

Package ‘SensMixed’

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Type Package

Title Analysis of Sensory and Consumer Data in a Mixed Model Framework

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Depends stats, methods, lmerTest

Imports Hmisc, parallel, plyr, doBy, xtable, reshape2, ggplot2, shiny,
shinyBS, lme4

Suggests pbkrtest

Description Functions that facilitate analysis of
Sensory as well as Consumer data within a mixed effects model
framework are provided. The so-called mixed assessor models,
that correct for the scaling effect are implemented.
The generation of the d-tilde plots forms part of the package.
The shiny application for the functionalities
forms part of the package.

LazyData TRUE

License GPL (>= 2)

Repository CRAN

NeedsCompilation no

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consmixed

Automated model selection process for the Consumer data

Description

Constructs the biggest possible model and reduces it to the best by principle of parcimony. First elimination of random effects is performed following by elimination of fixed effects. The LRT test is used for testing random terms, F-type hypothesis test is used for testing fixed terms. The post-hoc and plots are provided

Usage

```
consmixed(response, Prod_effects, Cons_effects=NULL,
Cons, data, structure = 3, alpha.random = 0.1, alpha.fixed = 0.05, ...)
```

Arguments

response	name of the liking variable in the Consumer data
Prod_effects	vector with names of the variables associated with products
Cons_effects	vector with names of the effects associated with consumers
Cons	name of the column in the data that represents consumers
data	data frame (data from consumer studies)
structure	one of the values in c(1,2,3). 1:Analysis of main effects, Random consumer effect AND interaction between consumer and the main effects(Automized reduction in random part, NO reduction in fixed part). 2: Main effects AND all 2-factor interactions. Random consumer effect AND interaction between consumer and all fixed effects (both main and interaction ones). (Automized reduction in random part, NO reduction in fixed part). 3: Full factorial model with ALL possible fixed and random effects. (Automized reduction in random part, AND automized reduction in fixed part).
alpha.random	significance level for elimination of the random part (for LRT test)
alpha.fixed	significance level for elimination of the fixed part (for F test)
...	other potential arguments.

Value

rand. table	table with value of Chi square test, p-values e t.c. for the random effects
anova. table	table which tests whether the model fixed terms are significant (Analysis of Variance)
model	Final model - object of class lmer or gls (after all the required reduction has been performed)

Author(s)

Alexandra Kuznetsova, Per Bruun Brockhoff, Rune Haubo Bojesen Christensen

Examples

```
library(SensMixed)

#convert some variables to factors in Tham
ham <- convertToFactors(ham, c("Consumer", "Product", "Information", "Gender"))

consmixed(response="Liking",
Prod_effects= c("Product","Information"),
Cons_effects=c("Gender","Age"), Cons = "Consumer", data =ham, structure=1)
```

convertToFactors *converts variables of the data frame to factors*

Description

the user specifies which variables he/she would like to consider as factors, the functions converts them to factors

Usage

```
convertToFactors(data, facs)
```

Arguments

data	data frame
facs	vector with names of variables that the user would like to convert to factors

Value

returns the same data frame as in the input but with the specified variables converted to factors

Author(s)

Alexandra Kuznetsova

Examples

```
library(SensMixed)

str(ham)

ham <- convertToFactors(ham, c("Gender"))

str(ham)
```

ham

Conjoint study of dry cured ham

Description

One of the purposes of the study was to investigate the effect of information given to the consumers measured in hedonic liking for the hams. Two of the hams were Spanish and two were Norwegian, each origin representing different salt levels and different aging time. The information about origin was given in such way that both true and false information was given. essentially a 4*2 design with 4 samples and 2 information levels. A total of 81 Consumers participated in the study.

Usage

ham

Format

Consumer factor with 81 levels: numbering identifying consumers

Product factor with four levels

Informed liking numeric: hedonic liking for the products

Information factor with two levels

Gender factor with two levels (gender)

Age numeric: age of Consumer

References

"Alternative methods for combining design variables and consumer preference with information about attitudes and demographics in conjoint analysis". T. Naes, V.Lengard, S. Bolling Johansen, M. Hersleth

plot *function creates plots for the sensmixed object*

Description

function creates barplots for the square roots of F statistics and square roots of chi square values for all attributes

Usage

```
## S3 method for class 'sensmixed'  
plot(x, mult = FALSE, dprime = FALSE, sep = FALSE,  
      cex = 2, interact.symbol = ":", isFixed = TRUE,  
      isRand = TRUE, isScaling = TRUE, ...)
```

Arguments

x	object of class sensmixed
mult	logical. Should multiple plots be plotted, that is barplots for each effect in a separate plot
dprime	logical. Should multiattribute plot for product effects use average squared dprimes instead of square root of F statistics
sep	logical. If TRUE then separate plot is plotted for each effect (mult argument should be then also TRUE)
cex	The magnification to be used
interact.symbol	The symbol to be used for the interaction effects
isFixed	logical. Whether to plot tests of the fixed effects
isRand	logical. Whether to plot tests of the random effects
isScaling	logical. Whether to plot the scaling factor if present
...	other potential arguments.

Value

NULL is returned

Author(s)

Alexandra Kuznetsova

Examples

```
res <- sensmixed(c("Coloursaturation", "Colourbalance"),
                Prod_effects=c("TVset"),
                individual="Assessor", data=TVbo, MAM=TRUE,
                reduce.random=FALSE)

plot(res)
plot(res, mult = TRUE)
plot(res, interact.symbol = " x ")
```

plot.consmixed	<i>plots the post-hoc for the consmixed object</i>
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Description

plots the least squares means and differences of least squares means together with the confidence intervals for the fixed effects

Usage

```
## S3 method for class 'consmixed'
plot(x, main = NULL, cex = 1.4,
      which.plot = c("LSMEANS", "DIFF of LSMEANS"),
      effs = NULL, ...)
```

Arguments

x	object of class consmixed
main	string. Title for the plots
cex	A numerical value giving the amount by which plotting text and symbols should be magnified relative to the default
which.plot	type of plot to be drawn
effs	name of the effect for which to draw the plots
...	other potential arguments.

Value

returns NULL

Author(s)

Alexandra Kuznetsova

Examples

```
#convert some variables to factors in Tham
ham <- convertToFactors(ham, c("Consumer", "Product", "Information", "Gender"))

res <- consmixed(response="Liking",
  Prod_effects= c("Product","Information"),
  Cons_effects=c("Gender","Age"), Cons = "Consumer", data =ham, structure=1)

plot(res)
```

plotLSMEANS

plots bars for the LSMEANS or differences of LSMEANS

Description

plots bars for the LSMEANS or differences of LSMEANS for product factors and confidence intervals

Usage

```
plotLSMEANS(table, response,
             which.plot=c("LSMEANS", "DIFF of LSMEANS"),
             main = NULL, cex = 1.4, effs = NULL, mult = TRUE)
```

Arguments

table	data table containing LSMEANS/ DIFFLSMEANS table from the step function of the lmerTest package
response	vector with the name of the attribute, for which the LSMEANS / DIFFLSMEANS are calculated
which.plot	name, indicating the type of plot to generate.
main	name of the title for the plot
cex	cex for representing the plot (UNUSED?..)
effs	vector with the names for the effects, for which to plot the LSMEANS / DIFFLSMEANS
mult	logical. TRUE means plot LSMEANS for all effects in one layout
...	other potential arguments.

Value

barplots created via ggplot2 package

Author(s)

Alexandra Kuznetsova, Per Bruun Brockhoff, Rune Haubo Bojesen Christensen

saveToDoc	<i>save the result in tables into a doc file for sensmixed or consmixed objects</i>
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Description

save the tests for the random and fixed effects into a doc file for sensmixed or consmixed objects

Usage

```
saveToDoc(x, file = NA, bold = FALSE, append = TRUE, type = "html", typeEffs = 1)
```

Arguments

x	object of class sensmixed or consmixed.
file	a character string naming the file to write to, or NULL to stop sink-ing.
bold	logical. Should the significance be in bold text instead of the stars. The default is FALSE
append	logical. If TRUE, output will be appended to file; otherwise, it will overwrite the contents of file.
type	type of output as in xtable. Either "html" or "latex"
typeEffs	one of the numbers in c(1,2,3,4). 1: save results for the random effects in a table 2: save results for the fixed effects in a table 3: save results for the scaling effects in a table 4: save results for all effects in a table

Author(s)

Alexandra Kuznetsova

Examples

```
## Not run:
res <- sensmixed(c("Coloursaturation", "Colourbalance"),
  Prod_effects=c("TVset"),
  individual="Assessor", data=TVbo)

saveToDoc(res, file = "C:/Desktop/output.doc")

## End(Not run)
```


Description

Constructs a mixed effects model for each of the selected by user attributes according to the specified by the user structure arguments. If required, then the random structures are reduced by eliminating NS random effects. The likelihood ratio test (LRT) is used for testing random terms, F-type hypothesis test is used for testing fixed terms

Usage

```
sensmixed(attributes=NULL, Prod_effects, replication = NULL,
           individual, data, product_structure = 3,
           error_structure = "No_Rep", MAM = FALSE,
           mult.scaling = FALSE, oneway_rand = TRUE,
           MAM_PER = FALSE, adjustedMAM = FALSE,
           alpha_conditionalMAM = 1,
           calc_post_hoc = FALSE, parallel = FALSE,
           reduce.random=TRUE, alpha.random = 0.1,
           alpha.fixed = 0.05, interact.symbol = ":",
           keep.offs = NULL, ...)
```

Arguments

attributes	vector with names of sensory attributes
Prod_effects	names of the variables related to the product
replication	names of the replication column in the data, if present
individual	name of the column in the data that represent assessors
data	data frame (data from sensory studies)
product_structure	one of the values in c(1, 2, 3). 1: only main effects will enter the initial biggest model. 2: main effects and 2-way interaction. 3: all main effects and all possible interaction
error_structure	one of the values in c("No_Rep", "2-WAY", "3-WAY"). "No_Rep" and "2-WAY" - assessor effect and all possible interactions between assessor and Product_effects. "3-WAY" - assessor and replicate effect and interaction between them and interaction between them and Product_effects
MAM	logical. if MAM model should be constructed (scaling correction)
mult.scaling	logical. Whether multiple scaling should be used
oneway_rand	logical. Whether there should be just prod effect as part of the random part in MAM
MAM_PER	logical. if MAManalysis function should be called (scaling correction)

adjustedMAM	logical. should MAM be adjusted for the scaling
alpha_conditionalMAM	logical. scaling should be part of the model in case its p-value is less than alpha_conditionalMAM
calc_post_hoc	logical. Should the post hoc analysis be performed on the final resued models for all the attributes
parallel	logical. Should the computation be done in parallel. the default is FALSE
reduce.random	logical. Eliminate non-significant random effects according to alpha.random or not. The default is TRUE
alpha.random	significance level for elimination of the random part (for LRT test)
alpha.fixed	significance level for elimination of the fixed part (for F test)
interact.symbol	symbol for the indication of the interaction between effects. the default one is ":".
keep. effs	which effects should be kept in a model.
...	other potential arguments.

Value

FChi	matrix with Chi square values from LRT test and F values form F-type test for the selected attributes
pvalue	matrix with p-values for all effects for the selected attributes

Author(s)

Alexandra Kuznetsova, Per Bruun Brockhoff, Rune Haubo Bojesen Christensen

Examples

```
#import SensMixed package
library(SensMixed)

#convert some variables to factors in TVbo
TVbo <- convertToFactors(TVbo, c("Assessor", "Repeat", "Picture"))

#run automated selection process
res <- sensmixed(c("Coloursaturation", "Colourbalance"),
  Prod_effects = c("TVset", "Picture"), replication="Repeat",
  individual="Assessor", data=TVbo, MAM=TRUE)

## run MAManalysis function
res_MAM <- sensmixed(c("Coloursaturation", "Colourbalance"),
  Prod_effects=c("TVset"), replication="Repeat",
  individual="Assessor", data=TVbo, MAM_PER=TRUE)

## print is not yet implemented
```

```
## get anova part
res_MAM[[3]][,1]

## compare with the general implementation
res <- sensmixed(c("Coloursaturation", "Colourbalance"),
  Prod_effects=c("TVset"),
  individual="Assessor", data=TVbo, MAM=TRUE,
  reduce.random=FALSE)

res$fixed

## Not run:
plot F and Chi square values
plot(result)

## End(Not run)
```

SensMixedUI

Graphical User interface for the SensMixed package

Description

launches a shiny application that provides the graphical user interface (GUI) for the functions contained in the SensMixed package. Application also includes such crucial functionalities as importing the data in different formats, presenting results in tables and plots as well as saving them.

Usage

```
SensMixedUI()
```

Author(s)

Alexandra Kuznetsova, Per Bruun Brockhoff, Rune Haubo Bojesen Christensen

Examples

```
## Not run:
library(SensMixed)
SensMixedUI()

## End(Not run)
```

TVbo

TV dataset

Description

The TVbo dataset comes from Bang and Olufsen company. The main purpose was to test products, specified by two attributes Picture and TVset. 15 different response variables (characteristics of the product) were assessed by trained panel list.

Usage

TVbo

Format

Assessor factor: numbering identifying assessors

TVset factor: attribute of the product

Picture factor: attribute of the product

15 Characteristics of the product numeric variables: Coloursaturation, Colourbalance, Noise, Depth, Sharpness, Lightlevel, Contrast, Sharpnessofmovement, Flickeringstationary, Flickeringmovement, Distortion, Dimlasseffect, Cutting, Flossyedges, Elasticeffect

Source

Bang and Olufsen company

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