

Package ‘LinRegInteractive’

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Title Interactive Interpretation of Linear Regression Models

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Author Martin Meermeyer

Maintainer Martin Meermeyer <meermeyer@statistik.uni-wuppertal.de>

Description Interactive visualization of effects and marginal effects for linear regression models and of link functions, response functions and marginal effects for generalized linear regression models with binary dependent variables. A major feature is the handling of the effects of categorical covariates: if two or more factors are used as covariates every combination of the levels of each factor is treated separately. The interactive approach, the automatic calculation of marginal effects and far-reaching possibilities to customize the graphical output are characteristic features as well.

License GPL-2

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R topics documented:

LinRegInteractive-package	2
creditdata	3
factor.combinations	5
glm.interactive	6
lm.interactive	13
munichrent03	20

LinRegInteractive-package

Interactive Interpretation of Linear Regression Models

Description

The two main functions `lm.interactive` and `glm.interactive` are based on the package `rpanel` and provide an interactive visualization of effects and marginal effects for linear regression models and of link functions, response functions and marginal effects for generalized linear regression models for binary dependent variables. A major feature is the handling of the effects of categorical covariates: if two or more factors are used as covariates every combination of the levels of each factor (referred to as *groups*) is treated separately. The interactive approach, the automatic calculation of marginal effects and far-reaching possibilities to customize the graphical output are characteristic features as well. In the accompanying vignette the usage is described in detail.

Details

Package: LinRegInteractive
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Version: 0.2-2
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Author(s)

Martin Meermeyer <meermeyer@statistik.uni-wuppertal.de>

References

Bowman, A., Crawford, E., Alexander, G., and Bowman, R. (2007). `rpanel`: Simple interactive controls for R functions using the `tecltk` package. *Journal of Statistical Software*, 17(9), 1-18.

See Also

The noninteractive visualization of the results for various types of regression models can be achieved with the package `effects`.

Examples

```
## Not run:  
  
### Binary dependent variable ###  
data("creditdata")
```

```

model.cd <- glm(credit ~ amount + I(amount^2) + age + duration*teleph + housing,
  family=binomial, data=creditdata)
glm.interactive(model.cd)

### Metric dependent variable ###
data("munichrent03")
model.rent <- lm(rent ~ yearc + I(yearc^2) + rooms + area*location + upkitchen,
  data=munichrent03)
lm.interactive(model.rent)

## End(Not run)

```

 creditdata

Credit Default Data

Description

Stratified sample of 1,000 credit receivers (in the following *cr*) from a private bank in southern Germany. The data were sampled at the end of the 1970s, therefore the credit amount is given in DEM (1.95583 DEM = 1 EUR).

Usage

```
data("creditdata")
```

Format

A data frame with 1,000 observations on the following 21 variables.

credit Factor with levels "good" (no problems occur in redemption) and "bad" (problems occur in redemption).

amount Credit amount in DEM (numeric).

duration Duration of lent term in months (numeric).

age Age of the cr in years (numeric).

addcredit Has the cr additional credits at other vendors? Ordered factor with levels "none" (no additional credits), "bank" (at other banks) and "bargain" (at other vendors than banks).

asset Most valuable asset of the cr. Ordered factor with levels "none" (no valuable assets), "car" (car), "savings" (savings) and "prop" (freehold property).

bail Bailsman available? Ordered factor with levels "none" (no bailsmen), "applicant" (bailsman is additional applicant for the credit) and "yes" (external bailsman).

curacc Current account of the cr. Ordered factor with levels "none" (no account), "debit" (account with debit balance), "credit" (account with credit balance) and "wage" (account with periodical income).

empldur Duration of employment of the cr at the current employer. Ordered factor with levels "none" (unemployed), "max1y" (less than 1 year), "max4y" (between 1 and 4 years), "max7y" (between 4 and 7 years) and "min7y" (more than 7 years).

- houstdur For which period does the cr lives in current housing? Ordered factor with levels "max1y" (less than 1 year), "max4y" (between 1 and 4 years), "max7y" (between 4 and 7 years) and "min7y" (more than 7 years).
- housing Accommodation of the cr. Ordered factor with levels "social" (social accommodation), "rent" (rented accommodation) and "freehold" (freehold accommodation).
- immigrant Factor: Is the cr an immigrant?
- installment Monthly installment in % of disposable income. Ordered factor with levels "max20" (installment is less than 20% of disposable income), "max25" (installment is more than 20% and less than 25% of disposable income), "max35" (installment is more than 25% and less than 35% of disposable income) and "min35" (installment is more than 35% of disposable income).
- intuse Intended usage for the credit. Factor with levels "car-new" (buy a new car), "car-old" (buy an used car), "fittings" (buy fittings), "hifi" (buy radio or TV), "holiday" (pay a holiday), "househ" (buy new household items), "misc" (miscellaneous activities), "qualif" (pay a new qualification), "repair" (repair something) and "retrain" (pay a retrain).
- job Employment status of the cr. Ordered factor with levels "none" (unemployed), "unskilled" (unskilled worker), "medium" (intermediate position) and "higher" (leading position).
- martsex Martial status and sex of the cr. Factor with levels "f-div-m-sing" (female-divorced and male-single), "f-sing" (female-single), "m-div" (male-divorced) and "m-mar" (male-married).
- moral Payment moral of the cr. Factor with levels "alright" (no problems with credits in the past at the bank), "critical" (further credits at other banks or problems with account management), "none" (no credits previously or fully paid back), "yetalright" (no problems with current credits at the bank so far) and "problems" (problems with credits in the past).
- pers Number of persons who are entitled to maintenance from cr. Ordered factor with levels "max2" (up to 2) and "min3" (more than 2).
- prevcred Number of previous credits of the cr at the bank (including the actual). Ordered factor with levels "max1" (1 credit), "max3" (between 2 and 3), "max5" (between 4 and 5) and "min6" (6 or more).
- savacc Savings account of the cr. Ordered factor with levels "none" (no savings account), "max1h" (savings account with a balance up to 100 DEM), "max5h" (savings account with a balance between 100 DEM and 500 DEM), "max1t" (savings account with a balance between 500 DEM and 1.000 DEM) and "min1t" (savings account with a balance greater than 1,000 DEM).
- teleph Factor: Has the cr a landline?

Source

<http://www.stat.uni-muenchen.de/service/datenarchiv/kredit/kredit.html>

References

- Fahrmeir, L., Hamerle, A., Tutz, G. (1996): *Multivariate statistische Verfahren*, 2nd edition. Berlin: de Gruyter. 390 ff.
- Fahrmeir, L., Kneib, T., Lang, S., Marx, B. (2013): *Regression: Models, Methods and Applications*. Berlin: Springer.

Examples

```
data("creditdata")
print(summary(creditdata))

par(ask=TRUE)
plot(credit ~ amount, data=creditdata)
plot(credit ~ duration, data=creditdata)
plot(credit ~ age, data=creditdata)
plot(credit ~ housing, data=creditdata)
plot(credit ~ intuse, data=creditdata)
plot(credit ~ teleph, data=creditdata)
par(ask=FALSE)
```

factor.combinations *Combine Levels of Different Factors to Groups*

Description

All levels of the factors from a `data.frame` provided are combined, each combination of factor levels is referred to as *group*.

Usage

```
factor.combinations(X, factor.sep = "-", level.sep = ".", count=TRUE)
```

Arguments

<code>X</code>	A <code>data.frame</code> containing at least one factor.
<code>factor.sep</code>	Character by which the factor-factor level combinations are separated in the group names.
<code>level.sep</code>	Character by which the level names are separated from the corresponding factor names in the group names.
<code>count</code>	Should the occurrences of the different groups in the <code>data.frame</code> provided be counted? Default to TRUE.

Value

A list with the following components:

<code>comb</code>	A data frame containing every combination of factor levels (groups) for the factors provided.
<code>names</code>	A character vector with the names of the groups. Factor-factor level combinations are separated by <code>factor.sep</code> and level names from the corresponding factor names by <code>level.sep</code> .
<code>counts</code>	If <code>count</code> is TRUE a vector indicating the number of occurrences of the different groups within the <code>data.frame</code> provided to the function. NULL if <code>count</code> is set to FALSE.

Note

Function is mainly for internal use in **LinRegInteractive** but may be useful for other purposes as well.

Examples

```
# multiple factors
data("CO2")
print(factor.combinations(CO2))

# single factor
data("chickwts")
print(factor.combinations(chickwts))
```

 glm.interactive

Interactive Interpretation of Models for Binary Outcomes

Description

The function is based on the package **rpanel** and implements proposals for the interpretation of models for binary outcomes made by Hoetker (2007). A major feature is the handling of the effects of categorical covariates: if two or more factors are used as covariates every combination of the levels of each factor (referred to as *groups*) is treated separately. The interactive approach, the automatic calculation of marginal effects and far-reaching possibilities to customize the graphical output are characteristic features as well. In the accompanying vignette the usage is described in detail.

Usage

```
glm.interactive(model, initial.values = as.list(NULL), preselect.var = NA,
  preselect.type = "link", preselect.groups = NULL,
  dev.height = 18, dev.width = 18, dev.width.legend = 8, dev.pointsize = 10,
  dev.defined = FALSE, col = NA, lty = 1, lwd = 1, main = NA, xlab = NA, ylab = NA,
  legend.add = TRUE, legend.space = legend.add, legend.only = FALSE,
  legend.pos = "center", legend.cex = 1, legend.width.factor = 1,
  rug.ticksize = 0.02, rug.col = "black", vline.actual = TRUE, pos.hline.link = 0,
  pos.hline.response = 0.5, pos.hline.marginal = 0, n.effects = 100,
  autosave.plot = FALSE, snapshot.plot = FALSE,
  graphics.filename = "LinRegIntPlot", graphics.extension = "pdf",
  latex2console = FALSE, decimal.mark = ".", big.mark = ",", factor.sep = "--",
  level.sep = ".", panel.title = "Model for Binary Response",
  label.button = "Snapshot", label.slider.act = "Variable displayed: ",
  label.box.type = "Type", label.types = c("linear predictor", "probability",
  "marginal effect"), label.box.groups = "Groups", slider.width = 200,
  slider.height = 60, button.height = 30, box.type.height = 90,
  box.group.character.width = 7, box.group.line.height = 28,
  dist.obj.width = 20, dist.obj.height = 10, ...)
```

Arguments

<code>model</code>	Object of class <code>glm</code> (mandatory). Other fitted-model objects may work as well, see section 6 of the vignette and examples below.
<code>initial.values</code>	Initial values for the metric covariates in a named list, default to the means. See section 4 of the vignette and examples below.
<code>preselect.var</code>	Name of continuous variable to be displayed as character or NA (default) for menu selection.
<code>preselect.type</code>	The type of the initial plot to be displayed. Must be one of the values "link" (default), "response" or "marginal".
<code>preselect.groups</code>	Numeric vector with the index of the groups which are displayed in the initial plot. If NULL (the default) all groups are displayed.
<code>dev.height</code>	Height of graphic device in cm, default to 18.
<code>dev.width</code>	Width of plot area in graphic device in cm, default to 18.
<code>dev.width.legend</code>	Width of legend area in graphic device in cm, default to 8.
<code>dev.pointsize</code>	Character pointsize of graphic device, default to 10.
<code>dev.defined</code>	Graphic device predefined? Default to FALSE, see section 6.3 of the vignette for usage.
<code>col</code>	Vector of color specifications to represent different groups. Passed to the line commands and the legend. Actual palette and consecutive sequence if NA (default).
<code>lty</code>	Vector of line type specifications to represent different groups. Passed to the line commands and the legend, default to solid lines.
<code>lwd</code>	Vector of line width specifications to represent different groups. Passed to the line commands and the legend, default to 1.
<code>main</code>	Title for the plot, default to NA.
<code>xlab</code>	Label for the x-axis. Name of the selected covariate, if NA (the default).
<code>ylab</code>	Label for the y-axis. Name of the selected plot type (see argument <code>label.types</code>), if NA (the default).
<code>legend.add</code>	Should a legend be added to the plot? Default to TRUE.
<code>legend.space</code>	Should the space for the legend be reserved? Default to the value of <code>legend.add</code> . Setting <code>legend.add</code> to FALSE and <code>legend.space</code> to TRUE plots white space instead of the legend. This can be useful when different plots are arranged in a document to ensure exact alignments and sizes, see section 6.2 of the vignette for details.
<code>legend.only</code>	Should just the legend be plotted? Default to FALSE. A plot with the legend alone can be useful when different plots are arranged in a document, see section 6.2 of the vignette for details.
<code>legend.pos</code>	Position of the legend as character, see legend for details. Default to "center".
<code>legend.cex</code>	Relative size of legend text. Can be reduced if the model contains many groups. Default to 1.

legend.width.factor	Factor by which the width of the legend is increased. Default to 1. Increasing this can solve the problem that the legend annotations do not fit in the surrounding box when the plots are saved as PDF or EPS files, see section 5 of the vignette for details.
rug.ticksize	Length of rugplot tickmarks, default to 0.02. Set to 0 or NA, if no rugplot should be drawn. For many observations the rug considerably slows down the rebuild of the plot.
rug.col	Color of rugplot tickmarks, default to "black".
vline.actual	Add vertical line at actual position of selected metric covariate? Default to TRUE.
pos.hline.link	Position of horizontal line for plot of the link functions. NA for no line, default to 0.
pos.hline.response	Position of horizontal line for plot of the responses. NA for no line, default to 0.5.
pos.hline.marginal	Position of horizontal line for marginal effects plot. NA for no line, default to 0.
n.effects	Number of equally spaced points over the span of the selected metric covariate to calculate the effects for plotting, default to 100. Increase, if lines are not smooth.
autosave.plot	Directly save the initial plot? Default to FALSE. If set to TRUE the GUI-panel is immediately closed after initialization.
snapshot.plot	Save plot via savePlot when snapshot button is pressed? Default to FALSE, see section 5 of the vignette for details.
graphics.filename	Filename (optionally including a path) as character for graphic file.
graphics.extension	Filetype argument passed to savePlot , default to "pdf".
latex2console	Should the textoutput triggered by the snapshot button be printed as LaTeX-code? Default to FALSE.
decimal.mark	Decimal character for LaTeX output, default to ".".
big.mark	Bigmark character for LaTeX output, default to ", ".
factor.sep	Character separating the factor-factor level combinations in the group names (default to "-").
level.sep	Character separating the factor name and the corresponding factor levels in the group names (default to ".").
panel.title	Title used in the title bar of the GUI-panel of type character.
label.button	Label for the snapshot-button of type character.
label.slider.act	Additional label for the slider of the selected metric covariate of type character.
label.box.type	Title for the radiogroup box of type character.
label.types	Labels for radiogroup buttons (character vector of length 3). By default these are also used as corresponding annotations for the y-axis.

label.box.groups	Title for the checkbox of type character.
slider.width	Width of each slider in points (default to 200).
slider.height	Height of each slider in points (default to 60).
button.height	Height of snapshot button in points (default to 30).
box.type.height	Height of radiobox for type selection in points (default to 70).
box.group.character.width	The width of the boxes is basically a this value times the number of characters in points (default to 7).
box.group.line.height	The height of the checkbox is this value times the number of groups in points (default to 29).
dist.obj.width	Vertical distance between sliders and boxes and vertical margins in points (default to 20).
dist.obj.height	Horizontal distance between panel objects in points (default to 10).
...	Other graphical parameters passed to <code>par</code> .

Details

The only mandatory argument of the function is a fitted-model object of class `glm`. For this object the following prerequisites must be met:

- The model must contain at least one metric covariate.
- The model must be specified with the formula interface and the data frame containing the variables must be passed with the `data` argument.
- The categorical variables must be `factors` (ordered or unordered).
- The `family` of the fitted-model object must be `binomial`.

The function may work for other fitted-model objects as well, see section 7 of the vignette for details and the examples below. The basic idea of the function lies in the interactive usage. It is nevertheless easy to reproduce the plots for publication purposes, refer to section 5 of the vignette for this.

Users of the IDE **RStudio** may need to change the graphic device with `options(device = "x11")` before calling the function because in current versions of RStudio multiple graphic devices occasionally do not work.

Value

There is no object returned. By calling the function usually a menu appears from which a metric covariate employed in the model must be selected. After choosing the covariate a graphic device which contains a termplot of the selected metric covariate and a GUI-panel to manipulate the plot will be opened. The GUI-panel has the following elements:

- A slider for each metric covariate.

- A radiobox to select the type of the current display (link, response or marginal effect).
- A checkbox to select the factor combinations (groups) to be displayed.
- A button to print tables of output to the console, see below.

The appearance of the panel can be controlled by a number of arguments, see section 6.4 of the vignette for details.

When the button is clicked four tables are printed to the console:

1. Table of coefficients obtained by the `summary`-method.
2. Table of the chosen values of the metric covariates and their ECDF-values in the dataset.
3. Table of the link and response function at the chosen values of the metric covariates for each group.
4. Table of marginal effects for each metric covariate at the chosen values of the metric covariates for each group.

With the argument `latex2console` set to TRUE the tables are printed as LaTeX-code, see section 4 of the vignette for details. The format of the text output and the layout of the plots can be controlled to a large extent, see section 6.1 and 6.2 of the vignette for details and the examples below.

Note

Printing LaTeX-output to the console was inspired by the package `xtable` (Dahl, 2012), but an own implementation is used.

Author(s)

Martin Meermeyer <meermeyer@statistik.uni-wuppertal.de>

References

- Bowman, A., Crawford, E., Alexander, G., and Bowman, R. (2007). `rpanel`: Simple interactive controls for R functions using the `tk` package. *Journal of Statistical Software*, 17(9), 1-18.
- Dahl, D. B. (2012). `xtable`: Export tables to LaTeX or HTML. R package version 1.7-0.
- Hoetker, G. (2007). The use of logit and probit models in strategic management research: Critical issues. *Strategic Management Journal*, 28(4), 331-343.
- Kleiber, C., Zeileis, A. (2008). *Applied Econometrics with R*. New York: Springer.

See Also

[lm.interactive](#) for the interactive visualization of multiple linear regression models.

The noninteractive visualization of the results for various types of regression models can be achieved with the package `effects`.

Examples

```
### Model specification ###
data("creditdata")
model.cd <- glm(credit ~ amount + I(amount^2) + age + duration*teleph + housing,
  family=binomial, data=creditdata)

## Not run:

### Basic usage ###

## RStudio users may need to change the graphic device, see details.
options(device = "x11")

## Using defaults
glm.interactive(model.cd)

## Switch text output to LaTeX
glm.interactive(model.cd, latex2console=TRUE)

## Continental European number format in LaTeX output
glm.interactive(model.cd, latex2console=TRUE, decimal.mark=",", big.mark=".")

## Save plot as PDF to current working directory when 'Snapshot' is clicked
glm.interactive(model.cd, snapshot.plot=TRUE)

## Change color scheme and line types
glm.interactive(model.cd, col=rep(c(2,4),each=3), lty=c(1,3,5))

## Change separation characters
glm.interactive(model.cd, factor.sep="|", level.sep=">")

## Suppress legend
glm.interactive(model.cd, legend.add=FALSE)

## Suppress rug plot
glm.interactive(model.cd, rug.ticks=NA)

## Set initial values of metric covariates
glm.interactive(model.cd, initial.values=list(amount=5000, age=30, duration=24))

## Preselect covariate, plot type and groups
glm.interactive(model.cd, preselect.var="duration", preselect.type="response",
  preselect.groups=c(2,5))

## Preselect covariate and plot type and change axis annotations
glm.interactive(model.cd, preselect.var="duration", preselect.type="response",
  xlab="duration (months)", ylab="probability of credit default")

### Visualization of statistical concepts ###

## Nonparametric effect
```

```

require("splines")
model.cd.bs <- glm(credit ~ bs(amount) + age + duration*teleph + housing,
  family=binomial, data = creditdata)
glm.interactive(model.cd.bs, preselect.var="amount")

## Interaction effect (directly)
glm.interactive(model.cd, preselect.var="duration")

## Interaction effect (indirectly)
glm.interactive(model.cd, preselect.var="age")
# manipulate slider for 'duration'

## Quasi-complete separation
# example from Kleiber, Zeileis (2008), p. 130ff
require("AER")
data("MurderRates")
model.mr <- glm(I(executions > 0) ~ time + income + noncauc + lfp + southern,
  family=binomial, data=MurderRates)
glm.interactive(model.mr, preselect.var="income", preselect.type="response")

### Other fitted-model objects ###

## Generalized additive model with gam() from package 'gam'
require("gam")
model.cd.gam <- gam(credit ~ s(amount) + lo(age) + s(duration)*teleph + housing,
  family=binomial, data=creditdata)
glm.interactive(model.cd.gam)

## Generalized additive model with gam() from package 'mgcv'
# Incompatible to package 'gam', restart R Session if necessary
require("mgcv")
model.cd.mgcv <- gam(credit ~ s(amount) + s(age) + duration*teleph + housing,
  family = binomial, data = creditdata)
glm.interactive(model.cd.mgcv)

### Additional examples ###

## Customize device for printing
glm.interactive(model.cd,
  dev.width=6,
  dev.width.legend=4,
  dev.height=6,
  dev.pointsize=6,
  col=c("darkred", "red", "salmon", "darkblue", "blue", "lightblue"),
  legend.width.factor=1.1,
  vline.actual=FALSE,
  snapshot.plot=TRUE,
  graphics.filename="creddefault-termplot",
  mar=c(2.5,2.5,1,1)+0.1,
  mgp=c(1.5,0.5,0),
  tcl= -0.3)

```

```

## Save predefined plot automatically
glm.interactive(model.cd,
  initial.values=list(amount=5000, duration=24, age=30),
  preselect.var="duration",
  preselect.type="link",
  autosave.plot=TRUE,
  graphics.filename="fig-creddefault-duration-link",
  legend.width.factor=1.05)

## Modifications for models with many groups
# Increase space for legend and squeeze panel controls
model.cd.moregroups <- glm(credit ~ amount + I(amount^2) + age
  + duration*teleph + housing + job, family=binomial, data=creditdata)
glm.interactive(model.cd.moregroups,
  dev.width.legend=9,
  legend.cex=1,
  box.type.height=90,
  box.group.character.width=6,
  box.group.line.height=25,
  dist.obj.height=2)

# Squeeze legend and panel controls
model.cd.manygroups <- glm(credit ~ amount + I(amount^2) + age
  + duration*teleph + housing + intuse, family=binomial, data=creditdata)
glm.interactive(model.cd.manygroups,
  dev.width.legend=6,
  legend.cex=0.54,
  box.type.height=90,
  box.group.character.width=6,
  box.group.line.height=25,
  dist.obj.height=2)
# Note that checkbox for groups grows beyond screen

## End(Not run)

```

lm.interactive

Interactive Interpretation of the Multiple Linear Regression Model

Description

The function is based on the package **rpanel** and a byproduct of the development of [glm.interactive](#). A major feature is the handling of the effects of categorical covariates: if two or more factors are used as covariates every combination of the levels of each factor (referred to as *groups*) is treated separately. The interactive approach, the automatic calculation of marginal effects and far-reaching possibilities to customize the graphical output are characteristic features as well. In the accompanying vignette the usage is described in detail.

Usage

```
lm.interactive(model, initial.values = as.list(NULL), preselect.var = NA,
  preselect.type = "effect", preselect.groups = NULL,
  dev.height = 18, dev.width = 18, dev.width.legend = 8, dev.pointsize = 10,
  dev.defined = FALSE, col = NA, lty = 1, lwd = 1, main = NA, xlab = NA, ylab = NA,
  legend.add = TRUE, legend.space = legend.add, legend.only = FALSE,
  legend.pos = "center", legend.cex = 1, legend.width.factor = 1,
  rug.ticksize = 0.02, rug.col = "black", vline.actual = TRUE, pos.hline.effect = 0,
  pos.hline.marginal = 0, n.effects = 100, autosave.plot = FALSE,
  snapshot.plot = FALSE, graphics.filename = "LinRegIntPlot",
  graphics.extension = "pdf", latex2console = FALSE, decimal.mark = ".",
  big.mark = ",", factor.sep = "-", level.sep = ".",
  panel.title = "Linear Model", label.button = "Snapshot",
  label.slider.act = "Variable displayed: ", label.box.type = "Type",
  label.types = c("effect", "marginal effect"), label.box.groups = "Groups",
  slider.width = 200, slider.height = 60, button.height = 30,
  box.type.height = 70, box.group.character.width = 7,
  box.group.line.height = 30, dist.obj.width = 20, dist.obj.height = 10,
  ...)
```

Arguments

<code>model</code>	Object of class <code>lm</code> (mandatory). Other fitted-model objects may work as well, see section 7 of the vignette and examples below.
<code>initial.values</code>	Initial values for the metric covariates in a named list, default to the means. See section 5 of the vignette and examples below.
<code>preselect.var</code>	Name of continuous variable to be displayed as character or NA (default) for menu selection.
<code>preselect.type</code>	The type of the initial plot to be displayed. Must be one of the values "effect" (default) or "marginal".
<code>preselect.groups</code>	Numeric vector with the index of the groups which are displayed in the initial plot. If NULL (the default) all groups are displayed.
<code>dev.height</code>	Height of graphic device in cm, default to 18.
<code>dev.width</code>	Width of plot area in graphic device in cm, default to 18.
<code>dev.width.legend</code>	Width of legend area in graphic device in cm, default to 8.
<code>dev.pointsize</code>	Character pointsize of graphic device, default to 10.
<code>dev.defined</code>	Graphic device predefined? Default to FALSE, see section 6.3 of the vignette for usage.
<code>col</code>	Vector of color specifications to represent different groups. Passed to the line commands and the legend. Actual palette and consecutive sequence if NA (default).
<code>lty</code>	Vector of line type specifications to represent different groups. Passed to the line commands and the legend, default to solid lines.

lwd	Vector of line width specifications to represent different groups. Passed to the line commands and the legend, default to 1.
main	Title for the plot, default to NA.
xlab	Label for the x-axis. Name of the selected covariate, if NA (the default).
ylab	Label for the y-axis. Name of the selected plot type (see argument <code>label.types</code>), if NA (the default).
legend.add	Should a legend be added to the plot? Default to TRUE.
legend.space	Should the space for the legend be reserved? Default to the value of <code>legend.add</code> . Setting <code>legend.add</code> to FALSE and <code>legend.space</code> to TRUE plots white space instead of the legend. This can be useful when different plots are arranged in a document to ensure exact alignments and sizes, see section 6.2 of the vignette for details.
legend.only	Should just the legend be plotted? Default to FALSE. A plot with the legend alone can be useful when different plots are arranged in a document, see section 6.2 of the vignette for details.
legend.pos	Position of the legend as character, see legend for details. Default to "center".
legend.cex	Relative size of legend text. Can be reduced if the model contains many groups. Default to 1.
legend.width.factor	Factor by which the width of the legend is increased. Default to 1. Increasing this can solve the problem that the legend annotations do not fit in the surrounding box when the plots are saved as PDF or EPS files, see section 5 of the vignette for details.
rug.ticksize	Length of rugplot tickmarks, default to 0.02. Set to 0 or NA, if no rugplot should be drawn. For many observations the rug considerably slows down the rebuild of the plot.
rug.col	Color of rugplot tickmarks, default to "black".
vline.actual	Add vertical line at actual position of selected metric covariate? Default to TRUE.
pos.hline.effect	Position of horizontal line for plot of the effects. NA for no line, default to 0.
pos.hline.marginal	Position of horizontal line for marginal effects plot. NA for no line, default to 0.
n.effects	Number of equally spaced points over the span of the selected metric covariate to calculate the effects for plotting, default to 100. Increase, if lines are not smooth.
autosave.plot	Directly save the initial plot? Default to FALSE. If set to TRUE the GUI-panel is immediately closed after initialization.
snapshot.plot	Save plot via savePlot when snapshot button is pressed? Default to FALSE, see section 5 of the vignette for details.
graphics.filename	Filename (optionally including a path) as character for graphic file.
graphics.extension	Filetype argument passed to savePlot , default to "pdf".

<code>latex2console</code>	Should the textoutput triggered by the snapshot button be printed as LaTeX-code? Default to FALSE.
<code>decimal.mark</code>	Decimal character for LaTeX output, default to ".".
<code>big.mark</code>	Bigmark character for LaTeX output, default to ",".
<code>factor.sep</code>	Character separating the factor-factor level combinations in the group names (default to "-").
<code>level.sep</code>	Character separating the factor name and the corresponding factor levels in the group names (default to ".").
<code>panel.title</code>	Title used in the title bar of the GUI-panel of type character.
<code>label.button</code>	Label for the snapshot-button of type character.
<code>label.slider.act</code>	Additional label for the slider of the selected metric covariate of type character.
<code>label.box.type</code>	Title for the radiogroup box of type character.
<code>label.types</code>	Labels for radiogroup buttons (character vector of length 3). By default these are also used as corresponding annotations for the y-axis.
<code>label.box.groups</code>	Title for the checkbox of type character.
<code>slider.width</code>	Width of each slider in points (default to 200).
<code>slider.height</code>	Height of each slider in points (default to 60).
<code>button.height</code>	Height of snapshot button in points (default to 30).
<code>box.type.height</code>	Height of radiobox for type selection in points (default to 70).
<code>box.group.character.width</code>	The width of the boxes is basically a this value times the number of characters in points (default to 7).
<code>box.group.line.height</code>	The height of the checkbox is this value times the number of groups in points (default to 29).
<code>dist.obj.width</code>	Vertical distance between sliders and boxes and vertical margins in points (default to 20).
<code>dist.obj.height</code>	Horizontal distance between panel objects in points (default to 10).
<code>...</code>	Other graphical parameters passed to <code>par</code> .

Details

The only mandatory argument of the function is a fitted-model object of class `lm`. For this object the following prerequisites must be met:

- The model must contain at least one metric covariate.
- The model must be specified with the formula interface and the data frame containing the variables must be passed with the `data` argument.
- The categorical variables must be `factors` (ordered or unordered).

The function may work for other fitted-model objects as well, see section 7 of the vignette for details and the examples below. The basic idea of the function lies in the interactive usage. It is nevertheless easy to reproduce the plots for publication purposes, refer to section 5 of the vignette for this.

Objects of class `lm` lack a data component. For some formulas this can cause problems, refer to section 7 of the vignette for details and the example for a nonparametric effect below.

Users of the IDE **RStudio** may need to change the graphic device with `options(device = "x11")` before calling the function because in current versions of RStudio multiple graphic devices occasionally do not work.

Value

There is no object returned. By calling the function usually a menu appears from which a metric covariate employed in the model must be selected. After choosing the covariate a graphic device which contains a termplot of the selected metric covariate and a GUI-panel to manipulate the plot will be opened. The GUI-panel has the following elements:

- A slider for each metric covariate.
- A radiobox to select the type of the current display (effect or marginal effect).
- A checkbox to select the factor combinations (groups) to be displayed.
- A button to print tables of output to the console, see below.

The appearance of the panel can be controlled by a number of arguments, see section 6.4 of the vignette for details.

When the button is clicked four tables are printed to the console:

1. Table of coefficients obtained by the `summary`-method.
2. Table of the chosen values of the metric covariates and their ECDF-values in the dataset.
3. Table of the effects at the chosen values of the metric covariates for each group.
4. Table of marginal effects for each metric covariate at the chosen values of the metric covariates for each group.

With the argument `latex2console` set to `TRUE` the tables are printed as LaTeX-code, see section 4 of the vignette for details. The format of the text output and the layout of the plots can be controlled to a large extent, see section 6.1 and 6.2 of the vignette for details and the examples below.

Note

Printing LaTeX-output to the console was inspired by the package `xtable` (Dahl, 2012), but an own implementation is used.

Author(s)

Martin Meermeyer <meermeyer@statistik.uni-wuppertal.de>

References

- Bowman, A., Crawford, E., Alexander, G., and Bowman, R. (2007). rpanel: Simple interactive controls for R functions using the tcltk package. *Journal of Statistical Software*, 17(9), 1-18.
- Dahl, D. B. (2012). xtable: Export tables to LaTeX or HTML. R package version 1.7-0.

See Also

[glm.interactive](#) for the interactive visualization of models for binary outcomes.

The noninteractive visualization of the results for various types of regression models can be achieved with the package [effects](#).

Examples

```
### Model specification ###
data("munichrent03")
model.rent <- lm(rent ~ yearc + I(yearc^2) + rooms + area*location + upkitchen,
  data=munichrent03)

## Not run:

### Basic usage ###

## RStudio users may need to change the graphic device, see details.
options(device = "x11")

## Using defaults
lm.interactive(model.rent)

## Switch text output to LaTeX
lm.interactive(model.rent, latex2console=TRUE)

## Continental European number format in LaTeX output
lm.interactive(model.rent, latex2console=TRUE, decimal.mark=",", big.mark=".")

## Save plot as PDF to current working directory when 'Snapshot' is clicked
lm.interactive(model.rent, snapshot.plot=TRUE)

## Change color scheme and line types
lm.interactive(model.rent, col=rep(c(1,2,4),each=2), lty=c(1,5))

## Change separation characters
lm.interactive(model.rent, factor.sep="|", level.sep=">")

## Suppress legend
lm.interactive(model.rent, legend.add=FALSE)

## Suppress rug plot
lm.interactive(model.rent, rug.ticks=NA)

## Set initial values of metric covariates
lm.interactive(model.rent, initial.values=list(yearc=1990, rooms=3, area=80))
```

```
## Preselect covariate, plot type and groups
lm.interactive(model.rent, preselect.var="yearc", preselect.type="effect",
  preselect.groups=c(2,4,6))

## Preselect covariate and plot type and change axis annotations
lm.interactive(model.rent, preselect.var="yearc", preselect.type="effect",
  xlab="year of construction", ylab="net rent (EUR)")

### Visualization of statistical concepts ###

## Nonlinear effect
lm.interactive(model.rent, preselect.var="yearc")

## Nonparametric effect
require("splines")
model.rent.bs <- lm(rent ~ bs(yearc) + rooms + area*location + upkitchen,
  data=munichrent03)
model.rent.bs$data <- munichrent03
lm.interactive(model.rent.bs, preselect.var="yearc")
# Note that the data must be attached to the fitted-model object
# afterwards, see section 7 of the vignette for details.

## Interaction effect (directly)
lm.interactive(model.rent, preselect.var="area")

## Interaction effect (indirectly)
lm.interactive(model.rent, preselect.var="yearc")
# manipulate slider for 'area'

### Other fitted-model objects ###

## Generalized additive model with gam() from package 'gam'
require("gam")
model.rent.gam <- gam(rent ~ s(yearc) + rooms + s(area)*location + upkitchen,
  data=munichrent03)
lm.interactive(model.rent.gam)

## Generalized additive model with gam() from package 'mgcv'
# Incompatible to package 'gam', restart R Session if necessary
require("mgcv")
model.rent.mgcv <- gam(rent ~ s(yearc) + rooms + area*location + upkitchen,
  data=munichrent03)
lm.interactive(model.rent.mgcv)

### Additional examples ###

## Customize device for printing
lm.interactive(model.rent,
  dev.width=6,
```

```

dev.width.legend=4,
dev.height=6,
dev.pointsize=6,
col=c("red","darkred","blue","darkblue","green","darkgreen"),
legend.width.factor=1.1,
vline.actual=FALSE,
snapshot.plot=TRUE,
graphics.filename="munichrent-termplot",
mar=c(2.5,2.5,1,1)+0.1,
mgp=c(1.5,0.5,0),
tcl= -0.3)

## Save predefined plot automatically
lm.interactive(model.rent,
  initial.values=list(yearc=1990, rooms=3, area=80),
  preselect.var="area",
  preselect.type="marginal",
  autosave.plot=TRUE,
  graphics.filename="fig-rent-area-marg",
  legend.width.factor=1.05)

## Modifications for models with many groups
# Increase space for legend and squeeze panel controls
model.rent.moregroups <- lm(rent ~ yearc + I(yearc^2) + rooms + area*location
  + upkitchen + bathtile, data=munichrent03)
lm.interactive(model.rent.moregroups,
  dev.width.legend=9,
  legend.cex=1,
  box.type.height=65,
  box.group.character.width=6,
  box.group.line.height=28,
  dist.obj.height=2)

# Squeeze legend and panel controls
model.rent.manygroups <- lm(rent ~ yearc + I(yearc^2) + rooms + area
  + district + upkitchen, data=munichrent03)
lm.interactive(model.rent.manygroups,
  dev.width.legend=6,
  legend.cex=0.65,
  box.type.height=90,
  box.group.character.width=6,
  box.group.line.height=25,
  dist.obj.height=2)
# Note that checkbox for groups grows beyond screen

## End(Not run)

```

Description

Sample of 2,053 apartments from the data collected for the preparation of the Munich rent index 2003.

Usage

```
data("munichrent03")
```

Format

A data frame with 2,053 observations on the following 12 variables.

rent Net rent in EUR (numeric).

rentsqm Net rent per square meter in EUR (numeric).

area Floor area in square meters (numeric).

rooms Number of rooms (numeric).

yearc Year of construction (numeric).

bathextra Factor: High quality equipment in the bathroom?

bathtile Factor: Bathroom tiled?

cheating Factor: Central heating available?

district Urban district where the apartment is located. Factor with 25 levels: "All-Umenz" (Allach - Untermenzing), "Alt-Le" (Altstadt - Lehel), "Au-Haid" (Au - Haidhausen), "Au-Lo-La" (Aubing - Lochhausen - Langwied), "BamLaim" (Berg am Laim), "Bogenh" (Bogenhausen), "Feld-Has" (Feldmoching - Hasenberg), "Had" (Hadern), "Laim" (Laim), "Lud-Isar" (Ludwigsvorstadt - Isarvorstadt), "Maxvor" (Maxvorstadt), "Mil-AmH" (Milbertshofen - Am Hart), "Moos" (Moosach), "Neuh-Nymp" (Neuhausen - Nymphenburg), "Obgies" (Obergiesing), "Pas-Obmenz" (Pasing - Obermenzing), "Ram-Per" (Ramersdorf - Perlach), "SchwWest" (Schwabing West), "Schwab-Frei" (Schwabing - Freimann), "Schwanth" (Schwanthalerhoehe), "Send" (Sendling), "Send-West" (Sendling - Westpark), "Th-Ob-Fo-Fu-So" (Thalkirchen - Obersendling - Forstenried - Fuerstenried - Solln), "Trud-Riem" (Trudering - Riem) and "Ugies-Har" (Untergiesing - Harlaching).

location Quality of location. Ordered factor with levels "normal", "good" and "top".

upkitchen Factor: Upscale equipment in kitchen?

wwater Factor: Hot water supply available?

Details

A detailed description (German only) of the factor levels can be found in the rent index brochure of the city of Munich. URL: http://www.muenchen.de/rathaus/dms/Home/Stadtverwaltung/Sozialreferat/wohnungsamt/Mietspiegel/pdf_mietspiegel/mietspiegel2013/Brosch%C3%BCre%20Mietspiegel%202013.pdf.

Source

<http://www.stat.uni-muenchen.de/service/datenarchiv/miete/miete03.html>

References

Fahrmeir, L., Kneib, T., Lang, S., Marx, B. (2013): *Regression: Models, Methods and Applications*. Berlin: Springer.

Fahrmeir, L., Kuenstler, R., Pigeot, I., Tutz, G. (2004): *Statistik: der Weg zur Datenanalyse*, 5th edition. Berlin: Springer.

Examples

```
data("munichrent03")
print(summary(munichrent03))

par(ask=TRUE)
plot(munichrent03[,1:5])
plot(rentsqm ~ bathextra, data=munichrent03)
plot(rentsqm ~ bathtile, data=munichrent03)
plot(rentsqm ~ cheating, data=munichrent03)
plot(rentsqm ~ location, data=munichrent03)
plot(rentsqm ~ upkitchen, data=munichrent03)
plot(rentsqm ~ wwater, data=munichrent03)

oldpar <- par(no.readonly = TRUE)
par(las=3, mar=c(8,4,4,2)+0.1)
plot(rentsqm ~ district, xlab=NA, data=munichrent03)
par(oldpar)

par(ask=FALSE)
```

Index

*Topic **datasets**

creditdata, 3

municrent03, 20

*Topic **package**

LinRegInteractive-package, 2

creditdata, 3

data.frame, 5

factor, 9, 16

factor.combinations, 5

family, 9

glm, 7, 9

glm.interactive, 2, 6, 13, 18

legend, 7, 15

LinRegInteractive

(LinRegInteractive-package), 2

LinRegInteractive-package, 2

lm, 14, 16, 17

lm.interactive, 2, 10, 13

municrent03, 20

par, 9, 16

savePlot, 8, 15

summary, 10, 17