Package 'Bayesrel'

January 7, 2021

Type Package

Title Bayesian Reliability Estimation

Version 0.7.0.3

Description Functionality for the most common single test reliability estimates:
Coefficient alpha, 'Guttman's' lambda-2/-4/-6, the Greatest lower bound and coefficient omega.
The Bayesian estimates are provided with credible intervals.
The frequentist estimates are provided with bootstrapped confidence intervals
The method for the Bayesian estimates, except for omega, is sampling from the posterior inverse 'Wishart'
for the covariance matrix based measures
(see 'Murphy', 2007, <https://www.seas.harvard.edu/courses/cs281/papers/murphy-2007.pdf>.
In the case of omega it is 'Gibbs' Sampling from the joint conditional distributions of a single factor model
('Lee', 2007, <doi:10.1002/9780470024737>).
The glb method uses adjusted code from the 'Rcsdp' package by 'Hector Corrada Bravo',
<https://CRAN.R-
project.org/package=Rcsdp>. This process applies a slightly adjusted solving algorithm
from the 'CSDP' library by 'Brian Borchers' <https://github.com/coin-or/Csdp/wiki>,
<doi:10.1080/10556789908805765>, but is wrapped in 'RcppArmadillo'.
Guttman's Lambda-4 is from 'Benton' (2015) <doi:10.1007/978-3-319-07503-7_19>.
The principal factor analysis for a version of frequentist omega is from 'Schlegel' (2017)
<https://www.r-bloggers.com/2017/03/iterated-principal-factor-method-of-factor-analysis-with-r/>.
The analytic confidence interval of alpha is from 'Bonett' and 'Wright' (2015) <doi:10.1002/job.1960>.

URL https://github.com/juliuspf/Bayesrel

BugReports https://github.com/juliuspf/Bayesrel/issues

License GPL-3

Encoding UTF-8

LazyData true

Imports LaplacesDemon, MASS, lavaan, coda, methods, stats, graphics,
Rdpack, Rcpp (>= 1.0.4.6)

LinkingTo Rcpp, RcppArmadillo

RdMacros Rdpack

RoxygenNote 7.1.1

Depends R (>= 2.10)

Suggests testthat (>= 2.1.0)

NeedsCompilation yes

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Repository CRAN

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R topics documented:

`asrm` *5-Item questionnaire data from Nicolai (2018)*

Description

A dataset consisting of 78 participants who filled out the 5-item Altman Self-Rating Mania Scale, rating from 1 to 5 on a Likert scale

Usage

```
asrm
```

Format

The format is a 5-column datamatrix containing 78 observations

Source

article

References

Nicolai, J., & Moshagen, M. (2018). Pathological buying symptoms are associated with distortions in judging elapsed time. Journal of Behavioral Addictions, 7(3), 752-759.

`asrm_mis` *5-Item questionnaire data from Nicolai (2018) with 10 % missings*

Description

A dataset consisting of 78 participants who filled out the 5-item Altman Self-Rating Mania Scale, rating from 1 to 5 on a Likert scale, 10 % missings were inserted at random

Usage

```
asrm_mis
```

Format

The format is a 5-column data matrix containing 78 observations, missing are NA

Source

article

References

Nicolai, J., & Moshagen, M. (2018). Pathological buying symptoms are associated with distortions in judging elapsed time. Journal of Behavioral Addictions, 7(3), 752-759.

`cavalini` *8-Item Questionnaire Data from Cavalini (1992)*

Description

A dataset consisting of eight item questionnaire data. It's Likert scaled from 0-3. It is data measuring how annoyed people were by malodors

Usage

```
cavalini
```

Format

The format is a 8-column datamatrix containing 828 observations

Source

Doctoral Dissertation

References

Cavalini, P. M. (1992). It's an ill wind that brings no good: Studies on odour annoyance and the dispersion of odorant concentrations from industries. Rijksuniversiteit Groningen.

`omega_fit` *graphical posterior predictive check for the 1-factor omega model, based on covariance matrix eigenvalues*

Description

gives posterior predictive check for the 1-factor model: comparison between model implied covariance matrix and sample covariance matrix also displays frequentist fit indices

Usage

```
omega_fit(x)
```

Arguments

`x`	A strel output object (list)

Examples

```
omega_fit(strel(asrm, "omega", n.chains = 2, n.iter = 100))
```

`p_strel` *prior and posterior probability of estimate being bigger than threshold*

Description

takes a mcmc posterior sample of any of the single test reliability estimates and calculates the prior and posterior probability of the estimate being bigger or smaller than an arbitrary value (priors are stored in the package)

Usage

```
p_strel(x, estimate, low.bound)
```

Arguments

x	A strel output object (list)
estimate	A character string indicating what estimate to plot from the strel output object
low.bound	A number for the threshold to be tested against

Examples

```
p_strel(strel(asrm, "lambda2", n.chains = 2, n.iter = 100, freq = FALSE), "lambda2", .80)
```

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strel *calculate single test reliability estimates*

Description

calculate Bayesian and frequentist single test reliability measures. Reported are Bayesian credible intervals (HDI) and frequentist confidence intervals (non parametric or parametric bootstrap). The estimates supported are Cronbach alpha, lambda2/4/6, the glb, and Mcdonald omega. Beware of lambda4 with many indicators, the computational effort is considerable

Usage

```
strel(
  data = NULL,
  estimates = c("alpha", "lambda2", "glb", "omega"),
  cov.mat = NULL,
  interval = 0.95,
  n.iter = 1000,
  n.burnin = 50,
  thin = 1,
  n.chains = 3,
  n.boot = 1000,
  omega.freq.method = "cfa",
  n.obs = NULL,
  alpha.int.analytic = TRUE,
  omega.int.analytic = TRUE,
  freq = TRUE,
  Bayes = TRUE,
  para.boot = FALSE,
  item.dropped = FALSE,
  missing = "pairwise",
  callback = function() { }
)
```

Arguments

data	The dataset to be analyzed, observations are rows, items are columns
estimates	A character vector containing the estimands, we recommend using lambda4 with only a few items due to the computation time
cov.mat	A covariance matrix can be supplied instead of a dataset, but number of observations needs to be specified
interval	A number specifying the uncertainty interval
n.iter	A number for the iterations of the Gibbs Sampler
n.burnin	A number for the burnin in the Gibbs Sampler
thin	A number for the thinning of the MCMC samples
n.chains	A number for the chains to run for the MCMC sampling
n.boot	A number for the bootstrap samples
omega.freq.method	A character string for the method of frequentist omega, either "pfa" or "cfa", with "pfa" the interval is always bootstrapped
n.obs	A number for the sample observations when a covariance matrix is supplied and the factor model is calculated
alpha.int.analytic	A logical for calculating the alpha confidence interval analytically
omega.int.analytic	A logical for calculating the omega confidence interval analytically, only works with cfa as the omega.freq.method
freq	A logical for calculating the frequentist estimates
Bayes	A logical for calculating the Bayesian estimates
para.boot	A logical for calculating the parametric bootstrap, the default is the non-parametric
item.dropped	A logical for calculating the if-item-dropped statistics
missing	A string specifying the way to handle missing data, 'listwise' is self-explanatory, 'pairwise' in the Bayesian paradigm means sampling the missing values as additional parameters from the joint conditional distribution, in the frequentist paradigm this means using the 'pairwise' covariance matrix and the full information ML method for omega
callback	step count for external use

References

Murphy KP (2007). "Conjugate Bayesian analysis of the Gaussian distribution." University of British Columbia. Lee S (2007). *Structural equation modeling: A Bayesian approach*, volume 711. John Wiley \& Sons.

Examples

```
summary(strel(asrm, estimates = "lambda2", n.chains = 2, n.iter = 200, n.boot = 200))
summary(strel(asrm, estimates = "lambda2", item.dropped = TRUE, n.chains = 2,
n.iter = 100, n.boot = 200))
```

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