Package 'IRTtestinfo'

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Type Package

Title IRTtestinfo

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Description Functions that estimate the levels of attenuation in correlation that occurs for two variables, given the IRT test information values for the two measures. The package also provides the test information functions for a number of assessment instruments in the literature.

Imports MASS, lattice, grDevices

LazyLoad yes

LazyData yes

License GPL (>= 2)

NeedsCompilation no

R topics documented:

IRTtestinfo-package *IRTtestinfo*

Description

This package provides functions that estimate the levels of attenuation in correlation that occurs for two variables, given the IRT test information values for the two measures. The focus is on the effect size attenuation that is caused by the (often fluctuating) levels of measurement error. It also provides the test information functions for a number of assessment instruments in the literature.

constant_info *Effect size attenuation for constant levels of IRT test information*

Description

What constitutes an adequate level of IRT test information? For example, at what levels of test information do effect size attenuation problems occur? This function displays the proportionate reductions in the magnitudes of correlation coefficients that occur for two measures with constant test information values (following O'Connor, 2018a, 2018b). The plot data are produced by converting the test information values into SEM values, adding these degrees of location-specific measurement error to two random normal variables (e.g., N = 1000) which has a specific, previously set correlation, and then computing the observed correlation for the altered variables. The procedure is repeated Nsets times for each value of test information. The means of the correlations are used as the data points for the plot. The proportionate reductions in the effect sizes are the same across levels of true population correlation. The function permits users to specify alternative values for the sampling variances, such as the values they may have for their own samples, and to observe the consequences for effect size attenuation.

Usage

```
constant_info(test1info,
              test2info,
              Nsets = 100,
              Ncases = 1000,
              rTruePop = .95,
              distribMN1 = 0, distribMN2 = 0, distribSD1 = 1, distribSD2 = 1)
```

Arguments

test1info	(required) A set or range of information values for test 1.
test2info	(required) A set or range of information values for test 2.
Nsets	(optional) The number of random data sets to be used in the analyses. The default = 100.
Ncases	(optional) The number of cases for each random data set. The default = 1000.
rTruePop	(optional) The true, population correlation to be used in the analyses. The default = .95.
distribMN1	(optional) The Measure 1 mean to be used for the random data sets. The default = 0.

`distribMN2` (optional) The Measure 2 mean to be used for the random data sets. The default = 0.

`distribSD1` (optional) The Measure 1 standard deviation to be used for the random data sets. The default = 1.

`distribSD2` (optional) The Measure 2 standard deviation to be used for the random data sets. The default = 1.

Details

It is best to first run the function using few values for test1info and test12info, in order to become familiar with how the function works. For example, try seq(1:5) for both. For smoother and more precise plots, use more numerous, finer values, such as seq(1, 10, by = .1), which will take much longer to produce results.

Set the true, population correlation to be used in the analyses (rTruePop) to a high value, e.g., .95. Fewer random data sets will be required for the findings to converge. The results will be identical to those for lower rTruePop values.

Value

The displayed output is a heatmap. The returned output is a list with the plot data.

Author(s)

Brian P. O'Connor

References

O'Connor, B. P. (2018a). Clarifications regarding test information and reliability, and new methods for estimating attenuation due to measurement error: Reply to Markon (2018). Psychological Assessment, 30(8), 1010-1012.

O'Connor, B. P. (2018b). An illustration of the effects of fluctuations in test information on measurement error, the attenuation of effect sizes, and diagnostic reliability. Psychological Assessment, 30(8), 991-1003.

Examples

```
constant_info(
   test1info <- c(1,2,3,4,5),
   test2info <- c(1,2,3,4,5),
   Nsets = 100,
   Ncases = 1000,
   rTruePop = .95,
   distribMN1 = 0,
   distribMN2 = 0,
   distribSD1 = 1,
   distribSD2 = 1 )
```

`fluctuating_info` *Effect size attenuation for fluctuating levels of IRT test information*

Description

This function estimates the level of attenuation in correlation that occurs for two variables, given the IRT test information functions for the two measures (following O'Connor, 2018a, 2018b). The degree of attenuation is determined empirically rather than by formulas. The function preserves and takes into account the distributions of the user's sample-specific raw data values, when such values are provided. The function answers these two questions: When there are two normally-distributed correlated variables in a population, how much attenuation due to measurement error is caused by the fluctuating levels of test information for the variables? What is the corrected-for-attenuation estimate of the correlation between the two variables?

Usage

```
fluctuating_info(plotdata1, plotdata2, rawdata1=NULL, rawdata2=NULL,
                   rTruePop = .95, rObserved = NULL, Nsets = 100,
                 distribMN1 = 0, distribMN2 = 0, distribSD1 = 1, distribSD2 = 1)
```

Arguments

`plotdata1`	(required) A dataframe with the test information & corresponding z values for Measure 1. The z values should be the first column of scores & the information values should be the second column of scores.
`plotdata2`	(required) A dataframe with the test information & corresponding z values for Measure 2. The z values should be the first column of scores & the information values should be the second column of scores.
`rawdata1`	(optional) A dataframe with the respondents' z scores for Measure 1.
`rawdata2`	(optional) A dataframe with the respondents' z scores for Measure 2.
`rTruePop`	(optional) The true, population correlation to be used in the analyses. The default = .95.
`rObserved`	(optional) An observed sample correlation.
`Nsets`	(optional) The number of random data sets to be used in the analyses. The default = 100.
`distribMN1`	(optional) The Measure 1 mean to be used for the random data sets. The default = 0.
`distribMN2`	(optional) The Measure 2 mean to be used for the random data sets. The default = 0.
`distribSD1`	(optional) The Measure 1 standard deviation to be used for the random data sets. The default = 1.
`distribSD2`	(optional) The Measure 2 standard deviation to be used for the random data sets. The default = 1.

Details

The analyses are conducted while preserving the variable distributions in the raw data. The function does so while first preserving the distribution for Measure 1, and then again while first preserving the distribution for Measure 2. The results for Measures 1 & 2 should be highly similar. If they are not highly similar, then re-run the analyses using a larger number of random data sets. The findings for the 2 measures will eventually converge. Tip: Set the true, population correlation to be used in the analyses (rTruePop) to a high value, e.g., .95. Fewer random data sets will be required for the findings for the two measures to converge. The results will be identical to those for lower rTruePop values, which would require more random dataset processing before convergence.

The analyses are conducted on the z values that correspond with the scale raw scores. The "rawdata" values should be standardized. When standardizing the scores, it is generally better to use the means and SDs from normative data for each measure, i.e., rather than using the (usually smaller) sample means and SDs.

If both rawdata1 and rawdata2 are provided, then the function will compute the observed correlation between the two variables. The output will include an estimate of the true population correlation, given the test information functions, the variable distributions, and the observed correlation.

If only one of rawdata1 or rawdata2 is provided, then the function will conduct the analyses using the distribution of the provided data along with random normal generated data, for the same number of cases, for the other variable. If a value for rObserved is not provided, then the function will return the proportionate reduction in effect size. If a value for rObserved is provided, then the output will include an estimate of the true population correlation, given the test information functions, the one provided variable distribution, and the provided observed correlation.

If neither rawdata1 or rawdata2 is provided, then the function will conduct the analyses using random normal generated data for both variables, for 1000 cases. If a value for rObserved is not provided, then the function will return the proportionate reduction in effect size. If a value for rObserved is provided, then the output will include an estimate of the true population correlation, given the test information functions and the provided observed correlation.

Value

The displayed output includes the set, population correlation for the analyses, the mean random data correlation before the addition of measurement error when using the raw data distribution for Measure 1; the mean random data correlation before the addition of measurement error when using the raw data distribution for Measure 2; the mean random data correlation after the addition of measurement error when using the raw data distribution for Measure 1; the mean random data correlation after the addition of measurement error when using the raw data distribution for Measure 2; the proportionate reduction in correlation when using the raw data distribution for Measure 1; the proportionate reduction in correlation when using the raw data distribution for Measure 2; the raw data correlation between the two measures; the corrected-for-attenuation correlation when using the raw data distribution for Measure 1; and the corrected-for-attenuation correlation when using the raw data distribution for Measure 2.

The returned output is a list with the following elements:

`rTruePop`	the set, population correlation for the analysess
`propred1`	the proportionate reduction in correlation when using the raw data distribution for Measure 1
`propred2`	the proportionate reduction in correlation when using the raw data distribution for Measure 2
`correctedR1`	the corrected-for-attenuation correlation when using the raw data distribution for Measure 1

correctedR2 the corrected-for-attenuation correlation when using the raw data distribution for Measure 2

Author(s)

Brian P. O'Connor

References

O'Connor, B. P. (2018a). Clarifications regarding test information and reliability, and new methods for estimating attenuation due to measurement error: Reply to Markon (2018). Psychological Assessment, 30(8), 1010-1012.

O'Connor, B. P. (2018b). An illustration of the effects of fluctuations in test information on measurement error, the attenuation of effect sizes, and diagnostic reliability. Psychological Assessment, 30(8), 991-1003.

Examples

```
# when both test information functions and raw data are provided
fluctuating_info(
    plotdata1 = testinfo_data_PCL_SV,
    plotdata2 = testinfo_data_NEO_FFI_A,
    rawdata1 = zscores_data_PCL_SV_NEO_FFI_A[,1],
    rawdata2 = zscores_data_PCL_SV_NEO_FFI_A[,2],
    rTruePop = .95,
    Nsets = 100,
    distribMN1 = 0,
    distribMN2 = 0,
    distribSD1 = 1,
    distribSD2 = 1 )

# when information functions but no raw data are provided
fluctuating_info(
    plotdata1 = testinfo_data_PCL_SV,
    plotdata2 = testinfo_data_NEO_FFI_A,
    rTruePop = .95,
    rObserved = .25,
    distribMN1 = 0,
    distribMN2 = 0,
    distribSD1 = 1,
    distribSD2 = 1 )


## Not run:

# # the next, example demonstrates how to obtain and use test information values
# # from the grm function (ltm package) and from the mirt function (mirt package)
# library(ltm)
# library(mirt)

# # obtain the test information and z values using the grm function (ltm package)
# # for the Science data in the ltm package
# # run the IRT analyses using grm
# test1results_<- grm(ltm::Science[c(1,3,4,7)])
# # display the test information curve
```

```
# plot(test1results, type = "IIC", z = seq(-4, 4, length = 100), items = 0) _
# # obtain the test information values & z scores
# test1info <- plot(test1results, type = "IIC", z = seq(-4, 4, length = 1000), items = 0)
# head(test1info); dim(test1info); summary(test1info)
# # The z values are in the first column & the test information
# # values are in the second column.


# # obtain the test information and z values using the mirt function (mirt package)
# # for generated data as in the mirt package example
# set.seed(12345)
# a <- matrix(abs(rnorm(15,1,.3)), ncol=1)
# d <- matrix(rnorm(15,0,.7),ncol=1)
# d <- cbind(d, d-1, d-2)
# itemtype <- rep('graded', nrow(a))
# N <- 1000
# dataset2 <- simdata(a, d, N, itemtype)
# # run the IRT analyses using mirt
# test2results <- mirt(dataset2, 1, itemtype = "graded", SE=TRUE)
# # display the test information curve
# plot(test2results, type ="info", theta_lim = c(-4,4))
# # obtain the test information values & z scores
# Theta <- matrix(seq(-4,4,.01))
# test2info <- cbind(Theta, testinfo(test2results, Theta))
# head(test2info); dim(test2info); summary(test2info)
# # The z values are in the first column & the test information
# # values are in the second column.


# fluctuating_info(
#  plotdata1 = test1info,
#  plotdata2 = test2info,
#  rTruePop = .95,
#  rObserved = .25,
#  Nsets = 100,
#  distribMN1 = 0,
#  distribMN2 = 0,
#  distribSD1 = 1,
#  distribSD2 = 1 )

## End(Not run)
```

`testinfo_data_AATOCAR5`

testinfo_data_AATOCAR5

Description

A data frame with IRT test information coefficients and the corresponding z values for the Authority Acceptance scale from the Teacher Observation of Classroom Adaptation-Revised test, based on responses from 8,820 participants (Wu et al., 2012). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_AATOCAR5)
```

Source

Wu, J., King, K.M., Witkiewitz, K., Racz, S.J., McMahon, R.J., & Conduct Problems Prevention Research Group. (2012). Item analysis and differential item functioning of a brief conduct problem screen._Psychological Assessment, 24,_444-454.

Examples

```
head(testinfo_data_AATOCAR5)

plot(testinfo_data_AATOCAR5, type="l",
     ylim=c(0,(max(testinfo_data_AATOCAR5[,2])+1)),
     xlim=c((min(testinfo_data_AATOCAR5[,1])-1),(max(testinfo_data_AATOCAR5[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

---

testinfo_data_AMT *testinfo_data_AMT*

Description

A data frame with IRT test information coefficients and the corresponding z values for the Autobiographical Memory Test, based on responses from 194 participants (Monahan et al., 2001). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_AMT)
```

Source

Griffith, J. W., Kleim, B., Sumner, J. A., & Ehlers, A. (2012). The factor structure of the Autobiographical Memory Test in recent trauma survivors. Psychological Assessment, 24, 640- 646.

Examples

```
head(testinfo_data_AMT)

plot(testinfo_data_AMT, type="l",
     ylim=c(0,(max(testinfo_data_AMT[,2])+1)),
     xlim=c((min(testinfo_data_AMT[,1])-1),(max(testinfo_data_AMT[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

testinfo_data_BDI *testinfo_data_BDI*

Description

A data frame with IRT test information coefficients and the corresponding z values for the Beck Depression Inventory, based on responses from 1709 participants (Olino et al., 2012). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_BDI)
```

Source

Olino, T.M., Yu, L., Klein, D.N., Rohde, P., Seeley, J.R., Pilkonis, P.A. & Lewinsohn, P.M._ (2012). Measuring depression using item response theory: An examination of three measures of depressive symptomatology. International Journal of Methods in Psychiatric Research, 21, 76-85.

Examples

```
head(testinfo_data_BDI)

plot(testinfo_data_BDI, type="l",
     ylim=c(0,(max(testinfo_data_BDI[,2])+1)),
     xlim=c((min(testinfo_data_BDI[,1])-1),(max(testinfo_data_BDI[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

testinfo_data_MMPI_SC *testinfo_data_MMPI_SC*

Description

A data frame with IRT test information coefficients and the corresponding z values for the MMPI-2-RF Somatic Complaints (RC1) Scale, based on responses from 399 participants (Thomas et al., 2010). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_MMPI_SC)
```

Source

Thomas, M. L., & Locke, D. E. C. (2010). Psychometric properties of the MMPI-2-RF Somatic Complaints (RC1) scale._Psychological Assessment,_22, 492-503.

Examples

```
head(testinfo_data_MMPI_SC)

plot(testinfo_data_MMPI_SC, type="l",
     ylim=c(0,(max(testinfo_data_MMPI_SC[,2])+1)),
     xlim=c((min(testinfo_data_MMPI_SC[,1])-1),(max(testinfo_data_MMPI_SC[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

`testinfo_data_NEO_FFI_A`

testinfo_data_NEO_FFI_A

Description

A data frame with IRT test information coefficients and the corresponding z values for the NEO-FFI Antagonism-Agreeableness scale, based on responses from 1229 participants in the MacArthur Violence Risk Assessment Study dataset (Monahan et al., 2001). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_NEO_FFI_A)
```

Source

Monahan, J., Steadman, H., Silver, E., Appelbaum, P., Robbins, P., Mulvey, E., Roth, L., Grisso, T., & Banks, S. (2001). Rethinking Risk Assessment: The MacArthur Study of Mental Disorder and Violence. New York: Oxford University Press.

Examples

```
head(testinfo_data_NEO_FFI_A)

plot(testinfo_data_NEO_FFI_A, type="l",
     ylim=c(0,(max(testinfo_data_NEO_FFI_A[,2])+1)),
     xlim=c((min(testinfo_data_NEO_FFI_A[,1])-1),(max(testinfo_data_NEO_FFI_A[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

testinfo_data_PCL_R *testinfo_data_PCL_R*

Description

A data frame with IRT test information coefficients and the corresponding z values for the Psychopathy Checklist-Revised (PCL-R), based on responses from 715 participants (Cooke et al., 2001). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_PCL_R)
```

Source

Cooke, D. J., Kosson, D. S. & Michie, C. (2001)_Psychopathy and ethnicity: structural, item and test generalizability of the Psychopathy Checklist Revised (PCL-R) in Caucasian and African-American participants._Psychological Assessment,_13,_531- 542.

Examples

```
head(testinfo_data_PCL_R)

plot(testinfo_data_PCL_R, type="l",
     ylim=c(0,(max(testinfo_data_PCL_R[,2])+1)),
     xlim=c((min(testinfo_data_PCL_R[,1])-1),(max(testinfo_data_PCL_R[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

testinfo_data_PCL_SV *testinfo_data_PCL_SV*

Description

A data frame with IRT test information coefficients and the corresponding z values for the PCL-SV scale, based on responses from 1229 participants in the MacArthur Violence Risk Assessment Study dataset (Monahan et al., 2001). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_PCL_SV)
```

Source

Monahan, J., Steadman, H., Silver, E., Appelbaum, P., Robbins, P., Mulvey, E., Roth, L., Grisso, T., & Banks, S. (2001). Rethinking Risk Assessment: The MacArthur Study of Mental Disorder and Violence. New York: Oxford University Press.

Examples

```
head(testinfo_data_PCL_SV)

plot(testinfo_data_PCL_SV, type="l",
     ylim=c(0,(max(testinfo_data_PCL_SV[,2])+1)),
     xlim=c((min(testinfo_data_PCL_SV[,1])-1),(max(testinfo_data_PCL_SV[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the PCL-SV Scale", font.lab=2, cex.lab=1.3)

## Not run:
```

---

testinfo_data_PICTo *testinfo_data_PICTo*

Description

A data frame with IRT test information coefficients and the corresponding z values for the Psychological Inventory of Criminal Thinking Styles, based on responses from 2872 participants (Walters et al., 2011). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_PICTo)
```

Source

Walters, G. D., Hagman, B. T., & Cohn, A. M. (2011). Toward a hierarchical model of criminal thinking: Evidence from item response theory and confirmatory factor analysis. Psychological Assessment, 23, 925-936.

Examples

```
head(testinfo_data_PICTo)

plot(testinfo_data_PICTo, type="l",
     ylim=c(0,(max(testinfo_data_PICTo[,2])+1)),
     xlim=c((min(testinfo_data_PICTo[,1])-1),(max(testinfo_data_PICTo[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

testinfo_data_RAPI *testinfo_data_RAPI*

Description

A data frame with IRT test information coefficients and the corresponding z values for the Rutgers Alcohol Problem Index, based on responses from 895 participants (Neal et al., 2006). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_RAPI)
```

Source

Neal, D. J., Corbin, W. R., & Fromme, K. (2006). Measurement of alcohol-related consequences among high school and college students: Application of item response models to the Rutgers Alcohol Problem Index. Psychological Assessment, 18, 402_414.

Examples

```
head(testinfo_data_RAPI)

plot(testinfo_data_RAPI, type="l",
     ylim=c(0,(max(testinfo_data_RAPI[,2])+1)),
     xlim=c((min(testinfo_data_RAPI[,1])-1),(max(testinfo_data_RAPI[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

testinfo_data_SOGSRA *testinfo_data_SOGSRA*

Description

A data frame with IRT test information coefficients and the corresponding z values for the South Oaks Gambling Screen-Revised for Adolescents, based on responses from 981 participants (Chiesi et al., 2012). The z values are in the first column and the test information values are in the second column.

Usage

```
data(testinfo_data_SOGSRA)
```

Source

Chiesi, F, Donati, M. A., Galli, S., & Primi, C. (2013). The Suitability of the SOGS-RA as Screening Tool: Item Response Theory-Based evidence. Psychology of Addictive Behaviors, 27(1), 287-293.

Examples

```
head(testinfo_data_SOGSRA)

plot(testinfo_data_SOGSRA, type="l",
     ylim=c(0,(max(testinfo_data_SOGSRA[,2])+1)),
     xlim=c((min(testinfo_data_SOGSRA[,1])-1),(max(testinfo_data_SOGSRA[,1])+1)),
     xlab="Latent Trait", ylab="Test Information",
     main="Test Information Function for the NEO-FFI-A Scale", font.lab=2, cex.lab=1.3)
## Not run:
```

---

zscores_data_PCL_SV_NEO_FFI_A

zscores_data_PCL_SV_NEO_FFI_A

Description

A data frame with respondent z scores on the NEO-FFI Antagonism-Agreeableness scale and on the PCL-SV scale, based on responses from 1229 participants in the MacArthur Violence Risk Assessment Study dataset (Monahan et al., 2001).

Usage

```
data(zscores_data_PCL_SV_NEO_FFI_A)
```

Source

Monahan, J., Steadman, H., Silver, E., Appelbaum, P., Robbins, P., Mulvey, E., Roth, L., Grisso, T., & Banks, S. (2001). Rethinking Risk Assessment: The MacArthur Study of Mental Disorder and Violence. New York: Oxford University Press.

Examples

```
## Not run:
head(zscores_data_PCL_SV_NEO_FFI_A)


## End(Not run)
```

Index