Package ‘HRM’

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Description Methods for testing main and interaction effects in possibly high-dimensional parametric or nonparametric repeated measures in factorial designs for univariate or multivariate data. The observations of the subjects are assumed to be multivariate normal if using the parametric test. The nonparametric version tests with regard to nonparametric relative effects (based on pseudoranks). It is possible to use up to 2 whole- and 3 subplot factors.  
License GPL-2 | GPL-3  
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**HRM-package**

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### Description

Tests for main and simple treatment effects, time effects, as well as treatment by time interactions in possibly high-dimensional multi-group repeated measures designs. The groups are allowed to have different variance-covariance matrices but the observations must follow a multivariate normal distribution.

### Details

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### Author(s)

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### References


Function to calculate confidence intervals

Description

Function to calculate simultaneous, asymptotic (1-alpha) confidence intervals for an object of class 'HRM'.

Usage

## S3 method for class 'HRM'
confint(object, parm, level = 0.95, ...)

Arguments

- **object**: an object from class 'HRM' returned from the function hrm_test
- **parm**: currently ignored; all possible confidence intervals are calculated
- **level**: confidence level (FWER) used for calculating the intervals
- **...**: Further arguments passed to 'hrm_test' will be ignored

Value

Returns a data.frame with mean and 1-alpha confidence interval for each factor combination

Examples

```r
# hrm.test with a data.frame using a 'formula' object

# using the EEG dataset
?EEG

## Not run:
# z <- hrm_test(value ~ group*region*variable, subject = "subject", data = EEG)
# confint(z)
## End(Not run)
```
EEG data of 160 subjects

Description
A dataset containing EEG data (Staffen et al., 2014) of 160 subjects, 4 variables are measured at ten different locations.

Usage
data(EEG)

Format
A data frame with 6400 rows and 7 variables.

Details
The columns are as follows:

- group. Diagnostic group of the subject: Alzheimer’s Disease (AD), Mild Cognitive Impairment (MCI), Subject Cognitive Complaints (SCC+, SCC-).
- value. Measured data of a subject at a specific variable and region.
- sex. Sex of the subject: Male (M) or Female (W).
- subject. A unique identification of a subject.
- variable. The variables measured are activity, complexity, mobility and brain rate coded from 1 to 4.
- region. Frontal left/right, central left/right, temporal left/right, occipital left/right, parietal left/right coded as 1 to 10.
- dimension. Mixing variable and region together, levels range from 1 to 40.

hrm_GUI

Graphical User Interface for Testing Multi-Factor High-Dimensional Repeated Measures

Description
Graphical User Interface (R Package RGtk2 needed) for the Function 'hrm_test': Test for main effects and interaction effects of one or two between-subject factors and one, two or three within-subject factors (at most four factors can be used).

Usage
hrm_GUI()
Value

The results can be saved as LaTeX Code or as plain text. Additionally a plot of the group profiles can be saved when using one whole- and one subplot factor.

### hrm_test

**Test for Multi-Factor High-Dimensional Repeated Measures**

**Description**

Performing main and interaction effects of up to three whole- or subplot-factors. In total, a maximum of four factors can be used. There are two different S3 methods available. The first method requires a list of matrices in the wide table format. The second method requires a data.frame in the long table format.

**Usage**

```r
hrm_test(data, ...)
```

```r
# S3 method for class 'list'
hrm_test(data, alpha = 0.05, ...)
```

```r
# S3 method for class 'data.frame'
hrm_test(
  data,
  formula,
  alpha = 0.05,
  subject,
  variable = NULL,
  nonparametric = FALSE,
  np.correction = NA,
  character.only = FALSE,
  ...
)
```

**Arguments**

- `data` Either a data.frame (one observation per row) or a list with matrices (one subject per row) for all groups containing the data
- `...` Further arguments passed to `hrm_test` will be ignored
- `alpha` alpha level used for calculating the critical value for the test
- `formula` A model formula object. The left hand side contains the response variable and the right hand side contains the whole- and subplot factors.
- `subject` column name within the data frame X identifying the subjects
- `variable` if not 'NULL' then multivariate tests are applied. We assume that for each factor level of 'variable', we observe several repeated measurements. Currently only supports designs with 1 whole- and one sub-plot factor.
nonparametric Logical variable indicating whether the nonparametric version of the test statistic should be used

np.correction Logical variable indicating whether a small sample size correction for the nonparametric test should be used (TRUE) or not (FALSE). By using NA, np.correction is used automatically in a high-dimensional setting.

character.only a logical indicating whether subject can be assumed to be a character string

Value

Returns an object from class HHRM containing

result A dataframe with the results from the hypotheses tests.

formula The formula object which was used.

alpha The type-I error rate which was used.

subject The column name identifying the subjects.

factors A list containing the whole- and subplot factors.

data The data.frame or list containing the data.

Examples

```r
## hrm_test with a list of matrices

# number patients per group
n = c(10,10)
# number of groups
a=2
# number of variables
d=40

# defining the list consisting of the samples from each group
mu_1 = mu_2 = rep(0,d)
# autoregressive covariance matrix
sigma_1 = diag(d)
for(k in 1:d) for(l in 1:d) sigma_1[k,l] = 1/(1-0.5^2)*0.5^abs(k-l)
sigma_2 = 1.5*sigma_1
X = list(mvrnorm(n[1],mu_1, sigma_1), mvrnorm(n[2],mu_2, sigma_2))
X=lapply(X, as.matrix)
hrm_test(data=X, alpha=0.05)

## hrm.test with a data.frame using a 'formula' object

# using the EEG dataset
?EEG

# Univariate Approach
hrm_test(value ~ group*region*variable, subject = "subject", data = EEG)

# Multivariate Approach: testing effects for each variable
```
hrm_test(value~group*region, subject=subject, variable=variable, data = EEG)

Description

Plotting profile curves for up to one whole- or subplot-factor

Usage

## S3 method for class 'HRM'
plot(x, xlab = "time", ylab = "mean", legend = TRUE, legend.title = "", ...)  

Arguments

x An object of class 'HRM' from the function 'hrm_test'
xlab label of the x-axis of the plot
ylab label of the y-axis of the plot
legend logical indicating if a legend should be plotted
legend.title title of the legend
... Further arguments passed to the 'plot' function

Examples

data(EEG)
head(EEG)

# plots profiles according to groups with
# subplot-factor called dimension

# first create an HRM object
object_hrm <- hrm_test(value ~ group*dimension, subject = "subject", data = EEG)

# plot the HRM object, here we use the additional argument 'theme_bw()' for ggplot2
plot(object_hrm, legend = TRUE, legend.title = "Group", ... = theme_bw() )

# same plot without a legend
# note that 'theme_bw' overwrites the standard legend properties of plot.HRM
plot(object_hrm, ... = theme_bw() +
     theme(legend.title = element_blank(), legend.position="none") )
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