

Package ‘recmetrics’

July 23, 2025

Type Package

Title Psychometric Evaluation Using Relative Excess Correlations

Version 0.1.0

Description

Modern results of psychometric theory are implemented to provide users with a way of evaluating the internal structure of a set of items guided by theory. These methods are discussed in detail in VanderWeele and Padgett (2024) <[doi:10.31234/osf.io/rnbk5](https://doi.org/10.31234/osf.io/rnbk5)>. The relative excess correlation matrices will, generally, have numerous negative entries even if all of the raw correlations between each pair of indicators are positive. The positive deviations of the relative excess correlation matrix entries help identify clusters of indicators that are more strongly related to one another, providing insights somewhat analogous to factor analysis, but without the need for rotations or decisions concerning the number of factors. A goal similar to exploratory/confirmatory factor analysis, but 'recmetrics' uses novel methods that do not rely on assumptions of latent variables or latent variable structures.

License MIT + file LICENSE

Depends R (>= 2.10)

Imports dplyr, lifecycle, magrittr, stats, tidyselect

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

Encoding UTF-8

LazyData true

RoxygenNote 7.3.0

URL <https://noah-padgett.github.io/recmetrics/>

NeedsCompilation no

Author R. Noah Padgett [aut, cre, cph] (ORCID:
<<https://orcid.org/0000-0002-9114-3896>>)

Maintainer R. Noah Padgett <npadgett@hsph.harvard.edu>

Repository CRAN

Date/Publication 2024-02-27 16:50:02 UTC

Contents

append_observed_residuals	2
cor.orc	3
cor.rec	3
cor.rowMeans	4
cov.orc	5
cov.rec	5
rec.average	6
rec.avg.wb.domains	7
rec.coherence	8
rec.pattern.matrix	9
SCWB	10
Index	12

append_observed_residuals
<i>Append Observed Correlations to Data</i>

Description

Compute observed residuals for each variables in data and appends these newly created variables to the original dataset.

Usage

```
append_observed_residuals(data, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble
na.rm	logical (defaults to TRUE)

Value

A numeric matrix of correlations among variable residuals.

Examples

```
# Use the SCWB data example
data(SCWB)
append_observed_residuals(SCWB[, 1:20])
```

cor.orc	<i>Observed Residual Correlations</i>
---------	---------------------------------------

Description

Compute observed residual correlation (ORC) matrix among observed residuals for variables supplied data.

Usage

```
cor.orc(data, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A numeric matrix of correlations among variable residuals.

Examples

```
# Use the SCWB data example
data(SCWB)
cor.orc(SCWB[, 1:20])
```

cor.rec	<i>Relative Excess Correlations</i>
---------	-------------------------------------

Description

Compute relative excess correlation (REC) matrix among variables in supplied data.

Usage

```
cor.rec(data, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble
na.rm	logical (defaults to TRUE)

Details**[Experimental]****Value**

A numeric matrix of correlations among variable residuals.

Examples

```
# Use the SCWB data example
data(SCWB)
cor.rec(SCWB[, 1:20])
```

`cor.rowMeans`*Compute rowMeans of a correlation matrix*

Description

A wrapper for computing the mean of the rows of a correlation matrix.

Usage

```
cor.rowMeans(x, na.rm = TRUE)
```

Arguments

<code>x</code>	A correlations
<code>na.rm</code>	logical (defaults to TRUE)

Value

A numeric vector of correlation means.

Examples

```
# Use the SCWB data example
data(SCWB)
mycor <- cor(SCWB)
cor.rowMeans(mycor)
```

cov.orc	<i>Observed Residual Covariances</i>
---------	--------------------------------------

Description

Compute observed residual covariances (ORC) matrix among observed residuals for variables supplied data.

Usage

```
cov.orc(data, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A numeric matrix of correlations among variable residuals.

Examples

```
# Use the SCWB data example
data(SCWB)
cov.orc(SCWB[, 1:20])
```

cov.rec	<i>Relative Excess Covariances</i>
---------	------------------------------------

Description

Compute relative excess covariances (REC) matrix among variables in supplied data.

Usage

```
cov.rec(data, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A numeric matrix of correlations among variable residuals.

Examples

```
# Use the SCWB data example
data(SCWB)
cov.rec(SCWB[, 1:20])
```

rec.average	<i>REC Metric 1</i>
-------------	---------------------

Description

The average of the absolute values of the C-REC matrix entries (this is essentially how much relative excess correlation there is still to distribute across groupings)

Usage

```
rec.average(data, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble (required)
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A single numerical value

Examples

```
{
  # Use the SCWB data example
  # Metric 1 - item scores
  rec.average(SCWB[, 1:20])
  # Metric 4 - domain total scores
  my_rec <- rec.average(SCWB[, 21:25])
  my_rec
  # Metric 4 - averages
  mean(abs(my_rec[lower.tri(my_rec)]))
}
```

rec.avg.wb.domains *REC Metric 2*

Description

For each domain i , the average of the REC entries within domain vs. the average of the REC entries when looking at correlations between indicators in domain $D=i$ with indicators in domains other than i (note that this does NOT include correlations in domain j with other indicators in domain j ; for a given domain, it is basically the average of the REC entries within the domain vs. the average of the REC entries for all of the other entries in the column of that domain). We might call this the REC domain coherence for domain i

Usage

```
rec.avg.wb.domains(data, domainlist = NULL, domainnames = NULL, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble (required)
domainlist	A list of character vectors or numeric vectors denoting the columns for each domain (required)
domainnames	A character vector supplying updated names to be attached to output
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A single numerical value

Examples

```
# Use the SCWB data example
mylist <- list(
  domain_goodrel = c("cwbcloserel", "cwbrespect", "cwbtrust", "cwbmutuality"),
  domain_prolead = c("cwbbeneficence", "cwbintegrity", "cwbcompetence", "cwbvision"),
  domain_healthyprac = c("cwbrelgrowth", "cwbfairness", "cwbsustenance", "cwbachieve"),
  domain_satcomm = c("cwbsatisf", "cwbvalue", "cwbbelonging", "cwbwelcome"),
  domain_strongmiss = c("cwbpurpose", "cwbcontrib", "cwbinterconn", "cwbsynergy")
)
rec.avg.wb.domains(SCWB, mylist)
```

rec.coherence

REC Metric 3

Description

The average value of the REC domain coherence taken across domains (which, when the domains all have the same number of indicators, I believe will also equal the average within-domain REC vs. the average cross-domain REC); this gives a measure of the coherence of the partition formed by the various domains as a whole

Usage

```
rec.coherence(data, domainlist = NULL, domainnames = NULL, na.rm = TRUE)
```

Arguments

data	A data.frame or tibble (required)
domainlist	A list of character vectors or numeric vectors denoting the columns for each domain (required)
domainnames	A character vector supplying updated names to be attached to output
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A single numerical value

Examples

```
# Use the SCWB data example
mylist <- list(
  domain_goodrel = c("cwbcloserel", "cwbrespect", "cwbtrust", "cwbmutuality"),
  domain_prolead = c("cwbbeneficence", "cwbintegrity", "cwbcompetence", "cwbvision"),
  domain_healthyprac = c("cwbrelgrowth", "cwbfairness", "cwbsustenance", "cwbachieve"),
  domain_satcomm = c("cwbsatisf", "cwbvalue", "cwbbelonging", "cwbwelcome"),
  domain_strongmiss = c("cwbpurpose", "cwbcontrib", "cwbinterconn", "cwbsynergy")
)
rec.coherence(SCWB, mylist)
```

rec.pattern.matrix *REC Metric 3*

Description

An (Number of Items)x(Number of Domains) matrix such that each row corresponds to an indicator, and the entry in column i is the average REC score for that indicator with the other indicators in domain i. This will allow one in some sense to see if certain indicators seem to have higher REC scores in a domain other than to the other in which they were assigned

Usage

```
rec.pattern.matrix(
  data,
  domainlist = NULL,
  domainnames = NULL,
  labels = NULL,
  na.rm = TRUE
)
```

Arguments

data	A data.frame or tibble (required)
domainlist	A list of character vectors or numeric vectors denoting the columns for each domain (required)
domainnames	A character vector supplying updated names to be attached to output
labels	A character vector supplying updated variable names to be attached to output
na.rm	logical (defaults to TRUE)

Details

[Experimental]

Value

A single numerical value

Examples

```
# Use the SCWB data example
mylist <- list(
  domain_goodrel = c("cwbcloserel", "cwbrespect", "cwbtrust", "cwbmaturity"),
  domain_prolead = c("cwbbeneficence", "cwbintegrity", "cwbcompetence", "cwbvision"),
  domain_healthyprac = c("cwbrelgrowth", "cwbfairness", "cwbsustenance", "cwbachieve"),
  domain_satcomm = c("cwbsatisf", "cwbvalue", "cwbbelonging", "cwbwelcome"),
  domain_strongmiss = c("cwbpurpose", "cwbcontrib", "cwbinterconn", "cwbsynergy")
)
rec.pattern.matrix(SCWB, mylist)
```

SCWB

*Subjective Community Well-Being Dataset (25 Variables)***Description**

These Subjective Community Well-Being (SCWB) data are a random subset from the full dataset used in the paper by Padgett et al. (in press). The SCWB dataset contains 501 responses to the 20 SCWB items plus 5 pre-computed total scores on the five theorized domains of Good Relationships, Proficient Leadership, Healthy Practices, Satisfying Community, and Strong Mission.

Usage

```
data(SCWB)
```

Format

SCWB A data frame with 501 observations of 25 variables.:

```
cwbcloserel
cwbrespect
cwbtrust
cwbmutuality
cwbbeneficence
cwbintegrity
cwbcompetence
cwbvision
cwbrelgrowth
cwbfairness
cwsustenance
cwbachieve
cwbsatisf
cwbvalue
cwbbelonging
cwbwelcome
cwbpurpose
cwbcontrib
cwbinterconn
cwbsynergy
total_goodrel Mean of items cwbcloserel, cwbrespect, cwbtrust, cwbmutuality
total_prolead Mean of items cwbbeneficence, cwbintegrity, cwbcompetence, cwbvision
total_healthyprac Mean of items cwbrelgrowth, cwbfairness, cwsustenance, cwbachieve
total_satcomm Mean of items cwbsatisf, cwbvalue, cwbbelonging, cwbwelcome
total_strongmiss Mean of items cwbpurpose, cwbcontrib, cwbintercon, cwbsynergy
```

Source

Data used in Padgett et al. (in press).

References

Padgett, R.N., ...

Examples

```
# SCWB example used in preprint  
data(SCWB)
```

Index

* **datasets**

SCWB, [10](#)

append_observed_residuals, [2](#)

cor.orc, [3](#)

cor.rec, [3](#)

cor.rowMeans, [4](#)

cov.orc, [5](#)

cov.rec, [5](#)

rec.average, [6](#)

rec.avg.wb.domains, [7](#)

rec.coherence, [8](#)

rec.pattern.matrix, [9](#)

SCWB, [10](#)