Package ‘cofad’

July 5, 2024

Type Package

Title Contrast Analyses for Factorial Designs

Version 0.3.0

Description Contrast analysis for factorial designs provides an alternative to the traditional ANOVA approach, offering the distinct advantage of testing targeted hypotheses. The foundation of this package is primarily rooted in the works of Rosenthal, Rosnow, and Rubin (2000, ISBN: 978-0521659802) as well as Sedlmeier and Renkewitz (2018, ISBN: 978-3868943214).

License LGPL (>= 3)

URL https://github.com/johannes-titz/cofad

Depends R (>= 3.1.0)

Imports dplyr, Hmisc, magrittr, readr, rhandsonetable, rlang, shiny, shinydashboard, shinyjs, stringr, tibble, utils

Suggests rmarkdown, shinytest2, testthat (>= 3.0.0)

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RoxygenNote 7.3.2

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Data from Akan et al. (2018), experiment 2B

Description

Data contains information from a within-subjects experiment with N = 90 participants. The goal of the experiment was to investigate the benefits of retrieval practice on memory performance. For the entire dataset and analysis scripts see: https://osf.io/bqr5f/. The data was licensed under CC-BY 4.0 Melisa Akan, Aaron Benjamin.

Usage

data(akan)
Format

a data frame with 270 rows and 3 variables:

subject subject id
condition experimental condition (test, restudy, control)
recalled dependent variable

Source


calc_contrast Calculate contrast analysis for factorial designs

Description

Calculate contrast analysis for factorial designs

Usage

calc_contrast(
  dv,
  between = NULL,
  lambda_between = NULL,
  within = NULL,
  lambda_within = NULL,
  ID = NULL,
  id = NULL,
  data = NULL
)

Arguments

dv dependent variable. Values must be numeric.
between independent variable that divides the data into independent groups. Vector must be a factor.
lambda_between contrast weights must be a named numeric. Names must match the levels of between. If lambda_between does not sum up to zero, this will be done automatically.
within independent variable which divides the data into dependent groups. This must be a factor.
lambda_within contrast must be a named numeric. Names must match the levels of between. If lambda_between does not sum up to zero, this will be done automatically.
ID deprecated, use id instead
id identifier for cases or subjects is needed for within- and mixed contrast analysis.
data optional argument for the data.frame containing dv and groups.
Details

For multi-factorial designs, the lambda weights of the factors must be connected. Note that cofad returns one-sided p-values for t-tests.

Value

an object of type cofad_bw or cofad_wi or cofad_mx, including p-value, F-value, contrast weights, different effect sizes. Call summary on this object to get a nice overview of all relevant statistics. Call print to get a short text that can be used for a report.

References


Examples

# Example for between-subjects design Table 3.1 from # Rosenthal, Rosnow and Rubin (2001)

data(rosenthal_tbl31)
contr_bw <- calc_contrast(
  dv = dv,
  between = between,
  lambda_between = c("A" = -3, "B" = -1, "C" = 1, "D" = 3),
  data = rosenthal_tbl31)
contr_bw
summary(contr_bw)

# Example for within-subjects design Calculation 16.6 from # Sedlmeier and Renkewitz (2018, p. 537)

data(sedlmeier_p537)
contr_wi <- calc_contrast(
  dv = reading_test,
  within = music,
  id = participant,
  lambda_within = c("without music" = 1.25,
  "white noise" = 0.25,
  "classic" = -0.75,
  "jazz" = -0.75
),
  data = sedlmeier_p537)
contr_wi
summary(contr_wi, ci = .90)

# Example for mixed-design Table 5.3 from # Rosenthal, Rosnow and Rubin (2001)
calc_contrast_aggregated

data(rosenthal_tbl53)

contr_mx <- calc_contrast(dv = dv, between = between, 
    lambda_between = c("age8" = -1, "age10" = 0, "age12" = 1),
    within = within,
    lambda_within = c("1" = -3, "2" = -1,"3" = 1, "4" = 3),
    id = id, data = rosenthal_tbl53
)

contr_mx
summary(contr_mx)

calc_contrast_aggregated

Calculate between contrast analysis from aggregated data (means, sds and ns)

Description

Calculate between contrast analysis from aggregated data (means, sds and ns)

Usage

calc_contrast_aggregated(means, sds, ns, between, lambda_between, data)

Arguments

means numeric vector of mean values for every condition
sds numeric vector of standard deviation values for every condition
ns numeric vector of sample size values for every condition
between factor for the independent variable that divides the data into independent groups
lambda_between numeric vector for contrast weights. Names must match the levels of between.
    If lambda_between does not sum up to zero, this will be done automatically (centering).
data optional argument for the data.frame containing all variables except for lambda_between

Value

an object of type cofad_bw, including p-value, F-value, contrast weights, different effect sizes

References

Examples

```r
library(dplyr)
furr_agg <- furr_p4 %>%
  group_by(major) %>%
  summarize(mean = mean(empathy), sd = sd(empathy), n = n())
lambdas = c("psychology" = 1, "education" = -1, "business" = 0,
            "chemistry" = 0)
calc_contrast_aggregated(mean, sd, n, major, lambdas, furr_agg)
```

---

**calc_r_alerting**  
*Calculate r_alerting from r_contrast and r_effectsize*

---

**Description**

Convenience function to transform effect sizes in contrast analyses.

**Usage**

```r
calc_r_alerting(r_contrast, r_effectsize)
```

**Arguments**

- `r_contrast` what it says
- `r_effectsize` what it says

---

**calc_r_alerting_from_f**  
*Calculate r_alerting from F-values*

---

**Description**

Convenience function to calculate effect sizes in contrast analyses.

**Usage**

```r
calc_r_alerting_from_f(f_contrast, f_between, df_between)
```

**Arguments**

- `f_contrast` F value from contrast analysis
- `f_between` F value from ANOVA (one between variable!)
- `df_between` degrees of freedom of ANOVA
calc_r_contrast

Calculate r_contrast from r_alerting and r_effectsize

Description

Convenience function to transform effect sizes in contrast analyses.

Usage

calc_r_contrast(r_alerting, r_effectsize)

Arguments

r_alerting what it says
r_effectsize what it says

calc_r_effectsize

Calculate r_effectsize from r_contrast and r_alerting

Description

Convenience function to transform effect sizes in contrast analyses.

Usage

calc_r_effectsize(r_alerting, r_contrast)

Arguments

r_alerting what it says
r_contrast what it says
furr_p4  
*Empathy data set by Furr (2004)*

**Description**

fictitious data set on empathy ratings of students from different majors

**Usage**

data(furr_p4)

**Format**

a data frame with 20 rows and 2 columns

- **empathy** Empathy rating
- **major** major of student

**Source**


haans_within1by4  
*Haans within data example*

**Description**


**Usage**

data(haans_within1by4)

**Format**

a data frame with 20 rows and 3 variables:

- **person** person id
- **name** group name (sitting row 1 to 4)
- **value** dv, final exam grade
**lambda_diff**

*Calculate lambdas for two competing hypotheses*

### Description

If you want to test two competing hypotheses, you can use this helper function to create the correct difference lambdas. There is no magic here. The two contrasts are z-standardized first and then subtracted (lambda_preferred - lambda_competing). You can use the new difference lambdas as the input for calc_difference.

### Usage

```r
lambda_diff(lambda_preferred, lambda_competing, labels = NULL)
```

### Arguments

- **lambda_preferred**
  - Lambdas of the preferred hypothesis. Has to be a named vector with the names corresponding with the groups in the analyzed data set. Alternatively, use the parameter labels.

- **lambda_competing**
  - Lambdas of the competing hypothesis. Has to be a named vector with the names corresponding with the groups in the analyzed data set. Alternatively, use the parameter labels.

- **labels**
  - If you provide lambdas without names, you can set the group labels for both contrasts here.

### Value

Lambdas for difference between lambda_preferred and lambda_competing

### Examples

```r
lambda <- lambda_diff(c("A" = 1, "B" = 2, "C" = 3),
                      c("A" = 1, "B" = 2, "C" = 6))
lambda
# same result
lambda2 <- lambda_diff(c(1, 2, 3), c(1, 2, 6),
                        labels = c("A", "B", "C"))
lambda2
```
### print.cofad_bw

**Output of between-subject design contrast analysis**

**Description**
Output of between-subject design contrast analysis

**Usage**

```r
## S3 method for class 'cofad_bw'
print(x, ...)
```

**Arguments**

- `x` output of `calc_contrast`
- `...` further arguments

**Value**
Displays the significance of the contrast analysis. The contrast weights, the corresponding group and an effectsize are given.

### print.cofad_mx

**Output of a mixed design contrast analysis**

**Description**
Output of a mixed design contrast analysis

**Usage**

```r
## S3 method for class 'cofad_mx'
print(x, ...)
```

**Arguments**

- `x` output of `calc_contrast`
- `...` further arguments

**Value**
Displays the significance of the contrast analysis. The contrast weights, the corresponding group and an effectsize are given.
print.cofad_wi

Output of a within subject design contrast analysis

Description

Output of a within subject design contrast analysis

Usage

```r
## S3 method for class 'cofad_wi'
print(x, ...)
```

Arguments

- `x`: output of `calc_contrast`
- `...`: further arguments

Value

Displays the significance of the contrast analysis. The contrast weights, the corresponding group and an effect size are given.

rosenthal_chap5_q2 Complexity data set by Rosenthal and Rosnow (2000)

Description

Exercise 2 from Chapter 5 (table on p. 147) in Rosenthal and Rosnow (2000)

Usage

```r
data(rosenthal_chap5_q2)
```

Format

a data frame with 12 rows and 4 columns

- `dv`: dependent variable: rating of degree of complexity of social interaction from a series of clips
- `id`: unique identifier of participant
- `within`: within variable: complexity of interaction (low, medium high)
- `between`: between variable: cognitive complexity of participant (high or low)

Source

Description
Fictitious example corresponding to aggregated data set on p. 141 in Rosenthal and Rosnow (2000)

Usage
data(rosenthal_p141)

Format
a data frame with 12 rows and 4 columns
- id unique identifier of participant
- dv dependent variable
- within within variable
- between between variable

Source

Description
Table 3.1 in Rosenthal and Rosnow (2000) on p. 38.

Usage
data(rosenthal_tbl31)

Format
a data frame with 20 rows and 2 columns
- dv dependent variable
- between group (A, B, C, D))

Source

**Description**
Table 5.3 in Rosenthal and Rosnow (2000) on p. 129.

**Usage**
data(rosenthal_tbl53)

**Format**
a data frame with 36 rows and 4 columns
- **dv**: dependent variable
- **between**: age group (8, 10, 12 years)
- **id**: unique identifier for child
- **within**: measurement (1, 2, 3, 4)

**Source**

---


**Description**
Table 5.9 in Rosenthal and Rosnow (2000)

**Usage**
data(rosenthal_tbl59)

**Format**
a data frame with 12 rows and 4 columns
- **id**: unique identifier
- **dv**: dependent variable
- **med**: within variable: medication (treatment or placebo)
- **pt**: between variable: psychotherapy (treatment or placebo)
Source


---

**rosenthal_tbl68**  *Data set by Rosenthal and Rosnow (2000)*

---

**Description**

Fictitious example of children ability, Table 6.8 in Rosenthal and Rosnow (2000)

---

**Usage**

data(rosenthal_tbl68)

---

**Format**

- a data frame with 8 rows and 4 columns
- **id** unique identifier of participant
- **dv** dependent variable
- **within** within variable
- **between** between variable

---

Source


---

**run_app**  *Starts the mimosa shiny app*

---

**Description**

Starts the mimosa shiny app

---

**Usage**

run_app()
Data from Schwoebel et al. (2018)

**Description**

For the entire dataset and analysis scripts see:

**Usage**

data(schwoebel)

**Format**

a data frame with 64 rows and 2 variables:

- **condition** experimental condition (massed-same, massed-different, spaced-same, spaced-different)
- **percent_recalled** dependent variable

**Source**


Problem solving data set by Sedlmeier & Renkewitz (2018)

**Description**

Example 16.2, table 16.1 in Sedlmeier & Renkewitz (2018). Fictitious data set with 15 boys divided into three groups (no training, boys-specific material, girls-specific training material). The DV is the number of solved problem (similar to the training).

**Usage**

data(sedlmeier_p525)

**Format**

a data frame with 15 rows and 3 columns

- **lsg** dv, number of solved exercises
- **between** group, KT=no training, JT=boys-specific, MT=girls-specific
- **lambda** lambdas used for this example

**Source**

**sedlmeier_p537**  
*Music data set by Sedlmeier & Renkewitz (2018)*

**Description**

Example 16.6, table 16.5 in Sedlmeier & Renkewitz (2018). Fictitious data set with 8 participants that listened to no music, white noise, classical music, and jazz music (within). The DV is a reading test.

**Usage**

```r
data(sedlmeier_p537)
```

**Format**

a data frame with 32 rows and 3 columns

- `reading_test` dependent variable
- `participant` unique id
- `music` within variable

**Source**


---

**summary.cofad_bw**  
*Summary of between subject design contrast analysis*

**Description**

Summary of between subject design contrast analysis

**Usage**

```r
## S3 method for class 'cofad_bw'
summary(object, ...)
```

**Arguments**

- `object` output of `calc_contrast`
- `...` further arguments

**Value**

Displays type of contrast analysis, lambdas, t-table, ANOVA table and typical effect sizes. If you assign this to a variable, it will be a list with the elements Lambdas, tTable, FTable, Effects.
summary.cofad_mx  Summary of a mixed design contrast analysis

Description
Summary of a mixed design contrast analysis

Usage
## S3 method for class 'cofad_mx'
summary(object, ...)

Arguments
object          output of calc_contrast
...             further arguments

Value
Displays type of contrast analysis, lambdas, t-table, ANOVA table and typical effect sizes. If you assign this to a variable, it will be a list with the elements Lambdas, tTable, FTable, Effects.

summary.cofad_wi  Summary of within subject design contrast analysis

Description
Summary of within subject design contrast analysis

Usage
## S3 method for class 'cofad_wi'
summary(object, ci = 0.95, ...)

Arguments
object          output of calc_contrast
ci              confidence intervall for composite Score (L-Values)
...             further arguments

Value
Displays type of contrast analysis, lambdas, t-table and typical effect sizes. If you assign this to a variable, it will be a list with the elements Lambdas, tTable, Effects.
Description

This dataset originates from a study conducted as part of a research seminar in the Psychology B.Sc. program of the University of Cologne. The study participants learned a list of 20 non-associated word pairs. Each half of the word pair was associated with one of two sources (imagining the word pair in the sky or underwater). The final memory test (cued recall) was conducted two days later. Cued recall means that one word of the word pair was presented, and the participant had to recall the other word. The participants were randomly assigned into one of three between-participant conditions: restudy, source test, item test.

Usage

data(testing_effect)

Format

a data frame with 60 rows and 3 variables:

- **subject** the participant’s id
- **condition** the between-participant condition
- **recalled** the number of words recalled in the cued-recall test
Index

* datasets
  akan, 2
  furr_p4, 8
  haans_within1by4, 8
  roenthal_chap5_q2, 11
  roenthal_p141, 12
  roenthal_tbl31, 12
  roenthal_tbl53, 13
  roenthal_tbl59, 13
  roenthal_tbl68, 14
  schwoebel, 15
  sedlmeier_p525, 15
  sedlmeier_p537, 16
  testing_effect, 18

akan, 2

calc_contrast, 3
calc_contrast_aggregated, 5
calc_r_alerting, 6
calc_r_alerting_from_f, 6
calc_r_contrast, 7
calc_r_effectsize, 7

furr_p4, 8

haans_within1by4, 8

lambda_diff, 9

print.cofad_bw, 10
print.cofad_mx, 10
print.cofad_wi, 11

rosenthal_chap5_q2, 11
rosenthal_p141, 12
rosenthal_tbl31, 12
rosenthal_tbl53, 13
rosenthal_tbl59, 13
rosenthal_tbl68, 14
run_app, 14

schwoebel, 15
sedlmeier_p525, 15
sedlmeier_p537, 16
summary.cofad_bw, 16
summary.cofad_mx, 17
summary.cofad_wi, 17

testing_effect, 18