Package ‘rmcorr’

December 13, 2022

Title Repeated Measures Correlation

Version 0.5.4

Description Compute the repeated measures correlation, a statistical technique for determining the overall within-individual relationship among paired measures assessed on two or more occasions, first introduced by Bland and Altman (1995). Includes functions for diagnostics, p-value, effect size with confidence interval including optional bootstrapping, as well as graphing. Also includes several example datasets. For more details, see the web documentation <https://lmarusich.github.io/rmcorr/index.html> and the original paper: Bakdash and Marusich (2017) <doi:10.3389/fpsyg.2017.00456>.

Depends R (>= 4.1.0)

License GPL-2

LazyData true

Imports stats, grDevices, graphics, psych, RColorBrewer

RoxygenNote 7.2.3

Encoding UTF-8

Suggests knitr, rmarkdown, plotrix, ggplot2, lme4, merTools, pwr, AICmodavg, pals, testthat (>= 3.0.0), vdiff2, corrplot, cocor, covr

VignetteBuilder knitr

Config/testthat/edition 3

URL https://github.com/lmarusich/rmcorr,
https://lmarusich.github.io/rmcorr/

BugReports https://github.com/lmarusich/rmcorr/issues

NeedsCompilation no

Author Jonathan Z. Bakdash [aut] (<https://orcid.org/0000-0002-1409-4779>), Laura R. Marusich [aut, cre] (<https://orcid.org/0000-0002-3524-6110>)

Maintainer Laura R. Marusich <lmarusich@gmail.com>

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R topics documented:

- rmcorr-package
- bland1995
- gilden2010
- marusch2016_exp2
- plot.rmc
- print.rmc
- print.rmcmat
- raz2005
- rmcorr
- rmcorr_mat
- twedt_dist_measures

Index

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**rmcorr-package**

*A package for computing the repeated measures correlation coefficient*

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**Description**

Compute the repeated measures correlation, a statistical technique for determining the overall within-individual relationship among paired measures assessed on two or more occasions, first introduced by Bland and Altman (1995). Includes functions for diagnostics, p-value, effect size with confidence interval including optional bootstrapping, as well as graphing. Also includes several example datasets. For more details, see the web documentation <https://lmarusich.github.io/rmcorr/index.html> and the original paper: Bakdash and Marusich (2017) <doi:10.3389/fpsyg.2017.00456>.

**References**


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**bland1995**

*Repeated measurements of intramural pH and PaCO2*

---

**Description**


**Usage**

bland1995
marusich2016_exp2

**Format**

A data frame with 47 rows and 3 variables

<table>
<thead>
<tr>
<th>[,1]</th>
<th>Subject</th>
<th>Unique identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>[,2]</td>
<td>pH</td>
<td>Potential of hydrogen, acidity to base</td>
</tr>
<tr>
<td>[,3]</td>
<td>PaCO2</td>
<td>Partial pressure of carbon dioxide</td>
</tr>
</tbody>
</table>

**Source**


---

gilden2010  

Repeted measurements of reaction time and accuracy

**Description**

A dataset containing four repeated measurements of reaction time (RT) and accuracy from eleven subjects in a visual search experiment. Each measurement is the mean RT and accuracy from a block of 288 search trials. blocks of visual search, for eleven subjects.

**Usage**

gilden2010

**Format**

A data frame with 44 rows and 4 variables

<table>
<thead>
<tr>
<th>[,1]</th>
<th>sub</th>
<th>Subject ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>[,2]</td>
<td>block</td>
<td>Block ID</td>
</tr>
<tr>
<td>[,3]</td>
<td>rt</td>
<td>Mean reaction time</td>
</tr>
<tr>
<td>[,4]</td>
<td>acc</td>
<td>Mean accuracy</td>
</tr>
</tbody>
</table>

**Source**


---

marusich2016_exp2  

Repeted measurements of dyads performance and subjective situation awareness
Description

A dataset containing three repeated measures of dyads (paired participants) working together to capture High Value Targets (lower task time is better performance) and their averaged Mission Awareness Rating Scale (MARS) score for each block, repeated three times. MARS evaluates subjective situation awareness ("knowing what is going on"), higher values indicate better situation awareness.

Usage

marusich2016_exp2

Format

A data frame with 84 rows (28 dyads/pairs) and 4 variables

[,1] Pair     Unique identifier for each dyad
[,2] HVT_capture Capture time
[,3] MARS     subjective situation awareness
[,4] Source Reliability 1 = none, 2 = accurate, and 3 = inaccurate

Source


---

**plot.rmc**

Plot the repeated measures correlation coefficient.

Description

plot.rmc produces a scatterplot of measure1 on the x-axis and measure2 on the y-axis, with a different color used for each subject. Parallel lines are fitted to each subject’s data.

Usage

```r
## S3 method for class ‘rmc’
plot(x,
     dataset = NULL,
     overall = F,
     palette = NULL,
     xlab = NULL,
     ylab = NULL,
     overall.col = "gray60",
     overall.lwd = 3,
)```

plot.rmc

overall.lty = 2,
...
)

Arguments

x an object of class "rmc" generated from the rmc function.
dataset Deprecated: This argument is no longer required
overall logical: if TRUE, plots the regression line between measure1 and measure2, ignoring the participant variable.
palette the palette to be used. Defaults to the RColorBrewer "Paired" palette
xlab label for the x axis, defaults to the variable name for measure1.
ylab label for the y axis, defaults to the variable name for measure2.
overall.col the color of the overall regression line
overall.lwd the line thickness of the overall regression line
overall.lty the line type of the overall regression line
...
additional arguments to plot.

See Also

rmcorr

Examples

## Bland Altman 1995 data
my.rmc <- rmc(participant = Subject, measure1 = PaCO2, measure2 = pH,
      dataset = bland1995)
plot(my.rmc)

#using ggplot instead
if (requireNamespace("ggplot2", quietly = TRUE)){
  ggplot(bland1995, aes(x = PaCO2, y = pH,
                  group = factor(Subject), color = factor(Subject))) +
  ggplot2::geom_point(aes(colour = factor(Subject))) +
  ggplot2::geom_line(aes(y = my.rmc$model$fitted.values),
                  linetype = 1)
}

## Raz et al. 2005 data
my.rmc <- rmc(participant = Participant, measure1 = Age, measure2 =
      Volume, dataset = raz2005)
library(RColorBrewer)
blueset <- brewer.pal(8, 'Blues')
pal <- colorRampPalette(blueset)
plot(my.rmc, overall = TRUE, palette = pal, overall.col = 'black')
## Gilden et al. 2010 data

my.rmc <- rmcorr(participant = sub, measure1 = rt, measure2 = acc, dataset = gilden2010)
plot(my.rmc, overall = FALSE, lty = 2, xlab = "Reaction Time", ylab = "Accuracy")

---

print.rmc  
*Print the results of a repeated measures correlation*

**Description**

Print the results of a repeated measures correlation

**Usage**

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

**Arguments**

- `x` An object of class "rmc", a result of a call to rmcorr.
- `...` additional arguments to `print`.

**See Also**

`rmcorr`

**Examples**

```r
## Bland Altman 1995 data
blandrmc <- rmcorr(Subject, PaCO2, pH, bland1995)
blandrmc
```

---

print.rmcmat  
*Print the repeated measures correlation matrix*

**Description**

Print the repeated measures correlation matrix

**Usage**

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

**Examples**

```r
```
Arguments

x  An object of class "rmcmat", a result of a call to \texttt{rmcorr_mat}.

\ldots  additional arguments to \texttt{print}.

See Also

\texttt{rmcorr_mat, rmcorr}

Examples

\begin{verbatim}
## Bland Altman 1995 data
blandrmc <- rmcorr(Subject, PaCO2, pH, bland1995)
blandrmc
\end{verbatim}

\begin{verbatim}
rz2005  Repeated measurements of age and cerebellar volume
\end{verbatim}

Description

A dataset containing two repeated measures, on two occasions (Time), of age and adjusted volume of cerebellar hemispheres from 72 participants. Data were captured from Figure 8, Cerebellar Hemispheres (lower right) of Raz et al. (2005).

Usage

rz2005

Format

A data frame with 144 rows and 4 variables

\begin{verbatim}
[,1] Participant  Participant ID
[,2] Time        Measurement time
[,3] Age         Participant’s age (years)
[,4] Volume      Adjusted volume of cerebellar hemispheres (cm\(^3\))
\end{verbatim}

Source


\begin{verbatim}
rmcorr  Calculate the repeated measures correlation coefficient.
\end{verbatim}
**Description**

Calculate the repeated measures correlation coefficient.

**Usage**

```r
rmcorr(
  participant,
  measure1,
  measure2,
  dataset,
  CI.level = 0.95,
  CIs = c("analytic", "bootstrap"),
  nreps = 100,
  bstrap.out = F
)
```

**Arguments**

- `participant`: A variable giving the subject name/id for each observation.
- `measure1`: A numeric variable giving the observations for one measure.
- `measure2`: A numeric variable giving the observations for the second measure.
- `dataset`: The data frame containing the variables.
- `CI.level`: The confidence level of the interval.
- `CIs`: The method of calculating confidence intervals.
- `nreps`: The number of resamples to take if bootstrapping.
- `bstrap.out`: Determines if the output include the bootstrap resamples.

**Value**

A list with class "rmc" containing the following components.

- `r`: the value of the repeated measures correlation coefficient.
- `df`: the degrees of freedom.
- `p`: the p-value for the repeated measures correlation coefficient.
- `CI`: the 95% confidence interval for the repeated measures correlation coefficient.
- `model`: the multiple regression model used to calculate the correlation coefficient.
- `resamples`: the bootstrap resampled correlation values.

**References**


See Also

plot.rmc

Examples

```r
## Bland Altman 1995 data
rmcorr(Subject, PaCO2, pH, bland1995)
```

---

### rmcorr_mat

*Create a repeated measures correlation matrix.*

#### Description

Create a repeated measures correlation matrix.

#### Usage

```r
rmcorr_mat(participant, variables, dataset, CI.level = 0.95)
```

#### Arguments

- **participant**: A variable giving the subject name/id for each observation.
- **variables**: A character vector indicating the columns of variables to include in the correlation matrix.
- **dataset**: The data frame containing the variables.
- **CI.level**: The level of confidence intervals to use in the rmcorr models.

#### Value

A list with class "rmcmat" containing the following components.

- **matrix**: the repeated measures correlation matrix
- **summary**: a dataframe showing rmcorr stats for each pair of variables
- **models**: a list of the full rmcorr model for each pair of variables

#### References

### Description

A dataset of repeated measures of distance perception at physical distances of 7, 8, 9, 10, and 11 meters. The data are also multivariate, with five dependent measures of distance perception. This is a 5 (physical distance) x 5 (dependent measure) within-participants design with a sample size of 46. Note data is missing for 15 trials due participant and experimenter errors.

### Usage

```r
twedt_dist_measures
```

### Format

A data frame with 230 rows and 7 columns

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[,1] Subject</td>
<td>Unique identifier for each participant</td>
</tr>
<tr>
<td>[,2] Physical Distance</td>
<td>Physical distance from the participant to the target cone, in meters</td>
</tr>
<tr>
<td>[,3] Blindwalk Away</td>
<td>Participants put on the blindfold after viewing the target. Next, participants took one step to the left and turned 180 degrees. Participants were instructed to walk forward until they had walked the original distance to the target cone.</td>
</tr>
<tr>
<td>[,4] Blindwalk Toward</td>
<td>Participants put on the blindfold after viewing the target. Next, participants walked forward until they thought they had reached the target cone.</td>
</tr>
<tr>
<td>[,5] Triangulated BW</td>
<td>Participants put on the blindfold after viewing the target. Next, participants turned right 90 degrees and walked forward two steps.</td>
</tr>
<tr>
<td>[,6] Verbal</td>
<td>Participants stated the distance between the target cone and themselves, in feet and inches</td>
</tr>
<tr>
<td>[,7] Visual Matching</td>
<td>An experimenter stood next to the target cone and walked away from the cone in a straight line.</td>
</tr>
</tbody>
</table>

### Source

Index

bland1995, 2

gilden2010, 3

marusich2016_exp2, 3

plot, 5
plot.rmc, 4, 9, 10
print, 6, 7
print.rmc, 6
print.rmcmat, 6

raz2005, 7
rmcorr, 5–7, 7, 10
rmcorr-package, 2
rmcorr_mat, 7, 9

twedt_dist_measures, 10