Package 'SINRELEF.LD'

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Type Package

Title Reliability and Relative Efficiency in Locally-Dependent
Measures

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Description Implements an approach aimed at assessing the accuracy and
effectiveness of raw scores obtained in scales that contain locally dependent
items. The program uses as input the calibration (structural) item estimates
obtained from fitting extended unidimensional factor-analytic solutions in
which the existing local dependencies are included. Measures of reliability
(Omega) and information are proposed at three levels: (a) total score, (b)
bivariate-doublet, and (c) item-by-item deletion, and are compared to those
that would be obtained if all the items had been locally independent. All the
implemented procedures can be obtained from: (a) linear factor-analytic
solutions in which the item scores are treated as approximately continuous,
and (b) non-linear solutions in which the item scores are treated as
ordered-categorical. A detailed guide can be obtained at the following url.

URL <https://psico.fcep.urv.cat/utilitats/SINRELEF-LD/>

Depends R (>= 3.5)

Imports stats, shiny, shinycssloaders, shinyjs

License GPL-3

Encoding UTF-8

NeedsCompilation no

LazyData true

RoxygenNote 6.0.1

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Contents

SINRELEF.LD-package	*Scores Information, reliability, and relative efficiency in measures that contain locally-dependent items.*

Description

SINRELEF.LD implements an approach aimed at assessing the accuracy and effectiveness of raw scores obtained in scales that contain locally dependent items. The program uses as input the calibration (structural) item estimates obtained from fitting extended unidimensional factor-analytic solutions in which the existing local dependencies are included. Measures of reliability (Omega) and information are proposed at three levels: (a) total score, (b) bivariate-doublet, and (c) item-by-item deletion, and are compared to those that would be obtained if all the items had been locally independent. All the implemented procedures can be obtained from: (a) linear factor-analytic solutions in which the item scores are treated as approximately continuous, and (b) non-linear solutions in which the item scores are treated as ordered-categorical.

Details

For more information about the methods used, please go to main page SINRELEF.LD.

Value

\link{SINRELEF.LD}

Assesses the accuracy and effectiveness of raw item and test scores, using the calibration estimates obtained from fitting unidimensional factor-analytic solutions in which item local dependences are included.

Author(s)

David Navarro-Gonzalez

Fabia Morales-Vives

Pere Joan Ferrando

References

Ferrando, P. J., & Morales-Vives, F. (2023). Is it quality, is it redundancy, or is model inadequacy? Some strategies for judging the appropriateness of high-discrimination items. Anales de Psicologia, 39(3), 517. doi:10.6018/analesps.535781

Ferrando, P. J., Navarro-Gonzalez, D., & Lorenzo-Seva, U. (2019). Assessing the Quality and Effectiveness of the Factor Score Estimates in Psychometric Factor-Analytic Applications. Methodology, 15(3), 119-127. doi:10.1027/16142241/a000170

Raykov, T. (2001). Estimation of congeneric scale reliability using covariance structure analysis with nonlinear constraints. British Journal of Mathematical and Statistical Psychology, 54(2), 315-323. doi:10.1348/000711001159582

Examples

```
## Example data set, containing the fitted model of a 17 item questionnaire, with 400 observations.
## The model was fitted as linear factor-analytic solution, and it contains 4 doublets
## (items 3-10, 12-13, 14-16 and 11-15) :

SINRELEF.LD(L = FIQ_CONT_L, PSI = FIQ_CONT_VAR, doublet_list = FIQ_CONT_ITEMS_D, cor_doublet =
  FIQ_CONT_VALUES_D, model = "linear", N=400)
```

FIQ400 *FIQ database.*

Description

A database to be used as example in the functions included on SINRELEF.LD package. It is part of the data from the study by Dueñas et al. (2022).

Usage

```
data("FIQ400")
```

Format

A data frame with 400 observations and 17 variables, ranged between 1 and 4.

Details

The participants in this study were parents of adolescents who were enrolled in secondary school. The parents completed the Spanish adaptation of the Family Involvement Questionnaire-High School Version (FIQ-HS), which assesses parental family involvement in the education of their sons and daughters. More specifically, we have randomly selected 400 participants from this study, and we have used their data in the 17 items of the Home-based activities subscale. These items have 4 response options (rarely, sometimes, often and always). We have chosen this subscale because the study by Dueñas et a. (2022) showed that the error terms of some pairs of items were substantially correlated. According to the authors, this was expected because the corresponding item stems were either very similarly worded or tapped similar (although not identical) content.

References

Dueñas, J. M., Morales-Vives, F., Camarero-Figuerola, M., Tierno-García, J. M. (2022). Spanish adaptation of The Family Involvement Questionnaire-High School: Version for parents. Psicología Educativa, 28(1), 31-38. doi:10.5093/psed2020a21

Examples

```
data(FIQ400)
```

SINRELEF.LD	*Score Information, reliability, and relative efficiency in measures that contain locally-dependent items.*

Description

`SINRELEF.LD` implements an approach aimed at assessing the accuracy and effectiveness of raw scores obtained in scales that contain locally dependent items. The program uses as input the calibration (structural) item estimates obtained from fitting extended unidimensional factor-analytic solutions in which the existing local dependencies are included. Measures of reliability (Omega) and information are proposed at three levels: (a) total score, (b) bivariate-doublet, and (c) item-by-item deletion, and are compared to those that would be obtained if all the items had been locally independent. All the implemented procedures can be obtained from: (a) linear factor-analytic solutions in which the item scores are treated as approximately continuous, and (b) non-linear solutions in which the item scores are treated as ordered-categorical.

Usage

```
SINRELEF.LD(L, PSI, THRES, ncat, model = 'linear', doublet_list, cor_doublet, N,
  CI = 90, display = TRUE)
```

Arguments

L	A vector containing the item loading estimates in the unidimensional factor-analytic (FA) solution.
PSI	A vector containing the item residual standard deviations.
THRES	A vector containing the item thresholds. It is also possible to import a matrix (number of categories x number of items).
ncat	Number of item response categories (for the graded model only).
model	The factor-analytic model used for calibrating the item set, being 'linear' for the standard FA model or 'graded' for the non-linear ordered-categorical FA model.
doublet_list	A vector containing the pairs of items with correlated specificities. It is also valid to import a two column matrix, containing each pair of doublets.
cor_doublet	A vector containing the residual correlations corresponding to each pair, specified in doublet_list.
N	The number of observations in the sample.
CI	Choice of the confidence level for the intervals (90 or 95, 90 by default).
display	Determines if the output will be displayed in the console, TRUE by default. If it is TRUE, the output is returned silently and if it is FALSE, the output is returned in the console.

Details

SINRELEF.LD implements a series of procedures developed by the authors of the package, which have two main purposes: the first is to assess the real amount of reliability and information provided by the item and scale scores when the scale contains locally dependent items. The second is to compare the results of the assessment to the results that would have been obtained if all the items had been locally independent.

The procedures are intended at three score levels. First, at the total score, SINRELEF.LD provides the Omega reliability estimate and the amount of score information obtained taking in to account the local dependencies as well as the estimates obtained if local independence had been assumed. Furthermore, a relative efficiency index that assesses the loss of efficiency of the scores due to the local dependencies is provided. Second, at the bivariate level, for each specified doublet, SINRELEF.LD provides the corresponding relative efficiency estimate. Finally, at the single item level, SINRELEF.LD provides estimates of the change in reliability and relative information if the item was omitted from the scale.

The indices implemented in the function assume that the items have been calibrated using an extended factor-analytic solution that models the existing local dependencies. So, the input of the function requieres the calibration estimates obtained by fitting a solution of this type (e.g. loadings, residual variances, and residual correlations) to be provided. This type of extended solutions can be obtained from widely available programs such as Mplus, FACTOR or lavaan package. Furthermore, the proposed approach works with solutions obtained from two types of factor-analytic models. First, is the linear model, in which the item scores are treated as approximately continuous. Second, is the non-linear model, based on the underlying variables approach in which the item scores are treated as orderered-categorical.

Finally, confidence intervals based on the Bollen-Stine empirical approach are proposed for all the indices provided in the package.

Value

omld	Omega reliability estimate taking in to account the item local dependences.
omli	Omega reliability estimate if all the items were locally independent.
relef	Score relative efficiency.
relef_doublet	Doublet score relative efficiency.
omega_del	Reliability estimate if the item was omitted.
r_info_del	Relative information if the item was omitted.

Author(s)

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References

Lorenzo-Seva, U., & Ferrando, P. J. (2006). FACTOR: A computer program to fit the exploratory factor analysis model. Behavior research methods, 38(1), 88-91. doi:10.3758/BF03192753

Muthén, L. K., & Muthén, B. O. (1998-2018). Mplus User's Guide. Sixth Edition. Los Angeles, CA: Muthén & Muthén.

Rosseel Y (2012). "lavaan: An R Package for Structural Equation Modeling." Journal of Statistical Software, 48(2), 1–36. doi:10.18637/jss.v048.i02.

Examples

```
## Example data set, containing the fitted model of a 17 item questionnaire, with 400 observations.
## The model was fitted as linear factor-analytic solution, and it contains 4 doublets
## (items 3-10, 12-13, 14-16 and 11-15) :

SINRELEF.LD(L = FIQ_CONT_L, PSI = FIQ_CONT_VAR, doublet_list = FIQ_CONT_ITEMS_D, cor_doublet =
  FIQ_CONT_VALUES_D, model = "linear", N=400)

## The original subset can be found in:
data(FIQ400)
```

SINRELEF.LD_GUI	*Score Information, reliability, and relative efficiency in measures that contain locally-dependent items, using a Graphical User Interface.*

Description

A Graphical User Interface (GUI) caller for the SINRELEF.LD main function. The GUI contains all the required inputs for the execution of SINRELEF.LD, as well as the output display on console.

For more info about the inputs required, or the output information, please SINRELEF.LD.

Usage

```
SINRELEF.LD_GUI()
```

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Examples

```
#Type SINRELEF.LD_GUI() to open the GUI.
```

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