are removed using the selected regression model.
- **quant1**: Quantile of the lower end to the elimination of outliers.
- **quant2**: Quantile of the upper end to the elimination of outliers.
- **ci**: If it is TRUE the confidence interval is depicted, but only for the linear regression model.
- **level**: Tolerance/confidence level.
ResetPAR
If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB
Legend of the X axis in the scatter plot.

YLAB
Legend of the Y axis in the scatter plot.

COLOR
Color of the symbols.

COLORR
Color of the line of the regression model.

PCH
Graphic symbol (see the description of the same argument in the function F1).

lty
Type of the regression line (see the description of the same argument in the function F1).

ltyci
Type of the confidence interval line (see the description of the same argument in the function F1).

lwd
Line width of the regression line.

R2.pos
If it is not NULL, with this argument is possible to specify the position of the $r^2$ of the regression in the scatter plot.

PLOT
It allows to specify the characteristics of the scatter plot with the function plot.default.

LEGEND
It allows to include a legend to the scatter plot.

AXIS
It allows to add axes to the scatter plot.

MTEXT
It allows to add text on the margins of the scatter plot.

TEXT
It allows to add text in any area of the inner part of the scatter plot.

dec
It defines if the comma "," is used as decimal separator or the dot ".".

file
TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.

HIST
It allows to specify the characteristics of the upper histogram with the function hist.

HISTh
It allows to specify the characteristics of the right side histogram with the function barplot.

breaks
Number of intervals.

COLOR1
Color of the borders. It must be as many as different variables.

COLORb
Color of the bars. It must be as many as different variables.

MTEXTh1
It allows to add text on the margins of the upper side histogram.

TEXTh1
It allows to add text in any area of the inner part of the upper side histogram.

MTEXTh2
It allows to add text on the margins of the right side histogram.

TEXTh2
It allows to add text in any area of the inner part of the right side histogram.
Details

FUNCTIONS
The scatter plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package. The function `lillie.test` of the package `nortest` (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function `dwtest` of the package `lmtest` (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function `bptest` of the package `lmtest` (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity. The histograms are performed with the functions `hist` and `barplot` of base graphics package.

EXAMPLES

Example 1 The data are scores of a Principal Component Analysis (PCA) performed to physico-chemical parameters from lakes in Colombia. In this example, text labels are assigned to the points with the argument `textlabel="Lake"`.

Example 2 For the examples, morphometric data of several fish species of Characiforms, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all species.
Example 3 A linear regression line is added to the example 2 with the argument `reg=TRUE`. 
For the explanation of the regression model shown in the TXT file, see function F1.

Value

A simple scatter plot with or without linear regression and marginal histograms is obtained. Moreover, a TXT file is saved with the results of the regression model.

References


Examples

```r
## Not run:

#Example 1

data(Z6)

F60(data=Z6, varY="Dimension2", varX="Dimension1", textlabel="Lake",
    XLAB="Dimension 1", YLAB="Dimension 2", PLOT = c("xlim= c(-1,1)",
    "xlab=xlab", "ylab=ylab", "col=COLOR", "pch=PCH")

#Example 2

data(Z1)

F60(data=Z1, varY="M13", varX="M11")

#Example 3

F60(data=Z1, varY="M13", varX="M11", reg=TRUE)

## End(Not run)
```
**F61**

**SIMPLE MEAN WITH ERROR BARS SCATTER PLOTS, WITH TEXT LABELS AND REGRESSION, AND WITH MARGINAL HISTOGRAMS**

**Description**

It performs a simple mean with error bars scatter plot for variable X quantitativ, with text labels and a regression model, and with marginal histograms.

**Usage**

```r
F61(data, varY, varX, Factor, method="mean", dev="sd", barY=TRUE, barX=FALSE, textlabel=FALSE, label=NULL, MAR1=c(5,1.5,1,0), MAR2=c(5,1.5,0,1), reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=FALSE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL,YLIM=NULL, COLOR="black", COLORI="black", COLORR="red", PCH=16, lty=3, lwd=2.5, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL, file1="Output.txt", file2="Average and error bars.csv", na="NA", dec=",", row.names=FALSE, HIST=NULL, HISTh=NULL, breaks=20, COLORl=NULL, COLORb="grey", MTEXTh1= NULL, TEXT2h1= NULL, MTEXTh2= NULL, TEXT2h2= NULL)
```

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Quantitative independent variable.
- **Factor**: Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.
- **method**: The average of each category of the grouped variable Factor is estimated with the "mean" or the "median".
- **dev**: The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
- **barY**: If it is TRUE the bar error of the variable Y is depicted.
- **barX**: If it is TRUE the bar error of the variable X is depicted.
- **textlabel**: If TRUE the text labels of the categories of the variable Factor are shown.
- **label**: It allows to specify the characteristics of the text labels with the function text.
- **MAR1**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot.
- **MAR2**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the upper histogram.
- **MAR3**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the right side histogram.
If it is TRUE a regression model is performed.

One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.

If it is TRUE, the outliers are removed using the selected regression model.

Quantile of the lower end to the elimination of outliers.

Quantile of the upper end to the elimination of outliers.

If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

It accesses the function PAR that allows to modify many different aspects of the graph.

Legend of the X axis in the scatter plot.

Legend of the Y axis in the scatter plot.

Vector with the limits of the X axis in the scatter plot.

Vector with the limits of the Y axis in the scatter plot.

Color of the symbols in the scatter plot.

Color of the error bars in the scatter plot.

Color of the line of the regression model in the scatter plot.

Graphic symbol (see the description of the same argument in the function F1).

Type of the regression line (see the description of the same argument in the function F1).

Line width of the regression line relative to the default (default=1), so 2 is twice as wide.

If it is not NULL, with this argument is possible to specify the position of the $r^2$ of the regression in the scatter plot.

It allows to specify the characteristics of the function plot.default.

It allows to include a legend to the graph.

It allows to add axes to the graph.

It allows to add text on the margins of the graph.

It allows to add text in any area of the inner part of the graph.

TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.

CSV FILE. File name with the mean, median, standard error and standard deviation for each category of the variable Factor.

CSV FILES. Text that is used in the cells without data.

CSV FILES. It defines if the comma ",," is used as decimal separator or the dot ".".

CSV FILES. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.
HISt

It allows to specify the characteristics of the upper histogram with the function hist.

HISth

It allows to specify the characteristics of the right side histogram with the function barplot.

breaks

Number of intervals.

COLORl

Color of the borders. It must be as many as different variables.

COLORb

Color of the bars. It must be as many as different variables.

MTEXTh1

It allows to add text on the margins of the upper side histogram.

TEXTh1

It allows to add text in any area of the inner part of the upper side histogram.

MTEXTh2

It allows to add text on the margins of the right side histogram.

TEXTh2

It allows to add text in any area of the inner part of the right side histogram.

Details

The equations of all regression models are in the section details of the function XI1 of the package StatR.

FUNCTIONS

All the functions used are the same than those described in function F22, and the histograms are performed with the functions hist and barplot of base graphics package.

EXAMPLES

For the examples, morphometric data of several fish species of Characiforms are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all genera.

Example 1 Relationship between the mean values of M13 and M11 for each genera with the standard deviation of the M11.
Example 2 As in the example 1 but adding the text labels of the genera with the argument `textlabel=TRUE`.

Example 3 As in the example 1 but a linear regression line is added with the argument `reg=TRUE` and also is shown the standard deviation on the variable M13 with the argument `barX=TRUE`. 
For the explanation of the regression model shown in the TXT file, see function F22.

**Value**

A simple scatter plot with mean error bars, with or without linear regression and with or without text labels, and with marginal histograms is obtained. A CSV file with the mean, median, standard error and standard deviation for each category of the variable Factor is also obtained.

**References**


**Examples**

```r
# Not run:

#Example 1
```
data(Z1)

F61(data=Z1, varY="M11", varX="M13", Factor="Genus")

#Example 2

F61(data=Z1, varY="M11", varX="M13", Factor="Genus", textlabel=TRUE, XLIM=c(0.2,0.8))

#Example 3

F61(data=Z1, varY="M11", varX="M13", Factor="Genus", barX=TRUE, reg=TRUE)

## End(Not run)

---

**F62 SCATTER PLOTS WITH MARGINAL BEANPLOTS**

**Description**

It performs a simple scatter plot with or without text labels and a regression model, and marginal beanplots.

**Usage**

```r
F62(data, varY, varX, textlabel=NULL, label=NULL, MAR1=c(5,5,1,1), MAR2=c(2,5,1,1), MAR3=c(5,1.5,1,1), reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ci=FALSE, level=0.95, ResetPAR=FALSE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR="black", COLORR="red", PCH=16, lty=1, ltyci=2, lwd=2.5, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT=NULL, TEXT=NULL, dec="", file="Output.txt", BEANPLOT=NULL, COLORb="grey", ll=0.16)
```

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **varX**: Quantitative independent variable.
- **MAR1**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot.
- **MAR2**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the upper beanplot.
- **MAR3**: A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the right side beanplot.
- **textlabel**: Variable with the text labels.
- **label**: It allows to specify the characteristics of the text labels with the function `text`.
- **reg**: If TRUE a regression model is performed.
model

One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.

outliers

If it is TRUE, the outliers are removed using the selected regression model.

quant1

Quantile of the lower end to the elimination of outliers.

quant2

Quantile of the upper end to the elimination of outliers.

ci

If it is TRUE the confidence interval is depicted, but only for the linear regression model.

level

Tolerance/confidence level.

ResetPAR

If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR

It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB

Legend of the X axis in the scatter plot.

YLAB

Legend of the Y axis in the scatter plot.

COLOR

Color of the symbols.

COLORR

Color of the line of the regression model.

PCH

Graphic symbol (see the description of the same argument in the function F1).

lty

Type of the regression line (see the description of the same argument in the function F1).

ltyci

Type of the confidence interval line (see the description of the same argument in the function F1).

lwd

Line width of the regression line.

R2.pos

If it is not NULL, with this argument is possible to specify the position of the $r^2$ of the regression in the scatter plot.

PLOT

It allows to specify the characteristics of the scatter plot with the function plot.default.

LEGEND

It allows to include a legend to the scatter plot.

AXIS

It allows to add axes to the scatter plot.

MTEXT

It allows to add text on the margins of the scatter plot.

TEXT

It allows to add text in any area of the inner part of the scatter plot.

dec

It defines if the comma "," is used as decimal separator or the dot ".".

file

TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.

BEANPLOT

It allows to specify the characteristics of the beanplots with the function beanplot.

COLORb

A vector of up to four colors can be used in the following order: area of the beans (without the border, use border for that color), the lines inside the bean, the lines outside the bean, and the average line per bean.

ll

The length of the beanline per point found.
Details

FUNCTIONS

The scatter plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package.

The function `lillie.test` of the package `nortest` (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction.

The function `dwtest` of the package `lmtest` (Hothorn et al., 2013) is used to analyze the autocorrelation with the test and the Durbin-Watson statistic.

The function `bptest` of the package `lmtest` (Hothorn et al., 2013) is used to perform the Breusch-Pagan test of homoscedasticity.

The beanplots are performed with the function `beanplot` of the `beanplot` package (Kampstra, 2008; Kampstra, 2015).

For further details see the help of the function `beanplot` and/or Guisande & Vammonde (2012).

EXAMPLES

Example 1 The data are scores of a Principal Component Analysis (PCA) performed to physicochemical parameters from lakes in Colombia. In this example, text labels are assigned to the points with the argument `textlabel="Lake"`.

Example 2 For the examples, morphometric data of several fish species of Characiforms are used (Guisande et al., 2010). It is shown the relationship between M11 and M13 for all species. The length of the lines inside the beanplot was modified with the argument `ll=0.05`.
Example 3 A linear regression line is added to the example 2 with the argument `reg=TRUE`.
For the explanation of the regression model shown in the TXT file, see function F1.

Value

A simple scatter plot with or without linear regression and marginal beanplots is obtained. Moreover, a TXT file is saved with the results of the regression model.

References


Examples

## Not run:

#Example 1

data(Z6)

F62(data=Z6, varY="Dimension2", varX="Dimension1", textlabel="Lake",
XLAB="Dimension 1", YLAB="Dimension 2", PLOT = c("xlim= c(-1,1)", "xlab=xlab",
"ylab=ylab", "col=COLOR", "pch=PCH")

#Example 2

data(Z1)

F62(data=Z1, varY="M13", varX="M11", ll=0.05)

#Example 3

F62(data=Z1, varY="M13", varX="M11", reg=TRUE, ll=0.05)

## End(Not run)

F63

SIMPLE MEAN WITH ERROR BARS SCATTER PLOTS, WITH TEXT LABELS AND REGRESSION, AND WITH MARGINAL BEANPLOTS

Description

It performs a simple mean with error bars scatter plot for variable X quantitativ, with text labels and a regression model, and with marginal beanplots.

Usage

F63(data, varY, varX, Factor, method="mean", dev="sd", barY=TRUE,
barX=FALSE, textlabel=FALSE, label=NULL, MAR1=c(5,5,1,1), MAR2=c(2,5,1,1),
MAR3=c(5,1.5,1,1), reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05,
quant2 = 0.95, ResetPAR=FALSE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLM=NULL,
YLM=NULL, COLOR="black", COLORI="black", COLORR="red", PCH=16, lty=3,
lwd=2.5, R2.pos="topleft", PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL,
TEXT=NULL, file1="Output.txt", file2="Average and error bars.csv", na="NA",
dec=",", row.names=FALSE, BEANPLOT=NULL, COLORb="grey", ll=0.16)
Arguments

data  Data file.
varY  Dependent variable.
varX  Quantitative independent variable.
Factor  Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.
method  The average of each category of the grouped variable Factor is estimated with the "mean" or the "median".
dev  The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
barY  If it is TRUE the bar error of the variable Y is depicted.
barX  If it is TRUE the bar error of the variable X is depicted.
textlabel  If TRUE the text labels of the categories of the variable Factor are shown.
label  It allows to specify the characteristics of the text labels with the function text.
MAR1  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot.
MAR2  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the upper beanplot.
MAR3  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the right side beanplot.
reg  If it is TRUE a regression model is performed.
model  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers  If it is TRUE, the outliers are removed using the selected regression model.
quant1  Quantile of the lower end to the elimination of outliers.
quant2  Quantile of the upper end to the elimination of outliers.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
XLAB  Legend of the X axis in the scatter plot.
YLAB  Legend of the Y axis in the scatter plot.
XLIM  Vector with the limits of the X axis in the scatter plot.
YLIM  Vector with the limits of the Y axis in the scatter plot.
COLOR  Color of the symbols in the scatter plot.
COLORI  Color of the error bars in the scatter plot.
COLORR  Color of the line of the regression model in the scatter plot.
PCH  Graphic symbol (see the description of the same argument in the function F1).
lty  Type of the regression line (see the description of the same argument in the function F1).
lwd  Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
R2.pos  If it is not NULL, with this argument is possible to specify the position of the \( r^2 \) of the regression in the scatter plot.
PLOT  It allows to specify the characteristics of the function plot.default.
LEGEND  It allows to include a legend to the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
file1  TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regression.
file2  CSV FILE. File name with the mean, median, standard error and standard deviation for each category of the variable Factor.
na  CSV FILES. Text that is used in the cells without data.
dec  CSV FILES. It defines if the comma "," is used as decimal separator or the dot ".".
row.names  CSV FILES. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.
BEANPLOT  It allows to specify the characteristics of the beanplots with the function beanplot.
COLORb  A vector of up to four colors can be used in the following order: area of the beans (without the border, use border for that color), the lines inside the bean, the lines outside the bean, and the average line per bean.
ll  The length of the beanline per point found.

Details

The equations of all regression models are in the section details of the function XII of the package StatR.

FUNCTIONS

All the functions used are the same than those described in function F22, and the beanplots are performed with the function beanplot of the beanplot package (Kampstra, 2008; Kampstra, 2015). For further details see the help of the function beanplot and/or Guisande & Vammonde (2012).

EXAMPLES

For the examples, morphometric data of several fish species of Characiforms are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all genera.

Example 1  Relationship between the mean values of M13 and M11 for each genera with the standard deviation of the M11. The length of the lines inside the beanplot was modified with the argument ll=0.05.
Example 2 As in the example 1 but adding the text labels of the genera with the argument `textlabel=TRUE`. 
Example 3 As in the example 1 but a linear regression line is added with the argument `reg=TRUE` and also is shown the standard deviation on the variable M13 with the argument `barX=TRUE`. 
For the explanation of the regression model shown in the TXT file, see function F22.

Value

A simple scatter plot with mean error bars, with or without linear regression and with or without text labels, and with marginal beanplots is obtained. A CVS file with the mean, median, standard error and standard deviation for each category of the variable Factor is also obtained.

References


Examples

```r
## Not run:
# Example 1
data(Z1)
F63(data=Z1, varY="M11", varX="M13", Factor="Genus", ll=0.05)

# Example 2
F63(data=Z1, varY="M11", varX="M13", Factor="Genus", textlabel=TRUE, XLIM=c(0.2,0.8), ll=0.05)

# Example 3
F63(data=Z1, varY="M11", varX="M13", Factor="Genus", barX=TRUE, reg=TRUE, ll=0.05)
```

## End(Not run)

F64

**SIMPLE SCATTER PLOT FOR LARGE DATASETS**

Description

It performs a simple scatter plot for large datasets, where the colors encode the density of the points in the scatter plot.

Usage

```r
F64(data, varY, varX, IPLOT=NULL, pixs=3, MAX="zmax", ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR=IDPcolorRamp, MTEXT=NULL, TEXT=NULL)
```

Arguments

- `data`: Data file.
- `varY`: Dependent variable.
- `varX`: Quantitative independent variable.
- `IPLOT`: It allows to specify the characteristics of the plot with the function `iplot`.
- `pixs`: Pixelsize in mm.
- `MAX`: When NULL, the density in the scatter plot is encoded from 0 to maximum number of counts per pixel observed. When "zmax", the color legend ranges from the minimum to the maximum number of counts per pixel. It may be also numeric indicating the maximum of the color legend.
ResetPAR
If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR
It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB
Legend of the X axis in the scatter plot.

YLAB
Legend of the Y axis in the scatter plot.

COLOR
Color ramp to encode the number of counts within a pixel.

MTEXT
It allows to add text on the margins of the graph.

TEXT
It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The scatter plot is performed with the function iplot of the package IDPmisc (Locher & Ruckstuhl, 2014). For further details see the help of the function iplot and/or Guisande & Vammonde (2012).

EXAMPLES
For the examples, morphometric data of several fish species of Characiforms are used. For details see Guisande et al. (2010). It is shown the relationship between M11 and M13 for all genera.

Value
A scatter plot is obtained, where the colors encode the density of the points in the scatter plot.
References


Examples

```r
## Not run:

data(Z1)

F64(data=Z1, varY="M11", varX="M13")

## End(Not run)
```

F65

**ROSE DIAGRAMS**

Description

It performs a wind rose diagram, although it may be depicted any other air-quality variable.

Usage

```r
F65(data, winds, windd, var=NULL, date=NULL, year, month, date.format="%d/%m/%Y %H:%M", type="default", ws.exp=2, statistic="prop.count", key.position="right", paddle=TRUE, annotate=TRUE, WROSE=NULL, PROSE=NULL, COLOR="default", SUB=NULL, dec=",")
```

Arguments

- **data**: Data file.
- **winds**: Variable with the wind speed.
- **windd**: Variable with the wind direction.
- **var**: Any air-quality variable.
- **date**: Variable with the date.
- **year**: It is possible to select one or several years in a vector. It is necessary to specify the variable `date`.
- **month**: It is possible to select one or several months in a vector. It is necessary to specify the variable `date`.
The format of date: "%d/%m/%Y %H:%M", "%d/%m/%Y", "%Y/%m/%d %H:%M" or "%Y/%m/%d".

type
It determines how the data are split: "year", "season", "month" "weekday" and so on. It is necessary to specify the variable date. It is also possible to choose type as another variable in the data frame. For further details see function windRose of the package openair (Carslaw, 2016).

ws.int
The wind speed interval.

statistic
The statistic to be applied to each data bin in the plot: "prop.count", "prop.mean" and "abs.count".

key.position
Location where the scale key is to plotted: "top", "right", "bottom" and "left".

paddle
If TRUE plots rose using ‘paddle’ style spokes. If FALSE plots rose using ‘wedge’ style spokes.

annotate
If TRUE then the percentage calm and mean values are printed in each panel together with a description of the statistic below the plot.

WROSE
It accesses the function windRose that allows to modify many different aspects of the wind rose diagram.

PROSE
It accesses the function pollutionRose that allows to modify many different aspects of the pollution rose diagram.

COLOR
Colours to be used for plotting. Options include "default", "increment", "heat", "jet", "hue" and user defined.

SUB
Legend of the subtitle in the rose diagram.

dec
It defines if the comma ",," is used as decimal separator or the dot ".".

Details

FUNCTIONS
The wind rose and pollution rose diagrams are performed with the function windRose of the package openair (Carslaw & Ropkins, 2012; 2016).

EXAMPLES
For the examples, hourly data of air pollutants, wind speed and wind direction in Santiago de Compostela (Spain) from 1/11/2015 to 31/12/2015 are used. The data were obtained from http://www.meteogalicia.es/web/index.action.

Example 1. Mean values of nitrogen dioxide for the all period.
Example 2. Monthly means of particulate matter 10 micrometers or less in diameter. The language of the months is according to regional language settings of the control panel.
Example 3. Weekly means of sulfur dioxide in grey scale.

Example 4. Mean values of wind speed and direction in November. The argument \textit{var=\texttt{NULL}}.
Value

A wind rose diagrams are obtained.

References


Examples

```R
## Not run:
#Example 1
data(Z22)
F65(data=Z22, winds="Ws", windd="Wd", var="NO2", paddle=FALSE)

#Example 2
F65(data=Z22, winds="Ws", windd="Wd", var="PM10", date="date", type="month", paddle=FALSE)

#Example 3
F65(data=Z22, winds="Ws", windd="Wd", var="SO2", date="date", type="weekday", paddle=FALSE, COLOR="greyscale")

#Example 4
F65(data=Z22, winds="Ws", windd="Wd", date="date", month=11)
## End(Not run)
```

### Description

It performs a calendar plot for time series data.

### Usage

```R
F66(data, date, var, winds=NULL, windd=NULL, year, month,
date.format="%d/%m/%Y %H:%M", annotate="date", key.position="right",
COLOR="heat", MAIN=NULL, CEX.LIM=c(0.6,1), BREAKS=FALSE, LABELS=NULL,
STATISTIC="mean", CALENDAR=NULL, dec="",
```
Arguments

data  Data file.
date  Variable with the date.
var  Variable to be depicted.
winds  Variable with the wind speed.
windd  Variable with the wind direction.
year  It is possible to select one or several years in a vector.
month  It is possible to select one or several months in a vector.
date.format  The format of date: "%d/%m/%Y %H:%M", "%d/%m/%Y", "%Y/%m/%d %H:%M" or "%Y/%m/%d".
annotate  This option controls what appears on each day of the calendar. The option "date" shows day of the month; "wd" shows vector-averaged wind direction, "ws" shows vector-averaged wind direction scaled by wind speed and "value" which shows the daily mean value.
key.position  Location where the scale key is to plotted: "top", "right", "bottom" and "left".
COLOR  Colours to be used for plotting. Options include "default", "increment", "heat", "jet" and user defined.
MAIN  The main title of the plot.
CEX.LIM  For the annotation of concentration labels on each day. The first sets the size of the text below lim and the second sets the size of the text above lim.
BREAKS  If a categorical scale is required then these breaks will be used. If it is TRUE is calculated automatically but it may be defined by the user with a vector.
LABELS  If a categorical scale is required then these labels will be used. There is one less label than breaks. If it is TRUE is calculated automatically as "Very low", "Low", "Medium", "High" and "Very High", but it may be defined by user.
STATISTIC  The statistic to apply when aggregating the data. Can be one of "mean", "max", "min", "median", "frequency", "sd" or "percentile".
CALENDAR  It accesses the function calendarPlot that allows to modify many different aspects of the plot.
dec  It defines if the comma ",," is used as decimal separator or the dot ".".

Details

FUNCTIONS
The calendar plot is performed with the function calendarPlot of the package openair (Carslaw & Ropkins, 2012; 2016).

EXAMPLES
For the examples, hourly data of air pollutants, wind speed and wind direction in Santiago de Compostela (Spain) from 1/11/2015 to 31/12/2015 are used. The data were obtained from http://www.meteogalicia.es/web/index.action.

Example 1. Daily mean values of nitrogen dioxide for the all period.
Example 2. Daily means of particulate matter 10 micrometers or less in diameter in November. The mean values are shown each day due to the argument `annotate="value"`. 
Example 3. Daily means of ozone in categorical scale with the argument `BREAKS=TRUE`.
Example 4. Daily means of nitrogen oxides showing vector-averaged wind direction with the argument `annotate="wd"`. 
Value

A calendar plot is depicted.

References


Examples

```r
# Example 1
```
data(Z22)

F66(data=Z22, date="date", var="NO2")

#Example 2
F66(data=Z22, date="date", var="PM10", month=11, annotate="value", CEX.LIM=c(1,1))

#Example 3
F66(data=Z22, date="date", var="O3", BREAKS=TRUE, annotate="value")

#Example 4
F66(data=Z22, date="date", var="NOx", wind="Wd", winds="Ws", annotate="wd")

## End(Not run)

F67

TIME AVERAGE PLOTS

Description

It performs a hourly, daily and monthly plots from time series data.

Usage

F67(data, date, var, year, month, date.format="%d/%m/%Y %H:%M", tzone=NULL, normalise=FALSE, type = "default", difference=FALSE, name.pol=var, SUB=NULL, XLAB=c("hour", "hour", "month", "weekday"), YLAB=NULL, COLOR="hue", STATISTIC="mean", CI=TRUE, TIMEV=NULL, dec=",")

Arguments

data
Variable(s) to be depicted.

date
Variable with the date.

year
It is possible to select one or several years in a vector.

month
It is possible to select one or several months in a vector.

date.format
The format of date: "%d/%m/%Y %H:%M", "%d/%m/%Y", "%Y/%m/%d %H:%M" or "%Y/%m/%d".

tzone
The time zone for the data. For further details see function timeVariation of the package openair (Carslaw, 2016).

normalise
If it is TRUE the variables are normalised.

type
It determines how the data are split: "default", "season", "year", "weekday" and so on.
If two variables are chosen then setting \textit{difference=TRUE} will also plot the difference in means between the two variables. For further details see function \texttt{timeVariation} of the package openair (Carslaw, 2016).

\textbf{name.pol} \quad Names to be given to the variable(s).

\textbf{SUB} \quad Legend of the subtitle.

\textbf{XLAB} \quad Legend of X axes, one for each sub-plot.

\textbf{YLAB} \quad Legend of Y axes.

\textbf{COLOR} \quad Colours to be used for plotting. Options include "hue", "default", "increment", "heat", "jet" and user defined.

\textbf{STATISTIC} \quad The statistic to apply when aggregating the data: "mean" or "median".

\textbf{CI} \quad If it is TRUE the confidence intervals are shown.

\textbf{TIMEV} \quad It accesses the function \texttt{timeVariation} that allows to modify many different aspects of the plot.

\textbf{dec} \quad It defines if the comma "," is used as decimal separator or the dot ".".

**Details**

**FUNCTIONS**

The calendar plot is performed with the function \texttt{timeVariation} of the package openair (Carslaw & Ropkins, 2012; 2016).

**EXAMPLES**

For the examples, hourly data of air pollutants, wind speed and wind direction in Santiago de Compostela (Spain) from 1/11/2015 to 31/12/2015 are used. The data were obtained from \url{http://www.meteogalicia.es/web/index.action}.

\textbf{Example 1.} Hourly, daily and monthly means of wind speed.

\textbf{Example 2.} Hourly, daily and monthly means of nitrogen dioxide and nitrogen oxides.
Value

Hourly, daily and monthly plots are depicted.

References


Examples

```r
## Not run:

# Example 1

data(Z22)

F67(data=Z22, date="date", var="Ws", YLAB="Wind speed (m/s)")

# Example 2

F67(data=Z22, date="date", var=c("NOX","NO2"))

## End(Not run)
```

Description

It performs a Walter-Lieth diagram.
Usage

F68(data, date, Tmin, Tmax, Prec, year, date.format="%d/%m/%Y", est="", alt=NA, per="", mlab="RLS", pcol="#005ac8", tcol="#e81800", pfcol="#79e6e8", sfcol="#09a0d1", shem=FALSE, p3line=FALSE, mar=c(4,4,5,4), ResetPAR=TRUE, PAR=NULL, file="Output.csv", na="NA", dec="", row.names=TRUE)

Arguments

data Data file. There are two options: 1) An 4x12 matrix, one column for each month, without NAs, where first row is monthly precipitation (mm), second row is monthly average maximum daily temperature (degrees C), third row is monthly average minimum daily temperature (degrees C) and forth row is monthly absolute minimum daily temperature (degrees C); 2) a data frame with the variables date, minimum temperature, maximum temperature and precipitation.
date Variable with the date.
Tmin Variable with the daily mean minimum temperature.
Tmax Variable with the daily mean maximum temperature.
Prec Variable with the daily total precipitation.
year It is possible to select one or several years in a vector.
date.format The format of date: "%d/%m/%Y %H:%M", "%d/%m/%Y", "%Y/%m/%d %H:%M" or "%Y/%m/%d".
est Name of the weather station.
alts Altitude of the weather station.
per Period for which the averages have been computed.
mlab If it is "RLS" the names of the months are those defined in the regional language settings of the computer. If it is "number" the number of the months are used.
pcol Color for precipitation.
tcol Color for temperature.
pfcol Fill color for probable frosts.
sfcol Fill color for sure frosts.
shem Set to TRUE for southern hemisphere stations.
p3line Set to TRUE to draw a suplementary precipitation line referenced to three times the temperature.
mar A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the figure.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR It accesses the function PAR that allows to modify many different aspects of the graph.
file Name of the CSV file with the estimation for each month of the monthly precipitation (mm), monthly average maximum daily temperature (degrees C), monthly average minimum daily temperature (degrees C) and monthly absolute minimum daily temperature (degrees C), if the data is not a 4x12 matrix.
Details

FUNCTIONS

The Walter-Lieth diagram is performed with the function climatol (Guijarro, 2103).

EXAMPLES

The data are maximum and minimum temperatures and precipitation in 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo (http://www.aemet.es/es/portada).

Example 1. An example using the format: date, minimum temperature, maximum temperature and precipitation. The plot shows the values in Vigo (Spain) in the year 2000.

Example 2. An example with the data format of an 4x12 matrix. The plot shows the values in Huelva (Spain) in the years 1990 and 2000.
A Walter-Lieth diagram is depicted and if the data is not a 4x12 matrix, a CSV is saved with the monthly precipitation (mm), monthly average maximum daily temperature (degrees C), monthly average minimum daily temperature (degrees C) and monthly absolute minimum daily temperature (degrees C), one column for each month.

References


Examples

```R
## Not run:

#Example 1

data(Z23)

data<-subset(Z23,(City == "Vigo"))

F68(data=data, date="date", Tmin="T.min", Tmax="T.max", Prec="Precipitation", year=2000, est="Vigo (Spain)", alt=261, per="2000")

#Example 2
```
F69

TIME PLOTS

Description

It performs time series plots.

Usage

F69(data, date, var, year, month, date.format="%d/%m/%Y %H:%M",
    avg.time="default", group=FALSE, smooth=TRUE, type = "default",
    name.pol=var, SUB=NULL, MAIN=NULL, XLAB=NULL, YLAB=NULL, COLOR="brewer1",
    STATISTIC=NULL, TIMEP=NULL, dec="","

Arguments

data Data file.
date Variable with the date.
var Variable(s) to be depicted.
year It is possible to select one or several years in a vector.
month It is possible to select one or several months in a vector.
date.format The format of date: "%d/%m/%Y %H:%M", "%d/%m/%Y", "%Y/%m/%d %H:%M"
or "%Y/%m/%d".
avg.time This defines the time period to average to: "default", "sec", "min", "hour", "day",
    "DSTday", "week", "month", "2 month", "quarter", "year" and so on. For further
details see function timePlot of the package openair (Carslaw, 2016).
group It is FALSE, if more than one variable is chosen, they are plotted in separate
    panels with their own scaled. If it is TRUE, then they are plotted on the same
    plot with the same scale.
smooth If it is TRUE a smooth line is applied to the data.
type It determines how the data are split: "default", "weekday", "month", "season",
    "year" and so on.
name.pol Names to be given to the variable(s).
SUB Legend of the subtitle.
MAIN Main title.
XLAB Legend of X axis.
YLAB Legend of Y axis.
COLOR  Colours to be used for plotting.

STATISTIC  The statistic to apply when aggregating the data: NULL, "mean", "max", "min", "median", "frequency", "sd", or "percentile". For further details see function `timePlot` of the package openair (Carslaw, 2016).

TIMEP  It accesses the function `timePlot` that allows to modify many different aspects of the plot.

dec  It defines if the comma "," is used as decimal separator or the dot ".".

Details

FUNCTIONS

The plot is performed with the function `timePlot` of the package openair (Carslaw & Ropkins, 2012; 2016).

EXAMPLES

For the examples, hourly data of air pollutants, wind speed and wind direction in Santiago de Compostela (Spain) from 1/11/2015 to 31/12/2015 are used. The data were obtained from http://www.meteogalicia.es/web/index.action.

Example 1. Hourly wind speed.

![Hourly Wind Speed Graph](image)

Example 2. Daily means of wind speed and ozone.
Value

Time series plots are depicted.

References


Examples

```r
## Not run:

#Example 1
data(Z22)
F69(data=Z22, date="date", var="Ws", YLAB="Wind speed (m/s)")

#Example 2
F69(data=Z22, date="date", var=c("Ws","O3"), avg.time="day")

## End(Not run)
```
Description

It performs interactive time series plots with the function plot_ly of the package plotly (Sievert et al., 2016). For further details see https://plot.ly/r/reference/ and https://github.com/ropensci/plotly.

Usage

F70(data, date, var, symbolvar=NULL, colorvar=NULL, year, month, avg.time="day", date.format="%d/%m/%Y %H:%M", ticks=10, symbols=NULL, colors=NULL, mode="lines", TRACE=FALSE, LEGEND=FALSE, MAIN=NULL, XLAB=NULL, YLAB=NULL, XFONT=list(family = "Courier New, monospace", size=24, color = "black"), YFONT=list(family="Courier New, monospace", size=24, color="black"), marker=list(size=10), yaxis=list(title=ylab, titlefont=YFONT), xaxis=list(title=xlab, autotick=TRUE, dtick=dtick, titlefont=XFONT), line=list(color=colors, dash="solid"), traceline=list(color=colors, dash="dash"), dec="","

Arguments

data  Data file.
date  Variable with the date.
var  Variable to be depicted in the Y axis.
symbolvar  Optionally a variable name or a (discrete) vector to use for symbol encoding.
colorvar  Optionally a variable name or a vector to use for color mapping.
year  It is possible to select one or several years in a vector.
month  It is possible to select one or several months in a vector.
avg.time  This defines the time period to average to: "hour", "day", "DSTday", "week", "month","2 month", "quarter", "year" and so on. For further details see function timePlot of the package openair (Carslaw, 2016).
date.format  The format of date: "%d/%m/%Y %H:%M", "%d/%m/%Y", "%Y/%m/%d %H:%M" or "%Y/%m/%d".
ticks  Number of ticks in the axes.
symbols  A character vector of symbol types. Possible values: "dot", "cross", "diamond", "square", "triangle-down", "triangle-left", "triangle-right" or "triangle-up".
colors  Either a colorbrewer2.org palette name (e.g. "YlOrRd" or "Blues"), or a vector of colors to interpolate in hexadecimal "#RRGGBB" format, or a color interpolation function like colorRamp.
mode  It determines the drawing mode of the plot: "lines", "markers", "lines+markers", "lines+markers+text", "markers+text", "lines+text" or "none"
TRACE If it is TRUE a trace is added.
LEGEND It it is TRUE the legend is shown.
MAIN Main title of the plot.
XLAB Legend of X axis.
YLAB Legend of Y axis.
XFONT Font of X axis.
YFONT Font of Y axis.
marker It defines the format of the symbols.
yaxis It defines the format of Y axis.
xaxis It defines the format of X axis.
line It defines the format of the line connecting the points.
traceline It defines the format of the trace line.
dec It defines if the comma "," is used as decimal separator or the dot ".".

Details

FUNCTIONS
The plot is performed with the function plot_ly of the package plotly (Sievert et al., 2016).

EXAMPLES
For the example 1, hourly data of air pollutants, wind speed and wind direction in Santiago de Compostela (Spain) from 1/11/2015 to 31/12/2015 are used. The data were obtained from http://www.meteogalicia.es/web/index.action. For the examples 2 and 3, the data are maximum and minimum temperatures and precipitation in 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo (http://www.aemet.es/es/portada).


Example 2. With groups. Monthly means of minimum temperature in three cities of Spain. The
symbols of the cities are specified with the argument `symbolvar="City"` and the symbols may be optionally modified with the argument `symbols`.

Example 3. With groups. Weekly means of maximum temperature in three cities of Spain. The colors are specified with the argument `colorvar="City"` and the colors may be optionally modified with the argument `colors`.

Value

Interactive time series plots are depicted.

References

### Examples

```r
## Not run:

# Example 1. Without groups

data(Z22)

F70(data=Z22, date="date", var="Ws", TRACE=TRUE, YLAB="Wind speed (m/s)")

# Example 2. With groups

data(Z23)

F70(data=Z23, date="date", var="T.min", symbolvar="City", avg.time="month",
symbol=c("dot","square","circle-open"), date.format="year=2000, mode="lines+markers", YLAB="Minimum temperature")

# Example 3. With groups

data(Z23)

F70(data=Z23, date="date", var="T.max", colorvar="City", avg.time="week",
YLAB="Maximum temperature")

## End(Not run)
```

---

### 3D LEVEL PLOT

#### Description

A 3D level plot is depicted.

#### Usage

```r
F71(data, X, Y, Z, SURFACE=NULL, axes=FALSE, AXES=NULL, MTEXT=NULL, TITLE=NULL, XLAB="", YLAB="", ZLAB="", MAIN=NULL, SUB=NULL, LINE=NA, COL=NULL, COLT="black", FONT=2, CEX=1.5)
```

#### Arguments

- **data**: Data file.
- **X**: Variable X.
- **Y**: Variable Y.
- **Z**: Variable Z.
- **SURFACE**: It accesses the function `rgl.surface` that allows to modify many different aspects of the 3d plot.
axes
If TRUE the axes are displayed.
AXES
It accesses the function axes3d that allows to modify the axes.
MTEXT
It accesses the function mtext3d that allows to add text outside the plot.
TITLE
It accesses the function title3d that allows to modify the text the plot.
XLAB
Legend of the X axis.
YLAB
Legend of the Y axis.
ZLAB
Legend of the Z axis.
MAIN
Main title of the 3d plot.
SUB
Subtitle of the 3d plot.
LINE
The line of the plot margin to draw the label on.
COL
Gradient color.
COLT
Color of the text.
FONT
Font of the text.
CEX
Size of the text.

Details

FUNCTIONS
The plot is performed with the functions mtext3d, axes3d, open3d, rgl.surface and title3d of the package rgl (Adler et al., 2017).

EXAMPLES
Altitude in the Himalayan region, with the altitude (variable Z) in a matrix format.

Value
A 3D surface plot is depicted.
References

Adler, D., Murdoch, D. et al. (2017) 3D Visualization Using OpenGL. R package version 0.98.1. Available at: https://CRAN.R-project.org/package=rgl.

Examples

```r
# Not run:

# Including the variable Z as a matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F71(data=Z10, X="Longitude", Y="Latitude", Z=m)

# Including only a matrix

data(volcano)
F71(data=volcano)

# Identifying the variable Z

data(Z10)
```
Description

A 2D contour plot is depicted.

Usage

\[
\text{F72}(\text{data, X, Y, Z, CONTOUR=NULL, XLAB=NULL, YLAB=NULL, ZLAB=NULL, COL="blue", ResetPAR=TRUE, PAR=NULL, MTEXT=NULL, TEXT=NULL})
\]

Arguments

data  Data file.
X     Variable X.
Y     Variable Y.
Z     Variable Z.
CONTOUR  It accesses the function contour that allows to modify many different aspects of the 2d plot.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
ZLAB  Legend of the Z axis.
COL   Color of the lines.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR   It accesses the function PAR that allows to modify many different aspects of the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
Details

FUNCTIONS
The plot is performed with the functions `contour` of the base package graphics. The matrix is obtained using the function `interp` of the package akima (Akima et al., 2015). For further details see Guisande & Vamonne (2012).

EXAMPLES
Example 1.
Depth in a coastal area close to Japan, with the depth (variable Z) in a column format.

Example 2.
Altitude in the Himalayan region, with the altitude (variable Z) in a matrix format.
A 2D contour plot is depicted.

References


Examples

## Not run:

#Example 1. With data format not as matrix

data(Z11)
F72(data=Z11, X="Longitude", Y="Latitude", Z="Depth")

#Example 2. With data format as matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F72(data=m)

## End(Not run)

Description

A 2D level plot is depicted.

Usage

F73(data, X, Y, Z, IMAGE=NULL, XLAB=NULL, YLAB=NULL, ZLAB=NULL, COL=rev(heat.colors(100)), ResetPAR=TRUE, PAR=NULL, MTEXT= NULL, TEXT=NULL)

Arguments

data Data file.
X Variable X.
Y Variable Y.
Z Variable Z.
| **IMAGE** | It accesses the function `image2D` that allows to modify many different aspects of the 2D plot. |
| **XLAB** | Legend of the X axis. |
| **YLAB** | Legend of the Y axis. |
| **ZLAB** | Legend of the Z axis. |
| **COL** | Color palette to be used for the image function or for the contours. |
| **ResetPAR** | If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics. |
| **PAR** | It accesses the function `PAR` that allows to modify many different aspects of the graph. |
| **MTEXT** | It allows to add text on the margins of the graph. |
| **TEXT** | It allows to add text in any area of the inner part of the graph. |

**Details**

**FUNCTIONS**

The plot is performed with the functions `image2D` of package `plot3D` (Soetaert, 2016). The matrix is obtained using the function `interp` of the package `akima` (Akima et al., 2015). For further details see Guisande & Vammonde (2012).

**EXAMPLES**

Altitude in the Himalayan region
Value

A 2D level plot is depicted.

References


Examples

## Not run:

#Including the variable Z as a matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F73(data=Z10, X="Longitude", Y="Latitude", Z=m)

#Including only a matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F73(data=m)

#With data format not as matrix

data(Z11)
F73(data=Z11, X="Longitude", Y="Latitude", Z="Depth")

## End(Not run)

---

**F74**

2D AND 3D LEVEL INTERACTIVE PLOTS

Description

2D AND 3D level interactive plots are depicted.

Usage

F74(data, X, Y, Z, type="contour", COLORS=NULL, XLAB=NULL, YLAB=NULL, MAIN=NULL, XFONT=list(family="Courier New, monospace", size=24, color="black"), YFONT=list(family="Courier New, monospace", size=24, color="black"), xaxis=list(title=xlab, autotick=TRUE, titlefont=XFONT), yaxis=list(title=ylab, autotick=TRUE, titlefont=YFONT))
Arguments

data  Data file.
X     Variable X.
Y     Variable Y.
Z     Variable Z.
type  Type of the plot: "contour" for 2D level plot and "surface" for 3D level plot.
COLORS Color palette to be used for the image function or for the contours.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
ZLAB  Legend of the Z axis.
MAIN  Main title of the plot.
XFONT Font of X axis.
YFONT Font of Y axis.
yaxis It defines the format of Y axis.
xaxis It defines the format of X axis.

Details

FUNCTIONS

The plot is performed with the function plot_ly of the package plotly (Sievert et al., 2016).

EXAMPLES

Altitude in the Himalayan region

2D level plot

3D level plot
A 2D level and 3D level interactive plots are depicted.

References


Examples

```r
## Not run:

#Example 1. 2D Level plot

#Including the variable Z as a matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F74(data=Z10, X="Longitude", Y="Latitude", Z=m)

#Including only a matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F74(data=m)

#Example 2. 3D surface plot

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F74(data=m, type="surface")
```
Description

Enables mapping of administrative areas with high resolution and raster maps of variables (species richness, environmental variables, biogeographic indexes, etc.) using CSV files or raster files, with a spatial resolution (cell size) specified in the file.

Usage

```r
F75(data, Area="World", minLon, maxLon, minLat, maxLat, colbg="#FFFFFF", colcon="#C8C8C8", colf="black", pro=TRUE, inc=0.005, exclude=NULL, colexc=NULL, colfexc="black", colscale=rev(heat.colors(100)), legend.pos="y", breaks=10, xl=0, xr=0, yb=0, yt=0, asp, lab=NULL, xlab="Longitude", ylab="Latitude", main=NULL, cex.main=1.2, cex.lab=1, cex.axis=0.9, cex.legend=0.9, family="sans", font.main=2, font.lab=1, font.axis=1, lwdP=0.6, lwdC=0.1, trans=c(1,1), log=c(0,0), ndigits=0, ini=NULL, end=NULL, jpg=FALSE, filejpg="Map.jpg")
```

Arguments

data: A matrix (see details section) or an ESRI ASCII raster file with the environmental variable, data of richness, etc.

Area: Only if using RWizard (http://www.ipez.es/RWizard). A character with the name of the administrative area or a vector with several administrative areas (countries, regions, etc.) or river basins. If it is "World" (default) the entire world is plotted. For using administrative areas or river basins, in addition to use RWizard, it is also necessary to replace data(world) by @_Build_AdWorld_ (see example 2).

minLon, maxLon: Optionally it is possible to define the minimum and maximum longitude.

minLat, maxLat: Optionally it is possible to define the minimum and maximum latitude.

colbg: Background color of the map (in some cases this is the sea).

colcon: Background color of the administrative areas.

colf: Color of administrative areas border.

pro: If it is TRUE an automatic calculation is made in order to correct the aspect ratio y/x along latitude.

inc: Adds some room along the map margins with the limits x and y thus not exactly the limits of the selected areas.

exclude: A character with the name of the administrative area or a vector with several administrative areas that may be plotted with a different color on the map (only if using RWizard).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>colexc</td>
<td>Background color of areas selected in the argument exclude.</td>
</tr>
<tr>
<td>colfexc</td>
<td>Color of borders of the areas selected in the argument exclude.</td>
</tr>
<tr>
<td>colscale</td>
<td>Palette color.</td>
</tr>
<tr>
<td>legend.pos</td>
<td>Whether to have a horizontal &quot;x&quot; or vertical &quot;y&quot; color scale.</td>
</tr>
<tr>
<td>breaks</td>
<td>Number of breakpoints of the color legend.</td>
</tr>
<tr>
<td>xl, xr, yb, yt</td>
<td>The lower left and upper right coordinates of the color legend in user coordinates.</td>
</tr>
<tr>
<td>asp</td>
<td>The y/x aspect ratio.</td>
</tr>
<tr>
<td>lab</td>
<td>A numerical vector of the form c(x, y) which modifies the default way that axes are annotated. The values of x and y give the (approximate) number of tickmarks on the x and y axes.</td>
</tr>
<tr>
<td>xlab</td>
<td>A title for the X axis.</td>
</tr>
<tr>
<td>ylab</td>
<td>A title for the Y axis.</td>
</tr>
<tr>
<td>main</td>
<td>An overall title for the plot.</td>
</tr>
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<td>The magnification to be used for main titles relative to the current setting of cex.</td>
</tr>
<tr>
<td>cex.lab</td>
<td>The magnification to be used for X and Y labels relative to the current setting of cex.</td>
</tr>
<tr>
<td>cex.axis</td>
<td>The magnification to be used for axis annotation relative to the current setting of cex.</td>
</tr>
<tr>
<td>cex.legend</td>
<td>The magnification to be used for the color scale relative to the current setting of cex.</td>
</tr>
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<td>family</td>
<td>The name of a font family for drawing text.</td>
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<td>The font to be used for plot main titles.</td>
</tr>
<tr>
<td>font.lab</td>
<td>The font to be used for x and y labels.</td>
</tr>
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<td>font.axis</td>
<td>The font to be used for axis annotation.</td>
</tr>
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<td>Line width of the plot.</td>
</tr>
<tr>
<td>lwdC</td>
<td>Line width of the borders.</td>
</tr>
<tr>
<td>trans</td>
<td>It is possible to multiply or divide the dataset by a value. For a vector with two values, the first may be 0 (divide) or 1 (multiply), and the second number is the value of the division or multiplication.</td>
</tr>
<tr>
<td>log</td>
<td>It is possible to apply a logarithmic transformation to the dataset. For a vector with two values, the first may be 0 (do not log transform) or 1 (log transformation), and the second number is the value to be added in case of log transformation.</td>
</tr>
<tr>
<td>ndigits</td>
<td>Number of decimals in legend of the color scale.</td>
</tr>
<tr>
<td>ini</td>
<td>Minimum to be considered in the color scale.</td>
</tr>
<tr>
<td>end</td>
<td>Maximum to be considered in the color scale.</td>
</tr>
<tr>
<td>jpg</td>
<td>If TRUE the plots are exported to jpg files instead of using the windows device.</td>
</tr>
<tr>
<td>filejpg</td>
<td>Name of the jpg file.</td>
</tr>
</tbody>
</table>
Details

The matrix required in the argument data may be obtained using ModestR, which is available at the web site http://www.ipez.es/ModestR: Export/Export checked maps/To RWizard Applications/To MapsR. It is also possible to use an ESRI ASCII raster file.

FUNCTIONS

The function color.legend of the package plotrix (Lemon et al., 2014) is used for building the map.

EXAMPLE

Example 1. An ESRI ASCII raster file with the information of species richness of freshwater fishes around the world.

Example 2. Selection of some countries.
Value

A map is obtained.

References


Examples

```r
## Not run:
# Example 1.

data(Z25)
data(adworld)
F75(data=Z25 , main = "Species richness of freshwater fishes", jpg=TRUE)

# Example 2.

### Only with RWizard
data(Z25)
 @_Build_AdWorld_
```
### Description

Enables mapping of shapes and also, shapes of administrative areas and river basins available into RWizard.

### Usage

```r
F76(Area="World", minLon, maxLon, minLat, maxLat, colbg="#FFFFFF",
    colcon="#C8C8C8", colf="black", pro = TRUE, boxf = "plot", inc = 0.005,
    exclude=NULL, colexc=NULL, colfexc="black", axes=TRUE, asp, lab= NULL,
    xlab="Longitude", ylab="Latitude", main=NULL, cex.main=1.6, cex.lab=1.4,
    cex.axis=1.2, family="sans", font.main=2, font.lab=1, font.axis=1,
    jpg=FALSE, filejpg="Map.jpg")
```

### Arguments

- **Area**: A character with the name of the administrative area or a vector with several administrative areas (see details).
- **minLon, maxLon**: Optionally it is possible to define the minimum and maximum longitude (see details).
- **minLat, maxLat**: Optionally it is possible to define the minimum and maximum latitude (see details).
- **colbg**: Background color of the map (in some cases is the sea).
- **colcon**: Background color of the administrative areas.
- **colf**: Color of administrative areas border.
- **pro**: If it is TRUE an automatic calculation is made in order to correct the aspect ratio y/x along latitude.
- **boxf**: Draws a box around the current plot: "plot", "figure", "inner", "outer" or "n" (without box).
- **inc**: Add some room on the margins of the map and, therefore, the limits x and y are not exactly the limits of the selected areas.
- **exclude**: A character with the name of the administrative area or a vector with several administrative areas that may be plotted with a different color in the map.
- **colexc**: Background color of areas selected in the argument exclude.
- **colfexc**: Color of borders of the areas selected in the argument exclude.
- **axes**: If FALSE does not draw the axes.
- **asp**: The y/x aspect ratio.
lab A numerical vector of the form c(x, y) which modifies the default way that axes are annotated. The values of x and y give the (approximate) number of tickmarks on the x and y axes.

xlab A title for the x axis.

ylab A title for the y axis.

main An overall title for the plot.

cex.main The magnification to be used for main titles relative to the current setting of cex.

cex.lab The magnification to be used for x and y labels relative to the current setting of cex.

cex.axis The magnification to be used for axis annotation relative to the current setting of cex.

family The name of a font family for drawing text.

font.main The font to be used for plot main titles.

font.lab The font to be used for x and y labels.

font.axis The font to be used for axis annotation.

jpg If TRUE the plots are exported to jpg files instead of using the windows device.

filejpg Name of the jpg file.

Details

FUNCTIONS

The function image and the function color.legend of the package plotrix (Lemon et al., 2014) are used for building the map.

EXAMPLES

Example 1

If the argument Area = "World" (default) the entire world is plotted.
Example 2

Clicking on the icon world, as it is shown in the following screenshot (red arrow), would display a menu with all countries and their regions.

It is possible to select one or several countries and/or regions and the selected administrative areas would be only shown in the map. For instance the following maps show Philippines, Haiti and Dominican Republic.
Example 3

It is also possible to change the background color.

Example 4

If the arguments minLon, maxLon, minLat and maxLat are not specified, they are calculated automatically based on the countries and/or regions selected. The latitude and longitude of the map may be delimited, by just specifying the arguments minLon, maxLon, minLat and maxLat.
Example 5

It is also possible to give different colors to the countries, as shown in the following map.

Value

Maps are depicted.
References


Examples

## Not run:

# Example 1. The world
@Build_AdWorld_ F76()

# Example 2. Map of Philippines
@Build_AdWorld_ F76(Area = "Philippines", main="Philippines")

# Two countries
@Build_AdWorld_ F76(Area=c("Dominican Republic","Haiti"), main="Haiti and Dominican Republic")

# Example 3. Changes of background color
@Build_AdWorld_ F76(Area = c("Bahamas") , colbg = "#7FFFD4FF" , colcon = "#CAFF70FF", main="Bahamas")

# Example 4. Selection of latitudes and longitudes in the Bahamas
@Build_AdWorld_ F76(Area = c("Bahamas") , minLon = -78.1 , maxLon = -77.4 , minLat = 23.6 , maxLat = 24.5 , colbg = "#7FFFD4FF" , colcon = "#CAFF70FF", main="Bahamas")

# Example 5. Countries with different colors

## End(Not run)
Description

A 2D filled contour plot is depicted.

Usage

\[ \text{F77}(\text{data, X, Y, Z, FCONTOUR=NULL, XLAB=NULL, YLAB=NULL, ZLAB=NULL, COL=NULL, ResetPAR=TRUE, PAR=NULL, MTEXT=NULL, TEXT=NULL}) \]

Arguments

- **data**: Data file.
- **X**: Variable X.
- **Y**: Variable Y.
- **Z**: Variable Z.
- **FCONTOUR**: It accesses the function \texttt{filled.contour} of base package graphics that allows to modify many different aspects of the 2D plot.
- **XLAB**: Legend of the X axis.
- **YLAB**: Legend of the Y axis.
- **ZLAB**: Legend of the Z axis.
- **COL**: Color palette to be used for the image function or for the contours.
- **ResetPAR**: If it is \texttt{FALSE}, the default condition of the function \texttt{PAR} is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function \texttt{PAR} that allows to modify many different aspects of the graph.
- **MTEXT**: It allows to add text on the margins of the graph.
- **TEXT**: It allows to add text in any area of the inner part of the graph.

Details

**FUNCTIONS**

The plot is performed with the functions \texttt{filled.contour} of base package graphics. The matrix is obtained using the function \texttt{interp} of the package akima (Akima et al., 2015). For further details see Guisande & Vammonde (2012).

**EXAMPLES**

Depth in region of the ocean.
Value

A 2D filled contour plot is depicted.

References


Examples

## Not run:

#Including the variable Z as a matrix

data(Z10)
m<-as.matrix(Z10[,c(-1,-2)])
F77(data=m, X="Longitude", Y="Latitude", Z=x)

#Including only a matrix

data(Z10)
\texttt{m<-as.matrix(Z10[,c(-1,-2)])}
\texttt{F77(data=m)}

\texttt{#With data format not as matrix}

\texttt{data(Z11)}
\texttt{F77(data=Z11, X="Longitude", Y="Latitude", Z="Depth")}
\texttt{## End(Not run)}

---

**CHOROPLETH MAPS FOR DEPICTING A VARIABLE OF A EXTERNAL SHAPE**

**Description**

Polygons of an external shape file are shaded or patterned, and being displayed on the map, in proportion to a variable available in the shape file or a vector with a variable.

**Usage**

\texttt{F78(data, var, admAreas=FALSE, Area="World", minLon, maxLon, minLat, maxLat, int=30, colbg="#FFFFFF", colcon="#C8C8C8", colf="black", pro=TRUE, inc=0.005, exclude=NULL, colexc=NULL, colfexc="black", colscale=rev(heat.colors(100)), legend.pos="y", breaks=10, x1=0, xr=0, yb=0, yt=0, asp, lab=NULL, xlab="Longitude", ylab="Latitude", main=NULL, cex.main=1.6, cex.lab=1.4, cex.axis=1.2, cex.legend=0.9, family="sans", font.main=2, font.lab=1, font.axis=1, lwdP=0.6, lwdC=0.1, trans=c(1,1), log=c(0,0), ndigits=0, ini=NULL, end=NULL, jpg=FALSE, filejpg="Map.jpg")}

**Arguments**

- \texttt{data} A shape file.
- \texttt{var} A variable available in the shape file or a vector with the values of the variable.
- \texttt{admAreas} If it is TRUE the border lines of the countries are depicted in the map.
- \texttt{Area} Only if using RWizard (\url{http://www.ipez.es/RWizard}). A character with the name of the administrative area or a vector with several administrative areas (countries, regions, etc.) or river basins. If it is "World" (default) the entire world is plotted. For using administrative areas or river basins, in addition to use RWizard, it is also necessary to replace \texttt{data(world)} by \texttt{@_Build_AdWorld_} (see examples).
- \texttt{minLon, maxLon} Optionally it is possible to define the minimum and maximum longitude.
- \texttt{minLat, maxLat} Optionally it is possible to define the minimum and maximum latitude.
- \texttt{int} Number of intervals into which the variable is splitted.
- \texttt{colbg} Background color of the map (in some cases this is the sea).
- \texttt{colcon} Background color of the administrative areas.
**colf**  Color of administrative areas border.

**pro**  If it is TRUE an automatic calculation is made in order to correct the aspect ratio y/x along latitude.

**inc**  Adds some room along the map margins with the limits x and y thus not exactly the limits of the selected areas.

**exclude**  A character with the name of the administrative area or a vector with several administrative areas that may be plotted with a different color on the map (only if using RWizard).

**colexc**  Background color of areas selected in the argument exclude.

**colfexc**  Color of borders of the areas selected in the argument exclude.

**colscale**  Palette color.

**legend.pos**  Whether to have a horizontal "x" or vertical "y" color scale.

**breaks**  Number of breakpoints of the color legend.

**xl, xr, yb, yt**  The lower left and upper right coordinates of the color legend in user coordinates.

**asp**  The y/x aspect ratio.

**lab**  A numerical vector of the form c(x, y) which modifies the default way that axes are annotated. The values of x and y give the (approximate) number of tickmarks on the x and y axes.

**xlab**  A title for the X axis.

**ylab**  A title for the Y axis.

**main**  An overall title for the plot.

**cex.main**  The magnification to be used for main titles relative to the current setting of cex.

**cex.lab**  The magnification to be used for X and Y labels relative to the current setting of cex.

**cex.axis**  The magnification to be used for axis annotation relative to the current setting of cex.

**cex.legend**  The magnification to be used for the color scale relative to the current setting of cex.

**family**  The name of a font family for drawing text.

**font.main**  The font to be used for plot main titles.

**font.lab**  The font to be used for x and y labels.

**font.axis**  The font to be used for axis annotation.

**lwdP**  Line width of the plot.

**lwdC**  Line width of the borders.

**trans**  It is possible to multiply or divide the dataset by a value. For a vector with two values, the first may be 0 (divide) or 1 (multiply), and the second number is the value of the division or multiplication.

**log**  It is possible to apply a logarithmic transformation to the dataset. For a vector with two values, the first may be 0 (do not log transform) or 1 (log transformation), and the second number is the value to be added in case of log transformation.
Details

FUNCTIONS

The function `color.legend` of the package `plotrix` (Lemon et al., 2014) is used for building the map.

EXAMPLE

Example 1. Population size of countries in Africa.

Example 2. Species richness of freshwater fishes in National Parks of Colombia. An example using a vector with the variable and including administrative areas available in RWizard.
Example 3. Area of National Parks in Colombia. A example using a variable available in the file of the shapes and including administrative areas available in RWizard.
A map is obtained.

References


Examples

```r
## Not run:

#Example 1. Without including administrative areas available in RWizard
data(Z27)
data(adworld)
F78(data=Z27, var="POP2005", main="Population size in 2005")

#Example 2. Using a vector with the richness of freshwater fishes in each National Park of Colombia and including administrative areas available in RWizard
```
data(Z26)
data(adworld)

richness1<-c(1, 6, 1, 2, 7, 1, 3, 1, 2, 8, 3, 2, 1, 1, 14, 1, 1, 1, 1, 1, 1, 1)
richness2<-c(1, 1, 5, 1, 3, 3, 1, 176, 1, 6, 1, 6, 1, 1, 44, 1, 1, 12, 4, 19, 9, 1, 1, 6)
richness<-append(richness1, richness2)

F78(data=Z26, var=richness, admAreas=TRUE, main="Richness of fishes in National Parks", cex.main=1.2, end=50)

#Example 3. Using a variable available in the file of the shapes
#and including administrative areas available in RWizard

data(Z26)
data(adworld)

F78(data=Z26, var="Area_Res", admAreas=TRUE, main="Area of the National Park", cex.main=1.2)

## End(Not run)

---

**Description**

It allows to shade the polygons in proportion to a variable of a data frame using the polygons available in RWizard or the polygons of an external shape.

**Usage**

F79(data, polygonname, var, shape=NULL, shapenames=NULL, admAreas=TRUE, Area="World", minLon, maxLon, minLat, maxLat, int=30, colbg="#FFFFFF", colcon="#C8C8C8", colf="black", pro=TRUE, inc=0.005, exclude=NULL, colexc="NULL", colfexc="black", colscale=rev(heat.colors(100)), legend.pos="y", breaks=10, xl=0, xr=0, yb=0, yt=0, asp, lab=NULL, xlab="Longitude", ylab="Latitude", main=NULL, cex.main=1.6, cex.lab=1.4, cex.axis=1.2, cex.legend=0.9, family="sans", font.main=2, font.lab=1, font.axis=1, lwdP=0.6, lwdC=0.1, trans=c(1,1), log=c(0,0), ndigits=0, ini=NULL, end=NULL, jpg=FALSE, filejpg="Map.jpg")

**Arguments**

- **data**: Data file with the variable.
- **polygonname**: A variable available in the data file with the names of the polygons.
- **var**: A variable available in the data file with the values to be used for shading the polygons.
- **shape**: If the polygons are in an external shape file, it is necessary to indicate the file in this argument. It is not necessary to select any polygon within the file, just to load the whole shape file.
shapenames  Variable in the shapefile with the names of the polygons.
admAreas  If it is TRUE the border lines of the countries are depicted in the map.
Area  Only if using RWizard (http://www.ipez.es/RWizard). A character with the name of the administrative area or a vector with several administrative areas (countries, regions, etc.) or river basins. If it is "World" (default) the entire world is plotted. For using administrative areas or river basins, in addition to use RWizard, it is also necessary to replace data(world) by @_Build_AdWorld_ (see examples).
minLon, maxLon  Optionally it is possible to define the minimum and maximum longitude.
minLat, maxLat  Optionally it is possible to define the minimum and maximum latitude.
int  Number of intervals into which the variable is splited.
colbg  Background color of the map (in some cases this is the sea).
colcon  Background color of the administrative areas.
colf  Color of administrative areas border.
pro  If it is TRUE an automatic calculation is made in order to correct the aspect ratio y/x along latitude.
inc  Adds some room along the map margins with the limits x and y thus not exactly the limits of the selected areas.
exclude  A character with the name of the administrative area or a vector with several administrative areas that may be plotted with a different color on the map (only if using RWizard).
colexc  Background color of areas selected in the argument exclude.
colfexc  Color of borders of the areas selected in the argument exclude.
colscale  Palette color.
legend.pos  Whether to have a horizontal "x" or vertical "y" color scale.
breaks  Number of breakpoints of the color legend.
xl,xr,yb,yt  The lower left and upper right coordinates of the color legend in user coordinates.
asp  The y/x aspect ratio.
lab  A numerical vector of the form c(x, y) which modifies the default way that axes are annotated. The values of x and y give the (approximate) number of tickmarks on the x and y axes.
xlab  A title for the X axis.
ylab  A title for the Y axis.
main  An overall title for the plot.
cex.main  The magnification to be used for main titles relative to the current setting of cex.
cex.lab  The magnification to be used for X and Y labels relative to the current setting of cex.
cex.axis  The magnification to be used for axis annotation relative to the current setting of cex.
cex.legend  The magnification to be used for the color scale relative to the current setting of cex.
family    The name of a font family for drawing text.
font.main The font to be used for plot main titles.
font.lab  The font to be used for x and y labels.
font.axis The font to be used for axis annotation.
lwdP     Line width of the plot.
lwdC     Line width of the borders.
trans    It is possible to multiply or divide the dataset by a value. For a vector with two values, the first may be 0 (divide) or 1 (multiply), and the second number is the value of the division or multiplication.
log      It is possible to apply a logarithmic transformation to the dataset. For a vector with two values, the first may be 0 (do not log transform) or 1 (log transformation), and the second number is the value to be added in case of log transformation.
ndigits Number of decimals in legend of the color scale.
ini      Minimum to be considered in the color scale.
end      Maximum to be considered in the color scale.
jpg      If TRUE the plots are exported to jpg files instead of using the windows device.
filejpg  Name of the jpg file.

Details

FUNCTIONS
The function color.legend of the package plotrix (Lemon et al., 2014) is used for building the map.

EXAMPLE
Completeness of the records of freshwater fish species in all countries of the world.
Value

A map is obtained.

References


Examples

```r
## Not run:

data(Z28)
data(adworld)
F79(data=Z28, polygonname="Area", var="Completeness")

## End(Not run)
```

Description

It performs a joyplot for several variables and the overlap of the area under de curve among variables is also estimated.

Usage

```r
F80(data, var, kernel="gaussian", PLOT=NULL, overlap=TRUE, lty=1, lwd=2.5,
ResetPAR=TRUE, PAR=NULL, XLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL,
COLORB=NULL, AXIS=NULL, CEX=1.2, file="Output.csv", na="NA", dec="",
row.names=FALSE)
```

Arguments

data  Data file.

var   Variables.

kernel A character string giving the smoothing kernel to be used. This must be one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". For further details about the estimation of the density curve see the details section of the function density of base stats package.

PLOT It allows to specify the characteristics of the function plot.default.
overlap

If it is TRUE the overlap of the area under the curve among variables is estimated. For further details about the estimation of the area under the curve see the details section of the function auc of the package kulife (Ekstrom et al., 2015).

lty

Type of line of the density curve for each variable. If it is a vector, it must be as many as different variables. See the description of the same argument in the function F1.

lwd

Line width relative to the default (default=1), so 2 is twice as wide.

ResetPAR

If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR

It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB

Legend of the X axis.

XLM

Vector with the limits of the X axis.

YLM

Vector with the limits of the Y axis.

COLOR

Color of the density curves. It must be as many as different variables.

COLORB

Color of the lines. It must be as many as different variables.

AXIS

It allows to add axes to the graph.

CEX

Size of the labels of each group and of the legend of X axis.

file

CSV FILE. File name with the overlap of the area under the curve among variables.

na

CSV FILE. Text that is used in the cells without data.

dec

CSV FILE. It defines if the comma "," is used as decimal separator or the dot ".".

row.names

CSV FILE. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.

Details

FUNCTIONS

The plot is performed with the function plot.default of base graphics package.

The density curve is estimated with the function density of base stats package.

The area under the curve is estimated with the function auc of the package kulife (Ekstrom et al., 2015).

EXAMPLES

For the examples, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

A joyyplot is depicted with some variables. The overlap of the area under the curve among variables is obtained in the results. For instance, the overlap is 18.3% between M4 and M9.
Value

A joyplot for several variables and a CSV file with the overlap of the area under de curve among variables are obtained.

References


Examples

```r
## Not run:

data(Z8)

F80(data=Z8, var=c("M4", "M9", "M15", "M16","M22","M23"))

## End(Not run)
```
Description

It performs a joyplot of one variable with different groups and the overlap of the area under the curve among groups is also estimated.

Usage

```r
F81(data, var, group, kernel="gaussian", PLOT=NULL, overlap=TRUE,
    lty=1, lwd=2.5, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, XLIM=NULL, YLIM=NULL,
    COLOR=NULL, COLORB=NULL, AXIS=NULL, CEX=1.2, file="Output.csv",
    na="NA", dec=".", row.names=FALSE)
```

Arguments

data  Data file.
var   Variables.
group Variable with the categories to be grouped.
kernal A character string giving the smoothing kernel to be used. This must be one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine" or "optcosine". For further details about the estimation of the density curve see the details section of the function `density` of base stats package.
PLOT  It allows to specify the characteristics of the function `plot.default`.
overlap If it is TRUE the overlap of the area under the curve among variables is estimated. For further details about the estimation of the area under the curve see the details section of the function `auc` of the package `kulife` (Ekstrom et al., 2015).
lty   Type of line of the density curve for each variable. If it is a vector, it must be as many as different variables. See the description of the same argument in the function `F1`.
lwd   Line width relative to the default (default=1), so 2 is twice as wide.
ResetPAR If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
PAR   It accesses the function `PAR` that allows to modify many different aspects of the graph.
XLAB  Legend of the X axis.
XLIM  Vector with the limits of the X axis.
YLIM  Vector with the limits of the Y axis.
COLOR Color of the density curves. It must be as many as different groups.
COLORB Color of the lines. It must be as many as different groups.
AXIS  It allows to add axes to the graph.
CEX  Size of the labels of each group and of the legend of X axis.
file  CSV FILE. File name with the overlap of the area under the curve among groups.
na  CSV FILE. Text that is used in the cells without data.
der  CSV FILE. It defines if the comma "," is used as decimal separator or the dot ".".
row.names  CSV FILE. Logical value that defines if identifiers are put in rows or a vector with a text for each of the rows.

Details

FUNCTIONS
The plot is performed with the function plot.default of base graphics package. The density curve is estimated with the function density of base stats package. The area under the curve is estimated with the function auc of the package kulife (Ekstrom et al., 2015).

EXAMPLES
For the example, morphometric data of three families of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010).

A joyplot plot is depicted for the variable M6 for each family.

![Joyplot plot](image)

The overlap of the area under the curve among families is obtained. The 87.87% of the area of the family Cichlidae overlaps with the family Sparidae, the 9.74% of the area of the family Cichlidae overlaps with the family Characidae, 87.69% of the area of the family Sparidae overlaps with the family Cichlidae, etc.
Value

A joyplot for one variable with different groups and a CSV file with the overlap of the area under curve among groups are obtained.

References


Examples

```r
## Not run:
data(Z8)
F81(data=Z8, var="M6", group="Family")
## End(Not run)
```

Description

It performs a multiple scatter plot with or without text labels, regression model and marginal histograms.

Usage

```r
F82(data, varY, varX, group, textlabel=NULL, label=NULL, MAR1=c(5,5,1,1), MAR2=c(1,5,1,1), MAR3=c(5,1,1,1), reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=FALSE, PAR=NULL, XLAB=NULL, YLAB=NULL, COLOR=NULL, COLORR=NULL, PCH=NULL, CEX=1, lty=NULL, lwd=2.5, PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTEXT= NULL, TEXT=NULL, HIST=NULL, HISTh=NULL, breaks=20, COLORl=NULL, COLORb=NULL, dec="", file="Output.txt")
```

Arguments

- `data` Data file.
- `varY` Dependent variable.
- `varX` Quantitative independent variable.
group  Variable with the categories to be grouped.
textlabel  Optionally, variable with the text labels.
label  It allows to specify the characteristics of the text labels with the function text.
MAR1  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot.
MAR2  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the upper histogram.
MAR3  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the right side histogram.
reg  If TRUE a regression model is performed.
model  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.
outliers  If it is TRUE, the outliers are removed using the selected regression model.
quant1  Quantile of the lower end to the elimination of outliers.
quant2  Quantile of the upper end to the elimination of outliers.
ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR  It accesses the function PAR that allows to modify many different aspects of the graph.
XLAB  Legend of the X axis.
YLAB  Legend of the Y axis.
COLOR  Color of the symbols. It must be as many as different categories of the variable group.
COLORR  Color of the line of the regression model. It must be as many as different categories of the variable group.
PCH  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.
CEX  Size of the symbols.
lty  Type of the regression line (see the description of the same argument in the function F1).
lwd  Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
PLOT  It allows to specify the characteristics of the function plot.default.
LEGEND  It allows to modify the legend of the graph.
AXIS  It allows to add axes to the graph.
MTEXT  It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
**HIST**
It allows to specify the characteristics of the upper histogram with the function `hist`.

**HISTh**
It allows to specify the characteristics of the right side histogram with the function `barplot`.

**breaks**
Number of intervals.

**COLORl**
Color of the borders. It must be as many as different variables.

**COLORb**
Color of the bars. It must be as many as different variables.

**dec**
It defines if the comma "," is used as decimal separator or the dot ".".

**file**
TXT FILE. If the argument `reg=TRUE` a TXT file is saved with the information of the regression.

**Details**

**FUNCTIONS**
The scatter plot is performed with the function `plot.default` of base graphics package and the linear regression with the function `lm` of base stats package. The function `lillie.test` of the package `nortest` (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function `dwtest` of the package `lmtest` (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function `bptest` of the package `lmtest` (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity. The histograms are performed with the functions `hist` and `barplot` of base graphics package.

**EXAMPLES**
Example 1 The data are scores of a Principal Component Analysis (PCA) performed to physicochemical parameters from lakes in Colombia. In this example, text labels are assigned to the points with the argument `textlabel="Lake"`, and the different regions are identified with the argument `group="Region"`.
Example 2 For the examples, morphometric data of several fish species of Characiforms, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the relationship between M12 and M13 for each genera.

Example 3 A linear regression line is added to the example 2 with the argument `reg=TRUE`. 
In the TXT file that generates the function, the regression model of each genera is shown. For the explanation of the regression models, normality, autocorrelation and homoscedasticity see the details section of the function F1.

**Value**

A multiple scatter plot with or without linear regression and marginal histograms is obtained. Moreover, a TXT file is saved with the results of the regression model.

**References**


**Examples**

```r
## Not run:

# Example 1
```
MULTIPLE MEAN WITH ERROR BARS SCATTER PLOTS WITH MARGINAL HISTOGRAMS

Description

It performs a multiple mean with error bars scatter plot with or without text labels, regression model and marginal histograms.

Usage

F83(data, varY, varX, Factor, group, method="mean", dev="sd", barY=TRUE, barX=FALSE, textlabel=NULL, label=NULL, MAR1=c(5,5,1,1), MAR2=c(1,5,1,1), MAR3=c(5,1,1,1), reg=FALSE, model="Linear", outliers=FALSE, quant1=0.05, quant2 = 0.95, ResetPAR=FALSE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, COLOR1="black", COLOR2=NULL, PCH=NULL, CEX=1.5, lty=NULL, lwd=2.5, PLOT=NULL, LEGEND=NULL, AXIS=NULL, MTXT=NULL, TEXT=NULL, HIST=NULL, HISTh=NULL, breaks=20, COLOR1=NULL, COLORb=NULL, file1="Output.txt", file2="Average and error bars.csv", na="NA", dec=" ", row.names=FALSE)

Arguments

data
varY
varX

Data file.
Dependent variable.
Quantitative independent variable.
Factor  Variable for the estimation of the average and error bars for each category of the variable. It is not possible to include variables with any of the categories with a single data, so if necessary several data for each category.

group  Variable with the categories to be grouped.

method  The average of each category of the grouped variable Factor is estimated with the "mean" or the "median".

dev  The error bars may be estimated using the standard deviation ("sd") or the standard error ("se").

barY  If it is TRUE the bar error of the variable Y is depicted.

barX  If it is TRUE the bar error of the variable X is depicted.

textlabel  Optionally, variable with the text labels.

label  It allows to specify the characteristics of the text labels with the function text.

MAR1  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot.

MAR2  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the upper histogram.

MAR3  A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the right side histogram.

reg  If TRUE a regression model is performed.

model  One regression model can be selected: "Linear", "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero.

outliers  If it is TRUE, the outliers are removed using the selected regression model.

quant1  Quantile of the lower end to the elimination of outliers.

quant2  Quantile of the upper end to the elimination of outliers.

ResetPAR  If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR  It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB  Legend of the X axis.

YLAB  Legend of the Y axis.

XLIM  Vector with the limits of the X axis.

YLIM  Vector with the limits of the Y axis.

COLOR  Color of the symbols. It must be as many as different categories of the variable group.

COLORI  Color of the error bars.

COLORR  Color of the line of the regression model. It must be as many as different categories of the variable group.
PCH  Graphic symbol (see the description of the same argument in the function F1).
      It must be as many as different categories of the variable group.
CEX  Size of the symbols.
lty  Type of the regression line (see the description of the same argument in the
      function F1).
lwd  Line width of the regression line relative to the default (default=1), so 2 is twice
      as wide.
PLOT It allows to specify the characteristics of the function plot.default.
LEGEND It allows to modify the legend of the graph.
AXIS  It allows to add axes to the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.
HIST It allows to specify the characteristics of the upper histogram with the function
      hist.
HISTh It allows to specify the characteristics of the right side histogram with the func-
      tion barplot.
breaks Number of intervals.
COLORl Color of the borders. It must be as many as different variables.
COLORb Color of their bars. It must be as many as different variables.
file1 TXT FILE. If the argument reg=TRUE a TXT file is saved with the information
      of the regression.
file2 CSV FILE. File name with the mean, median, standard error and standard deviation
      for each category of the variable Factor
na    CSV FILES. Text that is used in the cells without data.
dec   CSV FILES. It defines if the comma "," is used as decimal separator or the dot
      ".".
row.names CSV FILES. Logical value that defines if identifiers are put in rows or a vector
      with a text for each of the rows.

Details

See the equations of all regression models in the section details of the function XII1 of the package
StatR.

FUNCTIONS

The scatter plot is performed with the function plot.default of base graphics package and the linear
regression with the function lm of base stats package. The function lillie.test of the package
nortest (Gross, 2013) is used to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’correction,
the function dwtest of the package lmtest (Hothorn et al., 2013) to analyze the
autocorrelation with the test and the Durbin-Watson statistic function bptest of the package lmtest
(Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity. The histograms are
performed with the functions hist and barplot of base graphics package.

EXAMPLES

Example 1. Relationship between the mean values of M13 and M11 for each genera with the
standard deviation of the M11, and grouped by families.
Example 2. Relationship between the mean values of M6 and M7 for each family but adding the text labels of the genera with the argument `textlabel=TRUE`.

Example 3. As in the example 1 but a linear regression line is added for each family with the argument `reg=TRUE`.
In the TXT file that generates the function, the regression model of each family is shown. For the explanation of the regression models, normality, autocorrelation and homoscedasticity see the details section of the function F1.

Value

A multiple scatter plot with mean error bars, with or without linear regression, with or without text labels and with marginal histograms is obtained. A CVS file with the mean, median, standard error and standard deviation for each category of the variable Factor is also obtained.

References


Examples

## Not run:
data(Z8)

#Example 1
F83(data=Z8, varY="M11", varX="M13", Factor="Genus", group="Family")

#Example 2
F83(data=Z8, varY="M6", varX="M7", Factor="Family", group="Family", textlabel=TRUE, XLIM=c(0.35,0.55))

#Example 3
F83(data=Z8, varY="M11", varX="M13", Factor="Genus", group="Family", reg=TRUE)

## End(Not run)

---

**ADDITIONAL AXES IN LINE CHARTS AND SCATTER PLOTS FOR VARIABLE X QUANTITATIVE**

**Description**

It is possible to add up to 3 additional axes to line charts and scatterplots with or without text labels, and a regression model.

**Usage**

F84(data, varX, varY, varY1=NULL, varY2=NULL, varY3=NULL, textlabelY=NULL, textlabelY1=NULL, textlabelY2=NULL, textlabelY3=NULL, type=NULL, label=NULL, MAR1=c(5,5,3,4), MAR2=c(5,5,3,8), MAR3=c(5,5,3,12), reg=FALSE, model=NULL, outliers=FALSE, quant1=0.05, quant2=0.95, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, YLAB1=NULL, YLAB2=NULL, YLAB3=NULL, XLIM=NULL, YLIM=NULL, YLIM1=NULL, YLIM2=NULL, YLIM3=NULL, CEX=1.2, FONTLAB=2, CEXLAB=1.5, COLOR=NULL, COLORR=NULL, PCH=NULL, lty=NULL, ltyL=NULL, lwd=2.5, lwdL=1, LEGEND=NULL, MTEXT=NULL, TEXT=NULL, file="Output.txt")

**Arguments**

data Data file.

varX Quantitative independent variable.

varY Dependent variable.

varY1 First additional variable.

varY2 Second additional variable.

varY3 Third additional variable.

textlabelY Variable with the text labels for varY.
textlabelY1  Variable with the text labels for varY1.

textlabelY2  Variable with the text labels for varY2.

textlabelY3  Variable with the text labels for varY3.

type        Character string giving the type of plot desired. It must be as many as the number of variables Y. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines (default), "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.

label       It allows to specify the characteristics of the text labels with the function text.

MAR1        A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot when adding varY1.

MAR2        A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot when adding varY1 and varY2.

MAR3        A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot when adding varY1, varY2 and varY3.

reg         If TRUE a regression model is performed.

model       Regression model: "Linear" (default), "Log", "S-curve", "Power", "Exp", "Quadratic", "Cubic", "Inverse". It is not considered the model in those cases in which there is the logarithm that apply to any of the variables, if any value of the variable, which applies the logarithm, is zero or negative. The inverse model is not calculated if any value of the independent variable is zero. It must be as many as the number of variables Y.

outliers    If it is TRUE, the outliers are removed using the selected regression model.

quant1      Quantile of the lower end to the elimination of outliers.

quant2      Quantile of the upper end to the elimination of outliers.

ResetPAR    If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR         It accesses the function PAR that allows to modify many different aspects of the graph.

XLAB        Legend of the X axis.

YLAB        Legend of the Y axis.

YLAB1       Legend of the Y1 axis.

YLAB2       Legend of the Y2 axis.

YLAB3       Legend of the Y3 axis.

XLIM        Limits of X axis.

YLIM        Limits of Y axis.

YLIM1       Limits of Y1 axis.

YLIM2       Limits of Y2 axis.

YLIM3       Limits of Y3 axis.

CEX         Size of the symbols.
FONTLAB Family font of the legends.
CEXLAB Size of the legends.
COLOR Color of the symbols. It must be as many as the number of variables Y.
COLORR Color of the line of the regression model. It must be as many as the number of variables Y.
PCH Graphic symbol (see the description of the same argument in the function F1). It must be as many as the number of variables Y.
1ty Type of the regression line (see the description of the same argument in the function F1). It must be as many as the number of variables Y.
1tyL Type of the line chart (see figure of the argument 1ty in the function F1). It must be as many as the number of variables Y.
1wd Line width of the regression line relative to the default (default=1), so 2 is twice as wide.
1wdL Line width of the chart relative to the default (default=1), so 2 is twice as wide.
LEGEND It allows to modify the legend of the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT It allows to add text in any area of the inner part of the graph.
file TXT FILE. If the argument reg=TRUE a TXT file is saved with the information of the regressions.

Details

FUNCTIONS
The plot is performed with the function plot.default of base graphics package and the linear regression with the function lm of base stats package, the function lillie.test of the package nortest (Gross, 2013) to perform the test of Normality Kolmogorov-Smirnov with Lilliefors’ correction, the function dwtest of the package lmtest (Hothorn et al., 2013) to analyze the autocorrelation with the test and the Durbin-Watson statistic function bptest of the package lmtest (Hothorn et al., 2013) to perform the Breusch-Pagan test of homoscedasticity.

EXAMPLES
Example 1 Monthly temperature in Huelva (Spain) in the year 2000.
Example 2 Monthly temperature in Palma de Mallorca (Spain) in the year 2000. Text labels are assigned to the points with the argument `textlabel="Season"`. Moreover, a different color is assigned to each text label using a variable with colors.
Example 3 A cubic regression line is added with the arguments `reg=TRUE` and `model`. It is shown the relationships between year and the percentages of unemployment older than 65 and younger than 15, and the growth rate in North America from 1968 to 2010.
Value

Line charts and scatterplot with or without linear regression with additional axes are obtained.

References


Examples

## Not run:

#Example 1

data(Z13)

data<-subset(Z13,(City == "Huelva") & (Year == 2000))

F84(data=data, varX="Month", varY="Temperature", varY1="Precipitation", TEXT = c("x = 10.5", "y=12", "labels='Huelva\nyear 2000'", "font=2", "cex=1.3"))

#Example 2

data(Z13)

data<-subset(Z13,(City=="Palma de Mallorca") & (Year==2000))

colorlabel<-as.character(data[,"Color"])

F84(data=data, varX="Month", varY="Temperature", varY1="Precipitation", textlabelY="Season", label = c("pos=3", "col=colorlabel"), YLIM=c(10,28), YLIM1=c(0,1.7), TEXT = c("x=10.5", "y=12", "labels='Palma de Mallorca\nyear 2000'", "font=2", "cex=1.3"))

#Example 3

data(Z3)

data<-subset(Z3,(Region== "North America"))

F84(data=data, varX="Year", varY="Unemployment.younger.15", varY1="Unemployment.older.65", varY2="Growth", type=c("p","p","p"), YLAB="Percentage of unemployment younger than 15", YLAB1="Percentage of unemployment older than 65", reg="TRUE", model=c("Cubic","Cubic","Cubic"))

## End(Not run)
ADDITIONAL AXES IN LINE CHARTS AND SCATTER PLOTS FOR VARIABLE X QUALITATIVE

Description

It is possible to add up to 3 additional axes to line charts and scatterplots with or without text labels, and a regression model.

Usage

F85(data, FactorX, varY, varY1=NULL, varY2=NULL, varY3=NULL, method="mean", dev="sd", type=NULL, MAR1=c(5,5,3,4), MAR2=c(5,5,3,8), MAR3=c(5,5,3,12), ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, XLAB=NULL, YLAB=NULL, YLAB1=NULL, YLAB2=NULL, YLAB3=NULL, XLIM=NULL, YLIM=NULL, YLIM1=NULL, YLIM2=NULL, YLIM3=NULL, CEX=1.4, FONTLAB=2, CEXLAB=1.5, COLOR=NULL, COLORI="black", PCH=NULL, ltyL=NULL, lwdL=1, LEGEND=NULL, MTEXT= NULL, TEXT=NULL)

Arguments

data Data file.
FactorX Qualitative independent variable.
varY Dependent variable.
varY1 First additional variable.
varY2 Second additional variable.
varY3 Third additional variable.
method If it is not NULL, the average of each category of the independent variable FactorX is estimated with the "mean" or the "median".
dev If the argument method is not NULL, the error bars may be estimated using the standard deviation ("sd") or the standard error ("se").
type Character string giving the type of plot desired. It must be as many as the number of variables Y. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines (default), "c" for empty points joined by lines, "o" for overplotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
MAR1 A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot when adding varY1.
MAR2 A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot when adding varY1 and varY2.
MAR3 A numeric vector with the format c(down, left, up, right) that defines the lines of the margins of the scatter plot when adding varY1, varY2 and varY3.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR
It accesses the function PAR that allows to modify many different aspects of the graph.

order
If it is NULL the categories are ordered as found in the variable FactorX, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument method, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.

OrderCat
It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

LabelCat
It allows to specify a vector with the names of the categories.

XLAB
Legend of the X axis.

YLAB
Legend of the Y axis.

YLAB1
Legend of the Y1 axis.

YLAB2
Legend of the Y2 axis.

YLAB3
Legend of the Y3 axis.

XLIM
Limits of X axis.

YLIM
Limits of Y axis.

YLIM1
Limits of Y1 axis.

YLIM2
Limits of Y2 axis.

YLIM3
Limits of Y3 axis.

CEX
Size of the symbols.

FONTLAB
Family font of the legends.

CEXLAB
Size of the legends.

COLOR
Color of the symbols. It must be as many as the number of variables Y.

COLORI
Color of the error bars.

PCH
Graphic symbol (see the description of the same argument in the function F1). It must be as many as the number of variables Y.

ltyL
Type of the line chart (see figure of the argument lty in the function F1). It must be as many as the number of variables Y.

lwdL
Line width of the chart relative to the default (default=1), so 2 is twice as wide.

LEGEND
It allows to modify the legend of the graph.

MTEXT
It allows to add text on the margins of the graph.

TEXT
It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions boxplot, points and arrows of base graphics package.

EXAMPLE
For the examples, morphometric data of freshwater fishes, as the distance from the origin of the dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). The next figure shows the mean values and standard deviation of several morphometric variables for each genus.
Value

Line charts and scatterplot with or without linear regression with additional axes are obtained.

References


Examples

```r
## Not run:
data(Z1)
F86(data=Z1, FactorX="Genus", varY="M2", varY1="M6", varY2="M12", varY3="M24")
## End(Not run)
```

Description

This function makes a zoom in a scatterplot.

Usage

```r
F86(data, varY, varX, rylim, rxlim, ResetPAR=TRUE, PAR=NULL, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, MAIN=NULL, titlepos=NA, COLOR="tomato", PCH=16, ZOOM=NULL, MTEXT=NULL, TEXT=NULL)
```
Arguments

data          Data file.
varY          Dependent variable.
varX          Quantitative independent variable.
rylim         Limits for the expanded plot of the Y axis.
rxlim         Limits for the expanded plot of the X axis.
ResetPAR      If it is FALSE, the default condition of the function PAR is not placed and main-
t鞥 those defined by the user in previous graphics.
PAR           It accesses the function PAR that allows to modify many different aspects of the
               graph.
XLAB          Legends of the X axis.
YLAB          Legends of the Y axis.
XLIM          Limits of the X axis.
YLIM          Limits of the Y axis.
MAIN          Main title of the plot.
titlepos      Horizontal position of the main title.
COLOR         Color of the symbols.
PCH            Graphic symbol (see the description of the same argument in the function F1).
               It must be as many as the number of variables Y.
ZOOM          It accesses the function zoomInPlot that allows to modify many different aspects
               of the graph.
MTEXT          It allows to add text on the margins of the graph.
TEXT           It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the function zoomInPlot of the package plotrix (Lemon et al., 2017).

EXAMPLE
For the examples, morphometric data of freshwater fishes, as the distance from the origin of the
dorsal fin to the origin of the anal fin (M13), the length of the dorsal fin base (M12), body height
(M11), etc., are used. For details see Guisande et al. (2010).
The next figure shows the relationship between the variables M11 and M13 and a zoom in an inner
area.
It is depicted a scatterplot and a second graph with a zoom of the first graph.

References


Examples

## Not run:
data(Z1)

F86(data = Z1, varY = "M13", varX = "M11", rylim = c(0.35, 0.4), rxlim = c(0.3, 0.4),
MAIN = "Morphometry characters of freshwater fishes", titlepos = 0.26)
## End(Not run)

---

**SPIDER PLOT**

Description

A spider plot is depicted.

Usage

F87(data, var, cat, shade=TRUE, type="p", ResetPAR=TRUE, PAR=NULL, SPIDER=NULL,
COLOR=NULL, LIMITS=NULL, PCH=NA, LTY=1, AXISP=2, POSL=1.15, MAIN=NULL, LEG=TRUE,
LEGEND=NULL, MTEXT= NULL, TEXT=NULL)

Arguments

data Data file.
var Variables.
cat Variable with the categories.
shade If it is TRUE the polygons are shaded.
type It may be radial lines ("r"), a polygon ("p"), symbols ("s") or some combination of these. If lengths is a matrix and type is a vector, each row of lengths can be displayed differently.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR It accesses the function PAR that allows to modify many different aspects of the graph.
SPIDER It accesses the function radial.plot that allows to modify many different aspects of the graph.
COLOR It allows to modify the colors of the spider plot. It must be as many as different categories of the variable cat.
LIMITS Limits of axes.
PCH Graphic symbol (see the description of the same argument in the function F1).
LTY Type of line (see the description of the same argument in the function F1).
AXISP Position of the axis (1, 2, 3 or 4).
POSL  Position of the labels. A highest value means more distant from the plot.
MAIN  Main title of the plot.
LEG   If it is TRUE the legend is shown.
LEGEND It allows to modify the legend of the plot.
MTEXT It allows to add text on the margins of the graph.
TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the function `radial.plot` of the package `plotrix` (Lemon et al., 2017).

EXAMPLE
The concentration of metals in the sediment of one of the Yahuarkaka lakes (Leticia, Colombia) is used as example. It is selected only three depths.

Value
It is depicted a spider plot.
References

Lemon, J., Bolker, B., Oom, S., Klein, E., Rowlingson, B., Wickham, H., Tyagi, A., Eterradossi, O.,
Grothendieck, G., Toews, M., Kane, J., Turner, R., Witthoft, C., Stander, J., Petzoldt, T., Duursma,
R., Biancotto, E., Levy, O., Dutang, C., Solymos, P., Engelmann, R., Hecker, M., Steinbeck, F.,
version 3.7. Available at: https://CRAN.R-project.org/package=plotrix.

Examples

## Not run:
data(Z21)
data<-subset(Z21,(Depth==10) | (Depth==50) | (Depth==100))
F87(data=data, var=c("Cr", "Co", "Ni", "Pb", "Al"), cat="Depth")
## End(Not run)

---

F88 **BUBBLE MAP**

Description

An interactive bubble map is depicted.

Usage

```r
F88(data, var, lon, lat, tooltip, legend="bottomright", title=NULL,
color="white", colscale=rev(heat.colors(100)), breaks=10, opacity=0.9,
fillOpacity=0.7, radius=8, stroke=FALSE)
```

Arguments

- **data**  
  Data file.
- **var**  
  This variable defines the color gradient of the bubbles.
- **lon**  
  Variable with the longitude.
- **lat**  
  Variable with the latitude.
- **tooltip**  
  Variables displayed when moving the mouse over the bubble.
- **legend**  
  Position of the legend.
- **title**  
  Title of the legend.
- **color**  
  Color of the stroke.
- **colscale**  
  Color of the legend.
- **breaks**  
  Number of breaks of the legend.
- **opacity**  
  Stroke opacity.
- **fillOpacity**  
  Fill opacity.
- **radius**  
  Radius of the bubbles.
- **stroke**  
  Whether to draw stroke around the bubbles.
Details

FUNCTIONS
The plot is performed with the functions leaflet of the package leaflet (Cheng, 2018) and HTML of the package htmltools (Cheng, 2017).

EXAMPLE
Earthquakes around the world.

Value
It is depicted an interactive bubble map.

References


Examples

```r
## Not run:
data(Z29)

F88(data=Z29, var="Magnitude", lon="Longitude", lat="Latitude",
tooltip=c("Magnitude", "Depth"))
## End(Not run)
```
GROUPED BOXPLOT

Description

A grouped boxplot is a boxplot where each category is subdivided in several groups.

Usage

F89(data, varY, varX, group, jitter=FALSE, mar=c(4,4.5,3,1), ResetPAR=TRUE, PAR=NULL, OrderCatX=NULL, LabelCatX=NULL, OrderGroup=NULL, LabelGroup=NULL, COLOR=NULL, BOXWEX=0.4, XCEX=1, XLAS=1, XFONT=2, XTICK=TRUE, XCOLOR="grey", XLTY=1, BOXPLOT=NULL, LEGEND=NULL, MTEXT=NULL, TEXT=NULL)

Arguments

data        Data file.
varY        Dependent variable.
varX        Variable with the categories.
group       Variable for the groups.
jitter      If it is TRUE points are added with the function jitter of the base package.
mar          Margins of the boxplot.
ResetPAR    If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.
PAR          It accesses the function PAR that allows to modify many different aspects of the graph.
OrderCatX   It allows to specify a vector with the order in which the categories of the variable varX are shown.
LabelCatX   It allows to specify a vector with the names of the categories of the variable varX.
OrderGroup  It allows to specify a vector with the order in which the categories of the variable group are shown.
LabelGroup  It allows to specify a vector with the names of the categories of the variable group.
COLOR       Vector with the color of the categories or just one color for all categories of the variable group.
BOXWEX      A scale factor to be applied to all boxes. It is useful when there are many groups, because this argument allows to make the boxes narrower.
XCEX        Size of the text in the X axis.
XLAS         Axis label orientation: 0 is parallel to the shaft, 1 is horizontal, 2 is perpendicular, and 3 is vertical.
XFONT   Font type of the text in the X axis. The value 1 is a normal type, 2 is written in bold, 3 is written in italics and 4 is written in italics and bold.
XTICK   If it is TRUE, ticks are added in the X axis.
XCOLOR  Color of the lines that divide the groups.
XLTY    It defines the type of lines that divide the groups: 0 No line, 1 Solid line, 2 Dashed line, 3 Dotted line, 4 Line of dots and dashes, 5 Dash line and 6 Double stripe.
BOXPLOT It allows to specify the characteristics of the function boxplot.
LEGEND  It allows to include a legend to the graph.
MTEXT   It allows to add text on the margins of the graph.
TEXT    It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions boxplot of the graphics package and jitter of the base package.

EXAMPLE
The data are monthly mean temperature for 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo. They were obtained from the Agencia Estatal de Meteorología of Spain [http://www.aemet.es/es/portada](http://www.aemet.es/es/portada).

Value

A grouped boxplot is obtained.
Examples

```r
## Not run:

data(Z13)

F90(data=Z13, varY="Temperature", varX="City", group="Year",
LEGEND=c("x="bottom", "legend=texto", "bty=n", "pch=15", "pt.cex=1.5", "col=color"))

## End(Not run)
```

**F90**

**AREA PLOT FOR VARIABLE X QUANTITATIVE**

**Description**

It performs an area plot for variable Y quantitative.

**Usage**

```r
F90(data, varY, varX, group, ymin=NULL, alpha=0.5, method="mean", ResetPAR=TRUE,
PAR=NULL, SYMBOLS=FALSE, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL,
BORDER=NULL, PCH=NULL, CEX=1, LEGEND=NULL, MTEXT=NULL, TEXT=NULL)
```

**Arguments**

data

Data file.

varY

Dependent variable.

varX

Quantitative independent variable.

group

Variable with the categories to be grouped.

ymin

Minimum value of the area for the variable Y.

alpha

Transparency of the areas. It ranges from 0 to 1. The value 0 is transparent and 1 is opaque.

method

The average of each category of the independent variable varX is estimated with the "mean" or the "median", if there are several values for each category of the variable.

ResetPAR

If it is FALSE, the default condition of the function PAR is not placed and maintained those defined by the user in previous graphics.

PAR

It accesses the function PAR that allows to modify many different aspects of the graph.

SYMBOLS

If it is TRUE, symbols are depicted.

XLAB

Legend of the X axis.

YLAB

Legend of the Y axis.

XLIM

Vector with the limits of the X axis.
YLIM Vector with the limits of the Y axis.
COLOR Color of the symbols. It must be as many as different categories of the variable group.
BORDER Color of the borders of the area.
PCH Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.
CEX Size of the symbols.
LEGEND It allows to modify the legend of the graph.
MTEXT It allows to add text on the margins of the graph.
TEXT It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS
The plot is performed with the functions boxplot and points of base graphics package. For further details see Guisande & Vaamonde (2012).

EXAMPLE
The example is the height and weight of children of different ages.

![Boxplot Example](image)

References

Examples

```r
# Not run:

data(Z14)

F90(data=Z14, varY="Weight", varX="Height", group="Age")

# End(Not run)
```

---

### AREA PLOT FOR VARIABLE X QUALITATIVE

**Description**

It performs an area plot for variable X qualitative.

**Usage**

```r
F91(data, varY, FactorX, group, ymin=NULL, alpha=0.5, method="mean", ResetPAR=TRUE, PAR=NULL, order=NULL, OrderCat=NULL, LabelCat=NULL, SYMBOLS=FALSE, XLAB=NULL, YLAB=NULL, XLIM=NULL, YLIM=NULL, COLOR=NULL, BORDER=NULL, PCH=NULL, CEX=1, LEGEND=NULL, MTEXT=NULL, TEXT=NULL)
```

**Arguments**

- **data**: Data file.
- **varY**: Dependent variable.
- **FactorX**: Qualitative independent variable.
- **group**: Variable with the categories to be grouped.
- **ymin**: Minimum value of the area for the variable Y.
- **alpha**: Transparency of the areas. It ranges from 0 to 1. The value 0 is transparent and 1 is opaque.
- **method**: The average of each category of the independent variable `FactorX` is estimated with the "mean" or the "median", if there are several values for each category of the variable.
- **ResetPAR**: If it is FALSE, the default condition of the function `PAR` is not placed and maintained those defined by the user in previous graphics.
- **PAR**: It accesses the function `PAR` that allows to modify many different aspects of the graph.
- **order**: If it is NULL the categories are ordered as found in the variable `FactorX`, if it is "increasing" are ordered from lesser to greater median or mean according to the method selected in the argument `method`, if it is "decreasing" are ordered from greater to lesser median or mean, if it is "alphaAZ" are ordered from A to Z and if it is "alphaZA" from Z to A.
OrderCat  It allows to specify a vector with the order in which the categories are shown. If this argument is specified, the argument order is not taken into account.

LabelCat  It allows to specify a vector with the names of the categories.

SYMBOLS  If it is TRUE, symbols are depicted.

XLAB  Legend of the X axis.

YLAB  Legend of the Y axis.

XLIM  Vector with the limits of the X axis.

YLIM  Vector with the limits of the Y axis.

COLOR  Color of the symbols. It must be as many as different categories of the variable group.

BORDER  Color of the borders of the area.

PCH  Graphic symbol (see the description of the same argument in the function F1). It must be as many as different categories of the variable group.

CEX  Size of the symbols.

LEGEND  It allows to modify the legend of the graph.

MTEXT  It allows to add text on the margins of the graph.

TEXT  It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The plot is performed with the functions boxplot and points of base graphics package. For further details see Guisande & Vammonde (2012).

EXAMPLE

The example is the temperature in three cities of Spain over the seasons.
Value

An area plot for variable X qualitativeis is depicted.

References


Examples

```r
## Not run:
data(Z13)

F91(data=Z13, varY="Temperature", FactorX="Season", group="City")

## End(Not run)
```

Description

It performs a graph combining boxplots and beanplots.
Usage

F92(data, varY, varX, order=NULL, jitterBox=FALSE, jitterBean=TRUE,
line=TRUE, dist=0.2, boxwex=0.2, maxWidth=0.3, ResetPAR=TRUE, PAR=NULL,
OrderCat=NULL, LabelCat=NULL, side="no", beanlines="median", what=c(0,1,0,0),
border="black", PCH=15, CEX=1.8, COLOR=NULL, BOXPLOT=NULL, BEANPLOT=NULL,
YLIM=NULL, Xylim=NULL, XLab=NULL, YLab=NULL, LEGEND=NULL, Mtext= NULL, TEXT=NULL)

Arguments

data Data file.
varY Dependent variable.
varX Variable with the categories.
order If it is NULL the categories are ordered as found in the variable varX, if it is
"increasing" are ordered from lesser to greater median, if it is "decreasing" are
ordered from greater to lesser median, if it is "alphaAZ" are ordered from A to Z
and if it is "alphaZA" from Z to A.
jitterBox If it is TRUE, points are added with the function jitter of the base package to the
boxplots.
jitterBean If it is TRUE, points are added with the function jitter of the base package to the
beanplots.
line If it is TRUE, a line is depicted.
dist Distance between boxplots and beanplots.
boxwex Width of boxplots.
maxwidth Width of beanplots.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and main-
tained those defined by the user in previous graphics.
PAR It accesses the function PAR that allows to modify many different aspects of the graph.
OrderCat It allows to specify a vector with the order in which the categories are shown. If
this argument is specified, the argument order is not taken into account.
LabelCat It allows to specify a vector with the names of the categories.
side The side on which the beans are plot. Default is "no", for symmetric beans. The
options "first", "second" and "both" are also supported.
beanlines The method used for determining the average bean lines. Default is value "me-
dian", and other options are "mean" and "quantiles".
what A vector of four booleans describing what to plot. In the following order, these
booleans stand for the total average line, the beans, the bean average, and the
beanlines. For example, what=c(0,0,0,1) produces a stripchart.
border Color of the border around the bean.
PCH Type of the symbol.
CEX Size of the symbol.
COLOR Vector with the color of the categories or just one color for all categories.
Boxplot

It allows to specify the characteristics of the function `boxplot`.

Beanplot

It allows to specify the characteristics of the function `beanplot`.

Ylim

Limits of Y axis.

Xlim

Limits of X axis.

Xlab

Legend of X axis.

Ylab

Legend of Y axis.

Legend

It allows to include a legend to the graph.

Mtext

It allows to add text on the margins of the graph.

Text

It allows to add text in any area of the inner part of the graph.

Details

FUNCTIONS

The boxplot is performed with the functions `boxplot` of the graphics package and `jitter` of the base package. The beanplot is performed with the function `beanplot` of the beanplot package (Kampstra, 2008; Kampstra, 2015). For further details see the help of the function `beanplot` and/or Guisande & Vammonde (2012).

EXAMPLES

For the examples, morphometric data of several fish species of Characiforms, as the length of the dorsal fin base (M12), body height (M11), etc., are used. For details see Guisande et al. (2010). It is shown the length of the dorsal fin base (M12) for all genera.

Value

A graph combining boxplots and beanplots is depicted.
References


Examples

```r
## Not run:
data(Z1)
F93(data=Z1, varY="M12", varX="Genus")
## End(Not run)
```

---

**F93**

*Ishikawa DIAGRAM*

**Description**

It performs an Ishikawa diagram.

**Usage**

```r
F93(data, cause, effect="Effect", title="Cause-and-Effect diagram", cex=c(1.2,1.1,1.3,2), font=c(1,3,2,2), col.margin="transparent", col.figure="transparent")
```

**Arguments**

- `data`: Data file.
- `cause`: Variables with the potential causes.
- `effect`: A string character with the effect.
- `title`: Main title of the diagram.
- `cex`: A vector with 4 values indicating the size of the text in the following order: branches, causes, effect and title.
- `font`: A vector with 4 values indicating the font of the text in the following order: branches, causes, effect and title.
- `col.margin`: Color of the margin.
- `col.figure`: Color inside the diagram.
Details

This representation is also known as cause-effect diagram or fishbone diagram. It consists of a simple graphical representation consisting of a horizontal line, which represents the problem to be analyzed, whose main effect is written to the right, and various lines in the form of fish thorns, which allow to describe the different causal elements. At the ends of these lines the different categories are indicated, and between those groups and the center line, the different possible causes associated with each one.

FUNCTIONS

The plot is performed with the function `cause.and.effect` of the package qcc (Scrucca, 2017). For further details see Guisande & Vammonde (2012).

EXAMPLE

The example consists in analyzing the possible causes of the low academic performance of the students of a University

![Ishikawa Diagram](image)

Value

An Ishikawa diagram is depicted.

References


Examples

```r
## Not run:
data(Z30)
F93(data=Z30, cause=c( "TEACHING.MATERIAL", "ORGANIZATION", "PROFESSORS", "FACILITIES", "ACADEMIC.ASSESSMENT", "STUDENTS"), title="Academic performance", effect="Poor school\n performance", col.margin="#FFE4C4FF", col.figure="white")
```
## End (Not run)

**Pareto CHART**

**Description**

It performs an Pareto chart.

**Usage**

```
F94(data, defect, number, xlab=NULL, ylab="Frequency", ylab2="Cumulative percentage",
cumperc=seq(0, 100, by = 25), ylim=NULL, main="Pareto chart", col=NULL)
```

**Arguments**

- `data` Data file.
- `defect` Variable with the name of the defects.
- `number` Variable with the observed number of each of the defects.
- `xlab` Legend of X-axis.
- `ylab` Legend of Y-axis.
- `ylab2` Legend of Y-axis on the right side.
- `cumperc` A vector of percentage values to be used as tickmarks for the second Y-axis on the right side.
- `ylim` A numeric vector specifying the limits for the Y-axis.
- `main` Main title of the chart.
- `col` Color of the bars

**Details**

The purpose of the Pareto chart, in quality control, is to highlight the most important sources of defects, the highest occurring type of defect, the most frequent reasons for customer complaints, etc., among a set of factors.

**FUNCTIONS**

The plot is performed with the function `pareto.chart` of the package qcc (Scrucca, 2017). For further details see Guisande & Vammonde (2012).

**EXAMPLE**

The example consists in types of defects detected in the elaboration of a product and the observed number of each of these defects.
Value

An Pareto chart is depicted and a table with the descriptive statistics used to draw the Pareto chart.

References


Examples

```r
## Not run:
data(Z31)
F94(data=Z31, defect="Defect.Type", number="Number")
## End(Not run)
```

Description

It performs three plots of Measurement System Analyses (MSA) type I: Run chart, histogram and tolerance chart.
Usage

F95(data, var, combined=TRUE, cgOut=TRUE, target, tolerance, ref.interval, facCg, facCgk, n=0.2, type="b", col1="black", col2="cadetblue1", col3="black", pch=16, xlim, ylim, conf.level=0.95, cex.val=1.5, main1, main2, main3)

Arguments

data Data file.
var Variable to be analyzed.
combined If it is TRUE, the three plots are combined in only one.
cgOut It it is TRUE, centralized Gage potential index (\(C_g\)) and the non-centralized Gage Capability index (\(C_{gk}\)) values are shown in a legend.
target A numeric value giving the expected target value for the variable.
tolerance Vector with two values: the lower and upper specification limits.
ref.interval Numeric value giving the confidence intervall on which the calculation is based. By default it is based on 6 sigma methodology. Regarding the normal distribution this relates to \(\text{pnorm}(3) - \text{pnorm}(-3)\) which is exactly 99.73002 percent If the calculation is based on an other sigma value ref.interval needs to be adjusted. To give an example: If the sigma-level is given by 5.15 the ref.interval relates to \(\text{pnorm}(5.15/2) - \text{pnorm}(-5.15/2)\) which is exactly 0.989976 percent.
facCg Numeric value as a factor for the calculation of the gage potential index. The default Value for facCg is 0.2.
facCgk Numeric value as a factor for the calculation of the gage capability index. The default value for facCgk is 0.1.
n Numeric value between 0 and 1 giving the percentage of the tolerance field (values between the upper and lower specification limits given by tolerance) where the values of the variable should be positioned. Limit lines will be drawn. Default value is 0.2.
type Character string giving the type of plot desired. The following values are possible: "p" for points, "l" for lines, "b" for both points and lines, "c" for empty points joined by lines, "o" for overlotted points and lines, "s" and "S" for stair steps and "h" for histogram-like vertical lines. Finally, "n" does not produce any points or lines.
col1 Color of points and line of tolerance chart, when the three plots are not combined.
col2 Color of bars in the histogram, when the three plots are not combined.
col3 Color of points and line of run chart, when the three plots are not combined.
pch Graphic symbol (see the description of the same argument in the function F1).
xlim Limits of X-axis in run chart.
ylim Limits of Y-axis in run chart.
conf.level Confidence level for internal t.test checking the significance of the bias between target and mean of x. The default value is 0.95. The result of the t.test is shown in the histogram on the left side.
Details

The measurement systems analysis (MSA) type I are experiments or procedures designed to verify the correction of the measure. It is calculated the centralized Gage potential index ($C_g$) and the non-centralized Gage Capability index ($C_{gk}$). The index $C_g$ is calculated as a quotient between a fraction, typically 0.2, of the amplitude of the tolerance interval or difference between the upper limit ($LS$) and the lower limit ($LI$) and a measurement of the displacement, generally the range in which 95.5% or 99.73% of the values are found. These percentages correspond to amplitudes of interval of 4 or 6 typical deviations (values $k = 2$ and $k = 3$ of a standard Normal variable). The majority of the measurements follow a Normal distribution in practice, but the corresponding quantities can be used instead of the afore mentioned $k$ values, if it is another distribution. The value of the index ($C_g$) is any of these equations:

$$C_g = 0.2 \frac{(LS - LI)}{4s}$$

$$C_g = 0.2 \frac{(LS - LI)}{6s}$$

When there is bias, this must be subtracted from the numerator. The bias is calculated by repeatedly measuring a known magnitude exactly (a pattern), and subtracting the mean of the measurements ($x_m$) minus the exact quantity or standard measure ($x_e$):

$$Sesgo = |x_m - x_e|$$

$$C_{gk} = 0.2 \frac{(LS - LI - Sesgo)}{4s}$$

$$C_{gk} = 0.2 \frac{(LS - LI - Sesgo)}{6s}$$

FUNCTIONS

The plot is performed with the function cg of the package qualityTools (Roth, 2016).

EXAMPLE

The example consists in measurements of the inner diameter of two car parts in millimeters. The target diameter, which is intended to be achieved with the manufacture, is 23.65 mm, with tolerance limits $LI = 23.35$ and $LS = 23.95$. 
Value

Three plots of Measurement System Analyses (MSA) type I are depicted: Run chart, histogram and tolerance chart. Furthermore the centralized Gage potential index \((C_g)\) and the non-centralized Gage Capability index \((C_{gk})\) are calculated and displayed.

References


Examples

```r
## Not run:
data(Z32)
F95(data=Z32, var="Part1", target = 23.65, tolerance = c(23.35, 23.95))
## End(Not run)
```
Description

It performs six plots of Measurement System Analyses (MSA) type II: Components of variation, boxplot for each piece, boxplot for each operator, mean chart, interaction chart and R chart.

Usage

F96(data, measurements, pieces, operators, replicates, method="crossed", sigma=6, alpha=0.25, tolerance=NULL, dig=3, randomize=FALSE)

Arguments

data             Data file.
measurements     Variable with the measurements of the operators.
pieces           Variable with the names of the pieces, mechanical parts, etc.
operators        Variable with the operators.
replicates       Variable with the replicates.
method           The "crossed" method is the typical design for performing a Measurement Systems Analysis using Gage Repeatability and Reproducibility. The other option is "nested" which is used for destructive testing (i.e. the same part cannot be measured twice).
sigma            For sigma=6 this relates to 99.73 percent representing the full spread of a normal distribution function (i.e. pnorm(3) - pnorm(-3)). Another popular setting sigma=5.15 relates to 99 percent (i.e. pnorm(2.575) - pnorm(-2.575)).
alpha            alpha value for discarding the interaction Operator:Part and fitting a non-interaction model.
tolerance        Numeric value giving the tolerance for the measured parts. This is required to calculate the Process to Tolerance Ratio.
dig              Numeric value giving the number of significant digits.
randomize        If it is TRUE, randomizes the gageRR design.

Details

The measurement systems analysis (MSA) type II are procedures designed to study the repeatability and reproducibility (R&R) of a measuring system. Repeatability refers to the precision of the measurement, valued through the standard deviation, resulting from the taking of several measurements of the same measurement and in the same conditions, that is, in the same object, with a single instrument of measurement and by the same operator. Reproducibility is the average of variations due to the taking of a certain measure effected under different measurement conditions, which may be different instruments, different operators, different environmental conditions, etc. The total observed variance can be expressed as the sum of the different components:

\[ \sigma_{total}^2 = \sigma_{pieces}^2 + \sigma_{measurement}^2 \]

That is, a part of the variability is due to the fact that the pieces measured are different, and another part is due to the measurement process itself. In turn, the variability of the measure can be decomposed into the sum of the different effects or factors, including the interactions of two or more
factors:

\[ \sigma^2_{\text{measurement}} = \text{Reproducibility}(\sigma^2_{\text{workers}} + \sigma^2_{\text{equipment}} + \sigma^2_{\text{environment}} + \ldots) + \text{Repeatability}(\sigma^2_{\text{error}}) \]

The variance of the error is intrinsic to the measurement process, and generally inevitable, and is called repeatability. The rest of the variance of the measure can be explained, and even avoided (using a single operator, a single instrument, identical environmental conditions, etc.), and is called reproducibility.

FUNCTIONS

The plot is performed with the function `gageRR` of the package `qualityTools` (Roth, 2016).

EXAMPLE

The example consists in measurements taken by three operators to 10 different pieces and each operator measured two times each piece. It is necessary to measure at least twice each piece to obtain the residual or intrinsic variability of the system. The format of the file must be the one shown in the example. A column with the name of the pieces, a column with the operators, the column with the number of the replicates, and measurements.

The results of the table are those of an analysis of the variance (ANOVA), which allows to identify the different summands and calculate the components. The results show that the effect of the operator (p=0.945) and of the piece (p < 0.001) are both no significant, and also the interaction between them is not significant (p=0.672). Therefore, we will consider the model without interaction, as shown in the following ANOVA table. Again it is observed that there are not significant differences in the measurements made between pieces (p=0.121) and among the operators (p < 0.941).

\[
\begin{array}{llllll}
\text{AnOVA Table} & \text{crossed Design} \\
\text{DF} & \text{Sum Sq} & \text{Mean Sq} & \text{F value} & \text{Pr(>F)} \\
\text{Operator} & 2 & 0.00091 & 0.000455 & 0.057 & 0.945 \\
\text{Part} & 9 & 0.11218 & 0.012465 & 1.559 & 0.173 \\
\text{Operator:Part} & 18 & 0.11702 & 0.006501 & 0.813 & 0.672 \\
\text{Residuals} & 30 & 0.23985 & 0.007995 & & \\
\end{array}
\]

\[
\begin{array}{llllll}
\text{AnOVA Table Without Interaction} & \text{crossed Design} \\
\text{DF} & \text{Sum Sq} & \text{Mean Sq} & \text{F value} & \text{Pr(>F)} \\
\text{Operator} & 2 & 0.0009 & 0.000455 & 0.061 & 0.941 \\
\text{Part} & 9 & 0.1122 & 0.012465 & 1.677 & 0.121 \\
\text{Residuals} & 48 & 0.3569 & 0.007435 & & \\
\end{array}
\]

The following results show the decomposition of the variance between the different elements. As explained above, the total variance is due to two causes: the differences between pieces (**Part to Part**) with 10.1% of total and measurement errors (**totalRR**), which represent 89.9% of the total. The latter is what we are interested in analyzing and, in turn, is divided into two parts: repeatability (89.9%), or error attributable to the measurement process itself, and reproducibility (0%), or error attributable to other known factors, in this case to the differences between operators. In general it is
required that the contribution of the totalRR does not exceed the value 0.1 (10%) and values greater than 0.3 (30%) are considered unacceptable. In this case, it is 0%, so very good.

<table>
<thead>
<tr>
<th>Gage R&amp;R</th>
<th>VarComp</th>
<th>VarCompContrib</th>
<th>Stdev</th>
<th>StudyVar</th>
<th>StudyVarContrib</th>
</tr>
</thead>
<tbody>
<tr>
<td>totalRR</td>
<td>0.007435</td>
<td>0.899</td>
<td>0.517</td>
<td>0.948</td>
<td></td>
</tr>
<tr>
<td>repeatability</td>
<td>0.007435</td>
<td>0.899</td>
<td>0.517</td>
<td>0.948</td>
<td></td>
</tr>
<tr>
<td>reproducibility</td>
<td>0.000000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Operator</td>
<td>0.000000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Operator:Part</td>
<td>0.000000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Part to Part</td>
<td>0.000838</td>
<td>0.101</td>
<td>0.174</td>
<td>0.318</td>
<td></td>
</tr>
<tr>
<td>totalVar</td>
<td>0.008273</td>
<td>1.000</td>
<td>0.546</td>
<td>1.000</td>
<td></td>
</tr>
</tbody>
</table>

---

* Contrib equals Contribution in %
**Number of Distinct Categories (truncated signal-to-noise-ratio) = 1

The above data can also be seen in the graphs. On the left, the bar chart represents the components of the variance, in proportion, in red. In green, the proportions corresponding to the standard deviations are shown.

The boxplot, Measurement by Operator, shows that there are no differences between operators. The interaction diagram, Interaction operator: Part, below the previous one, indicates a similar evolution for the three operators, with lines that are barely crossed and, therefore, no interaction between operator and piece, as the ANOVA showed to be the interaction not significant.

On the right side, a boxplot that explains the differences between parts is shown first. The medium and lower graphs indicate the average values and the range of the two measurements taken for each operator. Almost all values are within the limits of confidence.
Value

Six plots of Measurement System Analyses (MSA) type II are depicted: Components of variation, boxplot for each piece, boxplot for each operator, mean chart, interaction chart and R chart.

References


Examples

```r
## Not run:
data(Z33)
F96(data=Z33, measurements=c("Measurement"), pieces="Piece", operators="Operator", replicates="Replicate")
```

```r
## End(Not run)```
F97 PROCESS CAPABILITY ANALYSIS

Description

It calculates the process capability indices cp, cpk, cpkL (onesided) and cpkU (onesided).

Usage

F97(data, var, distribution="normal", lsl, usl, target, boxcox=FALSE, lambda=c(-5,5), main="", xlim, ylim, grouping=NULL, std.dev= NULL, conf.level=0.9973002, start, lineWidth=1, lineCol="red", lineType="solid", specCol="red3", specWidth=1, cex.text=2, cex.val=1.5, cex.col="darkgray", bounds.lty=3, bounds.col="red")

Arguments

data  Data file.
var   Numeric vector containing the values for which the process capability should be calculated.
distribution  Character string specifying the distribution of the variable: "normal", "log-normal", "exponential", "logistic", "gamma", "weibull", "cauchy", "gamma3", "weibull3", "lognormal3", "beta", "geometric", "poisson" or "negative-binomial".
lsl   Numeric value for the lower specification limit.
usl   Numeric value for the upper specification limit.
target  Numeric value giving the target value.
boxcox  Logical value specifying whether a Box-Cox transformation should be performed or not.
lambda  Lambda for the transformation.
main  An overall title for the plot.
xlim  Vector giving the range of the X-axis.
ylim  Vector giving the range of the Y-axis.
grouping  If grouping is given the standard deviation is calculated as mean standard deviation of the specified subgroups corrected by the factor c4 and expected fraction of nonconforming is calculated using this standard deviation.
std.dev  Historical standard deviation (only provided for normal distribution).
conf.level  Numeric value between '0' and '1' giving the confidence interval. By default conf.level is 0.9973 (99.73%) which is the reference interval bounded by the 99.865% and 0.135% quantile.
start  A named list giving the parameters to be fitted with initial values. Must be supplied for some distribution (see fitdistr of the R-package MASS).
lineWidth  A numeric value specifying the width of the line for the density curve.
lineCol  Numerical value or character string (like “red”) specifying the color of the line for the density curve.

lineType Character string specifying the line type: "blank", "solid", "dashed", "dotted", "dotdash", "longdash" or "twodash".

specCol Numerical value or character string specifying the color for the specification limits.

specWidth Numerical value specifying the line width for the specification limits.

cex.text Numerical value specifying the cex for lsl, usl and target.

cex.val Numerical value specifying the cex for the process capability ratios.

cex.col Numerical value or character string specifying the color for lsl, usl and target.

bounds.col Numerical value or single character string giving the color of confidence bounds lines.

bounds.lty Numerical value giving the color of confidence bounds lines.

Details

Another important aspect in quality control is to analyze the capacity of the production process to find out to what extent the tolerance margins are being used for the common causes of variability. In this way we can also know what proportion of the units will be outside the margins (defective parts), if the process is controlled or not, and if it is necessary to perform some type of intervention. Three indices of process capacity are used:

\[ cp = \frac{(USL - LSL)}{(Q_{0.99865} - Q_{0.00135})} \]

\[ c_{pkL} = \frac{(Q_{0.5} - LSL)}{(Q_{0.5} - Q_{0.00135})} \]

\[ c_{pKU} = \frac{(USL - Q_{0.5})}{(Q_{0.99865} - Q_{0.05})} \]

where

\[ c_{pk} = \min(c_{pkL}, c_{pKU}) \]

The \( cp \) index is the potential capacity of the process if it is centered (if the variable is Normal), and \( cpk \) the real capacity incorporating the position and the shape of the distribution. In that case, two lateral capacities are measured, upper and lower, and the smaller one is taken. The \( Q \) value refers to the corresponding quantile, indicated by the subscript, \( USL \) and \( LSL \) being the upper and lower tolerance limits.

FUNCTIONS

The plot is performed with the function pcr of the package qualityTools (Roth, 2016). For further details see Guisande & Vammonde (2012).

EXAMPLE The example consists in measurements of the inner diameter of two car parts in millimeters. The objective is to determine what proportion of the car parts is outside the margins (defective parts).

It is necessary to indicate the distribution you want to use as a reference with the argument distribution. Other distributions other than Normal can be used, for example, the Weibull distribution, which is frequently used in the field of quality control.
The Anderson-Darling test is one of the most powerful to test the normality hypothesis. In this case, since the value p > 0.05, Normality is met.

**Anderson Darling Test for normal distribution**

data:  datos[, var]  
A = 0.6819, mean = 25.570, sd = 0.016, p-value = 0.06889  
alternative hypothesis: true distribution is not equal to normal

The graph shows a histogram, which allows an approximate appreciation of the Normal shape of the distribution, to which the small diagram on the right contributes - a graph qq - that transforms the variable so, if there is a Normal distribution, the points should be placed approximately above the diagonal, as in the example.

The histogram also shows the tolerance limits (25.5 and 25.6), and it is observed that no value is outside them, so there are not defective parts. The observed parts per million (ppm) are zero, and the expected fraction of defective or non-conforming parts is calculated, also expressed in parts per million: pL = 1349.9 above the upper margin, pu = 1349.9 below, 2699.8 in total for every million pieces, that is, 0.27% (pt = 2699.8).
The graph also shows the capacity indices: $c_p = 1$ and $c_{pk} = 1$. In general, indices with values greater than 1.33 are considered acceptable. The estimated Normal distribution parameters are also shown with the sample data (mean = 25.6; sd = 0.0157), and the A statistic and p-value of the Anderson-Darling Normality test.

**Value**

It returns a list with lambda, cp, cpl, cpu, ppt, ppl, ppm, A, usl, lsl, target.

**References**


**Examples**

```r
## Not run:
```
data(Z32)

F97(data=Z32, var="Part2", target=25.567)

## End(Not run)

---

**Shewhart CHARTS**

**Description**

It performs Shewhart charts, also called process-behavior charts, which are a statistical process control tool used to determine if a manufacturing or business process is in a state of control for quantitative or qualitative data.

**Usage**

```r
F98(data, measurements, samples, sizes, type="xbar", subset=NULL, center, std.dev, limits, data.name, labels, newdata, newdata.name, newlabels, nsigmas=3, confidence.level)
```

**Arguments**

- `data` - Data file.
- `measurements` - Variable with the measurements.
- `samples` - Variable with the samples.
- `sizes` - A value or a vector of values specifying the sample sizes associated with each group. For continuous data provided as data frame or matrix the sample sizes are obtained counting the non-NA elements of each row. For "p", "np" and "u" charts the argument sizes is required.
- `type` - A character string specifying the group statistics to compute: "xbar", "R", "S", "xbar.one", "p", "np", "c", "u" or "g". See details section for further information and the help manual of the function link[qcc]qcc of the package qcc (Scrucca, 2017).
- `subset` - With this argument it is possible to select a subset of the data. If it is a vector with two values, it means a range. For example, c(1,30) means the groups 1 to 30. A vector with more than two values means that the groups indicated in the vector are selected. The number of data in each group and the number of the group is defined in the variable of the argument `samples`.
- `center` - A value specifying the center of group statistics or the "target" value of the process.
- `std.dev` - A value or an available method specifying the within-group standard deviation(s) of the process.
- `limits` - A two-values vector specifying control limits.
data.name  A string specifying the name of the variable which appears on the plots. If not provided is taken from the object given in the argument `measurements`.

labels  A character vector of labels for each group.

newdata  With this argument it is possible to select a new subset of the data, which are used for plotting but not included in the computations. If it is a vector with two or more values, as explained in the argument `subset`.

newdata.name  A string specifying the name of the variable which appears on the plots. If not provided is taken from the object given in the argument `as newdata`.

newlabels  A character vector of labels for each new group defined in the argument `newdata`.

nsigmas  A numeric value specifying the number of sigmas to use for computing control limits. It is ignored when the `confidence.level` argument is provided.

confidence.level  A numeric value between 0 and 1 specifying the confidence level of the computed probability limits.

Details

Another phase of quality control consists in planning, documenting and conveniently implementing the necessary controls to ensure quality maintenance, using the results obtained in the previous phases.

The improvement achieved in the results must be quantified, the mechanisms and protocols for measurement and monitoring of the processes established, the alarm signals or deviation notices that indicate that some action is necessary, and the actions to be carried out in those cases. All this must be properly documented.

In this control phase the Shewhart charts are used. These charts allow you to observe the follow-up of a process, and know if it develops properly or deviates from the expected and, in that case, they help to find the problem and apply the correct solution.

The process must maintain the average value of the objective variable within these limits, for which it is useful to represent the mean in its temporal evolution. You must also keep the variability within reasonable limits, for which the standard deviation or range is usually represented. Although the standard deviation is usually considered the best indicator of variability, in the area of quality control the range or route is frequently used, difference between maximum and minimum value in a sample, for its ease of calculation.

In the argument `type` is possible to specify the group statistics to compute:

<table>
<thead>
<tr>
<th>Statistic charted</th>
<th>Chart description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;xbar&quot;</td>
<td>mean</td>
</tr>
<tr>
<td>&quot;R&quot;</td>
<td>range</td>
</tr>
<tr>
<td>&quot;S&quot;</td>
<td>standard deviation</td>
</tr>
<tr>
<td>&quot;xbar.one&quot;</td>
<td>one-at-time data of a continuous variable</td>
</tr>
<tr>
<td>&quot;p&quot;</td>
<td>proportion</td>
</tr>
<tr>
<td>&quot;np&quot;</td>
<td>count</td>
</tr>
<tr>
<td>&quot;c&quot;</td>
<td>count</td>
</tr>
<tr>
<td>&quot;u&quot;</td>
<td>count</td>
</tr>
<tr>
<td>&quot;g&quot;</td>
<td>count</td>
</tr>
</tbody>
</table>

means of a continuous process variable
ranges of a continuous process variable
standard deviations of a continuous variable
one-at-time data of a continuous process variable
proportion of nonconforming units
number of nonconforming units
nonconformities per unit
average nonconformities per unit
number of non-events between events
FUNCTIONS

The plot is performed with the function `qcc` of the package `qcc` (Scrucca, 2017). For further details see Guisande & Vammonde (2012).

EXAMPLE

In the example there are data on the length of a metal part, whose nominal value must be 80 mm, which consist of 300 values corresponding to 60 samples of 5 units. The variable "Measurement" indicates the value, and "Sample" the set to which it belongs. The variability of the manufacturing process means that each piece has a measurement close to the nominal value, within reasonable margins, but mismatches may occur that cause a percentage of defective parts inadmissible.

Example 1 with the mean.

In the first example the chart of means is shown, only including the first 30 groups, the argument `subset=c(1,30)`. As each group consists of 5 samples, there are a total of 150 data.

The chart shows that the process seems to be under control. The average values of the samples of 5 units randomly oscillate around the nominal value.

The control limits in the graph, $LCL$ and $UCL$, correspond to 3 times the standard deviation of the mean (only 2.67 per thousand of the values are expected to be outside them), and are calculated with the data itself.

The legend of the graph also indicates that there are no values outside limits (Number beyond limits), either groups outside the limits (Number violating runs).

A run is a set of 5 (because there were 5 samples in each run, as it is specified in the variable samples) or more consecutive values above or below the average, and could indicate a mismatch in the process.

Example 2 with the mean and new data for testing.

In the second example, we keep the sample already used (30 groups of 5) to perform the calculations and now add the remaining groups, from 31 to 60. The new data is added with the argument `newdata=c(31,60)`. These new data are not included to make the statistic and they are just plotted. Reserve some data to see if anomalies are observed, allows to control the quality of the process.
In the new chart it is observed that, while maintaining the control limits of the previous chart, there is a value outside the limits, an occasional mismatch, which in principle does not matter, since the subsequent process seems to remain under control.

**Example 3 with the range.**

In this example, we work with all the data and it is used the range as the statistic. To do this, the argument `type=“R”`. An excessively high range indicates a large variability that can lead to a large number of defective elements in the product.

It is observed that the variability is kept under control. The presence violating runs is usually not
worrying, when it comes to values below the mid-range (runs below the horizontal continuous line).

**Example 4 with the standard deviation.**

In this example, the standard deviation is used, a more appropriate measure in general to measure the variability, since it is not so influenced by outliers. To get this new chart, simply change the argument `type="S"`. The chart is very similar to that obtained with the range.

![S Chart for Measurements](image)

**Example 5 with qualitative data.**

Sometimes the objective variable is not quantitative but qualitative, such as a defective or non-defective element. We will use an example in which the product consists of fruit units (kiwis) packaged in boxes of 60 units. The inspection determines the number of units that have a defect of any kind. It is interesting to keep the percentage of defective units below an allowable limit. A box is sampled every hour chosen at random. The data format consists of the variable "Size", which indicates the size of the samples (60 units, a complete box, in all cases), and another variable called "Defects" that shows the number of defective units. The number of boxes reviewed is 50.
The chart shows the sequence of proportions of defective elements for the data set. Control limits are automatically set based on the data, based on your own variability. In this example, no element outside the limits is observed, and the presence of sporadic streaks is not worrying.

**Example 6 with qualitative data, a subset of data and newdata for testing.**

In this example, a chart is constructed with the first 30 elements of the sample, using the argument `subse=c(1,30)`, and checks if the process is also controlled with another sample additionally, in this case formed by the last 20 boxes, using the argument `newdata=c(31,50)`.

**Value**

Different types of Shewhart charts are obtained.

**References**


Examples

## Not run:
## Example 1 with the mean and a subset of data

data(Z34)
F98(data=Z34, measurements="Measurement", samples="Sample", subset=c(1,30), center=80)

## Example 2 with the mean, a subset of data and newdata for testing

data(Z34)
F98(data=Z34, measurements="Measurement", samples="Sample", subset=c(1,30), center=80, newdata=c(31,60))

## Example 3 with the range as statistic and all data

data(Z34)
F98(data=Z34, measurements="Measurement", samples="Sample", type="R")

## Example 4 with standard deviation as statistic and all data

data(Z34)
F98(data=Z34, measurements="Measurement", samples="Sample", type="S")

## Example 5 with qualitative data

data(Z35)
F98(data=Z35, measurements="Defects", sizes="Size", type="p")

## Example 6 with qualitative data, a subset of data and newdata for testing

data(Z35)
F98(data=Z35, measurements="Defects", sizes="Size", type="p", subset=c(1,30), newdata=c(31,50))

## End(Not run)
Description

A boxplot with three categorical variables.

Usage

F99(data, varY, varX, group1, group2, jitter=FALSE, mar=c(0.5, 0.5, 0.5, 1),
ResetPAR=TRUE, PAR=NULL, OrderCatX=NULL, LabelCatX=NULL, OrderCat1=NULL,
LabelCat1=NULL, OrderCat2=NULL, LabelCat2=NULL, COLOR=NULL, BOXWEX=0.4,
XCEX=1, XLAS=1, XFONT=2, XTICK=TRUE, XCOLOR="grey", COLREC = "#87CEEB32",
YLAB=NULL, CEXYLAB=1.7, YLIM=NULL, MFROW=NULL, CEXJITTER=2.5, XLYT=1,
BOXPLOT=NULL, LEGEND=NULL, MTEXT= NULL, TEXT=NULL)

Arguments

data Data file.
varY Dependent variable.
varX Variable with the categories that are depicted in the X axis.
group1 Second variable.
group2 Third variable with categories.
jitter If it is TRUE points are added with the function jitter of the base package.
mar Margins of the boxplot.
ResetPAR If it is FALSE, the default condition of the function PAR is not placed and main-
tained those defined by the user in previous graphics.
PAR It accesses the function PAR that allows to modify many different aspects of the graph.
OrderCatX It allows to specify a vector with the order in which the categories of the variable varX are shown.
LabelCatX It allows to specify a vector with the names of the categories of the variable varX.
OrderCat1 It allows to specify a vector with the order in which the categories of the variable group1 are shown.
LabelCat1 It allows to specify a vector with the names of the categories of the variable group1.
OrderCat2 It allows to specify a vector with the order in which the categories of the variable group2 are shown.
LabelCat2 It allows to specify a vector with the names of the categories of the variable group2.
COLOR Vector with the color of the categories or just one color for all categories of the variable group.
BOXWEX A scale factor to be applied to all boxes. It is useful when there are many groups, because this argument allows to make the boxes narrower.
XCEX Size of the text in the X axis.
XLAS  
Axis label orientation: 0 is parallel to the shaft, 1 is horizontal, 2 is perpendicular, and 3 is vertical.

XFONT  
Font type of the text in the X axis. The value 1 is a normal type, 2 is written in bold, 3 is written in italics and 4 is written in italics and bold.

XTICK  
If it is TRUE, ticks are added in the X axis.

XCOLOR  
Color of the lines that divide the groups.

COLREC  
Color of the shaded area for the variable group2.

YLAB  
Legend of Y axis.

CEXYLAB  
Size of the Y legend.

YLIM  
Limits of Y axis.

MFROW  
It allows to specify the boxplot panel. It is a vector with two numbers, for example c(2,5) which means that the boxplots are put in 2 rows and 5 columns.

CEXJITTER  
Size of the points depicted with the argument jitter.

XLTY  
It defines the type of lines that divide the groups: 0 No line, 1 Solid line, 2 Dashed line, 3 Dotted line, 4 Line of dots and dashes, 5 Dash line and 6 Double stripe.

BOXPLOT  
It allows to specify the characteristics of the function boxplot.

LEGEND  
It allows to include a legend to the graph.

MTEXT  
It allows to add text on the margins of the graph.

TEXT  
It allows to add text in any area of the inner part of the graph.

**Details**

**FUNCTIONS**

The plot is performed with the functions boxplot of the graphics package and jitter of the base package.

**EXAMPLE**

The data are monthly mean temperature for 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo. They were obtained from the Agencia Estatal de Meteorologia of Spain [http://www.aemet.es/es/portada](http://www.aemet.es/es/portada).
Value

A boxplot with three categorical variables.

Examples

```r
## Not run:
data(Z13)
F99(data=Z13, varY="Temperature", varX="City", group1="Year", group2="Season", XCEX=1.5, YLAB="Temperature (°C)"

## End(Not run)
```

Description

Morphometric data of several species of Characiforms, as the length of the dorsal fin base (M12), body height (M11), etc. For details see Guisande et al. (2010).
Usage
data(Z1)

Format
An data frame with 31 columns: taxonomic data (order, family, genus and species) and 27 morphometric variables.

Source
http://www.ipez.es.

References

Description
Latitude, logitude and altitude (in km) in the Himalayan region, from 21.91 to 60.91 N and 68 to 108 W.

Usage
data(Z10)

Format
Two columns with the latitude and longitude and the rest of columns is a matrix with the altitude.

Description
Latitude, logitude and depth (in meters) from 33 to 35 N and 130 to 150 W.

Usage
data(Z11)

Format
Three columns with the latitude, longitude and depth.
### Z12: Geographical Records and Altitude of Freshwater Fish Species

**Description**
Geographical records and altitude of fish freshwater species of the genus Cyphocharax (Guisande et al., 2010).

**Usage**
data(Z12)

**Format**
An data frame with 3 columns: Longitude, Latitude and Altitude.

**Source**
http://www.ipez.es.

**References**

### Z13: Temperature and Precipitation in Cities of Spain

**Description**

**Usage**
data(Z13)

**Format**
An data frame with 8 columns: city, year, mean temperature, mean precipitation, month, season, color of the labels and season only for the city of Huelva.

**Source**
Z14  
**HEIGHT AND WEIGHT OF CHILDREN**

**Description**

Height and weight data for children aged 2-5 years.

**Usage**

```r
data(Z14)
```

**Format**

An array (matrix) with 3 columns: age, weight and height.

---

Z15  
**ABILITY TO REMEMBER**

**Description**

In an experiment conducted with expert tasters and people who had no experience tasting, they were taught to identify 15 types of wines from different regions. Variations in ability to ascertain the wine provenance over time (after one hour, one day, one week and one month) was measured between experts and non-experts. For every time, each person assessed a large number of samples and the degree of success was recorded on a scale of 0 to 12.

**Usage**

```r
data(Z15)
```

**Format**

An data frame with 3 columns: if taster has or does not have any experience (YES / NO), the measurement time (Hour, Day, Week and Month) and a degree of success on a scale of 0 to 12.
**Description**

Presence of the wolf (*Canis lupus*) and mean of environmental variables in cells of 1 degree x 1 degree around the world.

**Usage**

data(Z16)

**Format**

A data frame of the presence of the wolf and the means altitude, annual temperature (BIO1), diurnal range (BIO2), isothermality (BIO3), temperature seasonality (BIO4), maximum temperature of the warmest month (BIO5), annual precipitation (BIO12), primary terrestrial production (PP), slope and vegetation index (VI) in cells of 1 degree x 1 degree around the world.

**Source**

The range map of the wolf was obtained from the International Union for Conservation of Nature (IUCN) at the web page [http://www.iucn.org/](http://www.iucn.org/). The data of the means annual temperature (BIO1), diurnal range (BIO2), isothermality (BIO3), temperature seasonality (BIO4), maximum temperature of the warmest month (BIO5) and annual precipitation (BIO12) were downloaded from the web [http://www.worldclim.org/](http://www.worldclim.org/). Both range map and environmental variables were inputted into ModestR (www.ipez.es/ModestR) and the output file from ModestR is a CSV file that was converted to a RData file.

**References**


AMINO ACIDS IN ROTIFERS

Description

Percentages of three amino acids in different species of rotifers obtained from ponds of Doñana National Park (Spain) (Guisande et al., 2008).

Usage

data(Z17)

Format

A data frame with five columns: pond, species and the percentages of aspartate, serine and glutamate.

References


dEMOGRAPHIC PARAMETERS FOR COUNTRIES

Description

Demographic parameters from 57 countries in Europe, Africa and America.

Usage

data(Z18)

Format

An data frame with 7 columns: continent, country, scores of the Principal Component Analysis (PCA) 1 and 2, variables of the PCA, and position of the variables in the axes 1 and 2 of the PCA.
**RECORDS OF A FRESHWATER FISH SPECIES**

**Description**
Records of the freshwater fish species *Perca fluviatilis* in different geographic coordinates, and the temperature and altitude.

**Usage**
data(Z19)

**Format**
An data frame with 5 columns: Longitude, latitude, records, altitude and temperature.

**TEMPERATURE PREDICTED BY DIFFERENT MODELS**

**Description**
Monthly temperature observed and predicted by different models.

**Usage**
data(Z2)

**Format**
An data frame with 6 columns: month, temperature observed and temperature predicted by four models.

**STUDY ON SMOKING**

**Description**
Range data in men and women who smoke in different work centres. The categories used were: 1 (Non-smoker), 2 (between 1 and 10 cigarettes a day), 3 (between 11 and 20 cigarettes a day), 4 (from 1 to 2 packs per day) and 5 (more than 2 packs a day). There is also information if any parents of these workers are smokers and their categories are: workers in which one parent is a smoker (category value = 1) and the other group for those in which none of his/her parents is a smoker (category value = 0).
Usage
data(Z20)

Format
An data frame with 5 columns: age, gender, workplace, if either parent smokes and degree of smoking.

---

Z21  METALS IN SEDIMENT

Description
Concentration of metals at different depth in the sediment of the Yahuarkaka lake in Leticia (Amazonas, Colombia).

Usage
data(Z21)

Format
An data frame with 6 columns: depth and the concentration of Cr (chromium), Co (cobalt), Ni (nickel), Pb (lead) and Al (aluminum).

---

Z22  AIR POLLUTANTS

Description
Hourly data of air pollutants, wind speed and wind direction in Santiago de Compostela (Spain) from 1/11/2015 to 31/12/2015.

Usage
data(Z22)

Format
An data frame with 10 columns: date, sulfur dioxide (SO2), nitrogen monoxide (NO), nitrogen dioxide (NO2), nitrogen oxides (NOX), carbon monoxide (CO), ozone (O3), particulate matter 10 micrometers or less in diameter (PM10), wind speed (Wd) and wind direction (Ws).

Source
Z23  MAXIMUM AND MINIMUM TEMPERATURES AND PRECIPITATION IN CITIES OF SPAIN

Description
Daily maximum and minimum temperatures and precipitation in 1990 and 2000 in three cities in Spain: Huelva, Palma de Mallorca and Vigo.

Usage
data(Z23)

Format
An data frame with 5 columns: City, T.max, T.min and precipitation.

Source

Z24  MONTHLY MEAN TEMPERATURES AND PRECIPITATION IN HUELVA (SPAIN)

Description
Monthly mean temperatures and precipitation in 1990 and 2000 in Huelva (Spain).

Usage
data(Z24)

Format
An 4X12 matrix, one column for each month, without NAs. First row is monthly precipitation (mm), second row is monthly average maximum daily temperature (degrees C), third row is monthly average minimum daily temperature (degrees C) and forth row is monthly absolute minimum daily temperature (degrees C).

Source
**Z25**  
**SPECIES RICHNESS OF FRESHWATER FISHES**

**Description**

Species richness of freshwater fish species in cells of 1 degree around the world (Guisande et al., 2010).

**Usage**

data(Z25)

**Source**

http://www.ipez.es.

**References**


---

**Z26**  
**NATIONAL PARKS OF COLOMBIA**

**Description**

Shapes with the National Parks of Colombia.

**Usage**

data(Z26)

---

**Z27**  
**AFRICA**

**Description**

Shapes with the countries of Africa and information about the population size in the year 2005.

**Usage**

data(Z27)

**Source**

Z28  

Estimators obtained with the function *KnowShape*

Description

Estimators obtained with the function *KnowBPolygon* using species of freshwater fish species in all the countries of the world (Guisande et al., 2010).

Usage

```r
data(Z28)
```

Source

http://www.ipez.es.

References


Z29  

Earthquakes

Description

Magnitude, longitude, latitude and depth of earthquakes around the world.

Usage

```r
data(Z29)
```

Source

**Z3**  
*Annual Demographic Parameters from Continents*

**Description**
Annual demographic parameters from several continents.

**Usage**
`data(Z3)`

**Format**
An data frame with 10 columns: region, year, percentage of people with an age range from 0 to 14, percentage of people with an age range from 15 to 64, percentage of people older than 65, unemployment older than 65, unemployment younger than 15, growth rate, population size, percentage of women.

**Source**

---

**Z30**  
*Academic Performance*

**Description**
Causes of the poor performance of university students.

**Usage**
`data(Z30)`

---

**Z31**  
*Types of Defects*

**Description**
Types of defects detected in the elaboration of a product and the observed number of each of these defects.

**Usage**
`data(Z31)`
Z32  Mechanical parts

Description
Measurements of two mechanical parts of a car in mm.

Usage
data(Z32)

Z33  Mechanical pieces

Description
Measurements taken by three workers to 10 different pieces and each worker measured two times each piece.

Usage
data(Z33)

Z34  Metal piece

Description
Data of the length of a metal part, whose nominal value must be 80 mm, consisting of 300 values corresponding to 60 samples of 5 units.

Usage
data(Z34)

Z35  Quality control of kiwis

Description
Number of defective kiwis in groups of 60 units.

Usage
data(Z35)
**EARTHQUAKES**

**Description**

Magnitude and depth of several earthquakes which have happened around the world.

**Usage**

`data(Z4)`

**Format**

An data frame with 3 columns: Latitude/Longitude, depth and magnitude of the earthquake.

**Source**


---

**POPULATION PARAMETERS OF DIFFERENT COUNTRIES**

**Description**

Population size and annual growth in different countries.

**Usage**

`data(Z5)`

**Format**

An data frame with 4 columns: country, population size, growth rate and annual population growth from the web site world gazetter.
**Scores of a Principal Component Analysis**

**Description**

Scores of a Principal Component Analysis (PCA) performed to physicochemical parameters from lakes in Colombia.

**Usage**

```r
data(Z6)
```

**Format**

An data frame with 4 columns: Region, lake and the scores of the dimensions 1 and 2.

---

**Human Population Density by Sex and Age Group in Spain**

**Description**

Human population density by sex and age group in Spain for the years 1900 and 1991. Data were obtained from the Spanish Statistical Office.

**Usage**

```r
data(Z7)
```

**Format**


**Source**

http://www.ine.es
MORPHOMETRIC VARIABLES OF FRESHWATER FISHES

Description

Morphometric data of several species of three families of freshwater fishes, as the length of the dorsal fin base (M12), body height (M11), etc. For details see Guisande et al. (2010).

Usage

data(Z8)

Format

An data frame with 31 columns: taxonomic data (order, family, genus and species) and 26 morphometric variables.

Source

http://www.ipez.es.

References


X AND Y COORDINATES

Description

X and Y coordinates, which may be used to estimate the functions of response surface plots.

Usage

data(Z9)

Format

An array (matrix) with 2 columns: x and y.
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