Package 'subscore'

August 17, 2016

Title Computing Subscores in Classical Test Theory

Version 1.3

Author Shenghai Dai [aut, cre],
Xiaolin Wang [aut],
Dubravka Svetina [aut]

Maintainer Shenghai Dai <dais@indiana.edu>

Description Functions for computing test subscores using methods applicable to classical test theory (CTT) scores. This package enables two sets of subscoring methods within the framework of CTT: (1) Wainer's augmentation method, and (2) Haberman's three subscoring methods. The package also includes the function to compute Proportional Reduction of Mean Squared Errors (PRMSEs) proposed by Haberman's, which are used to examine whether test subscores are of added value.

Depends R (>= 3.2.5), CTT, stats

NeedsCompilation no

LazyData true

License GPL (>= 2)

RoxygenNote 5.0.1

Repository CRAN

Date/Publication 2016-08-17 10:40:33

R topics documented:

CTTsub *This main function estimates true subscores using different methods based on original CTT scores.*

Description

This function estimates true subscores using methods introduced in Haberman (2008) and Wainer et al. (2001).

Usage

```
CTTsub(test.data, method = "Haberman")
```

Arguments

test.data	A list that contains item responses of all subtests and the total test, which can be obtained using function "data.prep".
method	Subscore estimation methods. method="Haberman" (by default) represents the three methods propose by Harberman (2008). method="Wainer" represents Wainer's augmented method.

Value

summary	Summary of estimated subscores (e.g., mean, sd).
PRMSE	PRMSEs of estimated subscores (for Haberman's methods only).
subscore.original	Original subscores and total score.
estimated.subscores	Subscores computed using selected methods. Three sets of subscores will be returned if method = "Haberman".

References

Haberman, S. J. (2008). "When can subscores have value?." Journal of Educational and Behavioral Statistics, 33(2), 204-229.

Wainer, H., Vevea, J., Camacho, F., Reeve, R., Rosa, K., Nelson, L., Swygert, K., & Thissen, D. (2001). "Augmented scores - "Borrowing strength" to compute scores based on small numbers of items" In Thissen, D. & Wainer, H. (Eds.), Test scoring (pp.343 - 387). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Examples

```
# Transfering original scored data to a list format
# that can be used in other functions.
test.data<-data.prep(scored.data,c(3,15,15,20))
#-------------------------------------------
# Estimating subscores using Haberman's methods
```

```
CTTsub(test.data,method="Haberman") # Estimating subscores using Haberman's methods

# Obtaining PRMSEs for the three methods
CTTsub(test.data,method="Haberman")$PRMSE

# Obtaining descriptive statistics summary for estimated subscores
CTTsub(test.data,method="Haberman")$summary

# Obtaining raw subscores
CTTsub(test.data,method="Haberman")$subscore.original

# Obtaining subscores that are estimated as a function of the observed subscores
CTTsub(test.data,method="Haberman")$subscore.RegOnSub

# Obtaining subscores that are estimated as a function of the observed total score
CTTsub(test.data,method="Haberman")$subscore.RegOnTot

# Obtaining subscores that are estimated as a function of
# both the observed subscores and the observed total score.
CTTsub(test.data,method="Haberman")$subscore.RegOnTotSub

#-----------------------------------------
# Estimating subscores using Wainer's method
CTTsub(test.data,method="Wainer")

# Obtaining descriptive statistics summary for subscores
CTTsub(test.data,method="Wainer")$summary

# Obtaining original subscores
CTTsub(test.data,method="Wainer")$subscore.original

# Obtaining subscores that are estimated using Wainer's augmentation method
CTTsub(test.data,method="Wainer")$subscore.augmented
```

`data.prep` *This function prepares data into a requried list format*

Description

This function generates a list of datasets using the scored original dataset, which can be used as objects in subscore computing functions.

Usage

```
data.prep(scored.data, subtest.infor)
```

Arguments

scored.data	Original scored dataset with rows as individuals and columns as items.
subtest.infor	A numerical vector. The first number indicates the number of subtests, followed by numbers o items on each subscale.

Value

A list that contains subscale responses and the total test response.

Examples

```
subtest.infor<-c(3,15,15,20)
# This test consists of 3 subtests, which have 15, 15 and 20 items respectively.
test.data<-data.prep(scored.data,subtest.infor)
```

RegOnSub *Computing subscores using Haberman's method based on observed subscores.*

Description

This function estimate true subscores based on observed subscores, using the method introduced by Haberman (2008).

Usage

```
RegOnSub(test.data)
```

Arguments

test.data	A list that contains subscale responses and the total test responses. It can be obtained using the function 'data.prep'.

Value

summary	Summary of obtained subscores (e.g., mean, sd).
PRMSE	PRMSEs of obtained subscores (for Haberman's methods only).
subscore.original	Original subscores and total score.
subscore.RegOnSub	Subscores that are estimated based on the observed subscore.

References

Haberman, S. J. (2008). "When can subscores have value?." Journal of Educational and Behavioral Statistics, 33(2), 204-229.

Examples

```
# Transfering scored response data to the requried list format
test.data<-data.prep(scored.data,c(3,15,15,20))

#Estimate true subscores using Hamerman's method based on observed subscores
RegOnSub(test.data)

RegOnSub(test.data)$summary
RegOnSub(test.data)$PRMSE
RegOnSub(test.data)$subscore.RegOnSub
```

`RegOnTot` *Computing subscores using Haberman's method based on observed total scores.*

Description

This function estimates true subscores based on observed total scores using the method introduced by Haberman (2008).

Usage

```
RegOnTot(test.data)
```

Arguments

`test.data`	A list that contains subscale responses and the total test responses. It can be obtained using the function 'data.prep'.

Value

`summary`	Summary of obtained subscores (e.g., mean, sd).
`PRMSE`	PRMSEs of obtained subscores (for Haberman's methods only).
`subscore.original`	Original observed subscores and total score.
`subscore.RegOnTot`	Subscores that are estimated based on the observed total score.

References

Haberman, S. J. (2008). "When can subscores have value?." Journal of Educational and Behavioral Statistics, 33(2), 204-229.

Examples

```
test.data<-data.prep(scored.data,c(3,15,15,20))

RegOnTot(test.data)

RegOnTot(test.data)$summary
RegOnTot(test.data)$PRMSE
RegOnTot(test.data)$subscore.RegOnTot
```

RegOnTotSub *Computing subscores using Haberman's method based on both observed total scores and observed subscores.*

Description

This function estimate true subscores based on both observed stotal scores and observed subscores using the method introduced by Haberman (2008).

Usage

```
RegOnTotSub(test.data)
```

Arguments

test.data	A list that contains subscale responses and the total test responses. It can be obtained using the function 'data.prep'.

Value

summary	Summary of obtained subscores (e.g., mean, sd).
PRMSE	PRMSEs of obtained subscores (for Haberman's methods only).
subscore.original	Original observed subscores and total score.
subscore.RegOnTotSub	Subscores that are estimated based on both the observed total score and observed subscore.

References

Haberman, S. J. (2008). "When can subscores have value?." Journal of Educational and Behavioral Statistics, 33(2), 204-229.

Examples

```
test.data<-data.prep(scored.data,c(3,15,15,20))

RegOnTotSub(test.data)

RegOnTotSub(test.data)$summary
RegOnTotSub(test.data)$PRMSE
RegOnTotSub(test.data)$subscore.RegOnTotSub
```

---

scored.data *Sample scored data*

Description

This dataset contains responses of 150 examinees to three subscales. These subscales consist of 15, 15, and 20 items respectively.

Usage

```
data("scored.data")
```

Format

A data frame with 150 observations on the following 50 variables.

`V1` Item 1

`V2` Item 2

`V3` Item 3

`V4` Item 4

`V5` Item 5

`V6` Item 6

`V7` Item 7

`V8` Item 8

`V9` Item 9

`V10` Item 10

`V11` Item 11

`V12` Item 12

`V13` Item 13

`V14` Item 14

`V15` Item 15

`V16` Item 16

`V17` Item 17

`V18` Item 18

`V19` Item 19

`V20` Item 20

`V21` Item 21

`V22` Item 22

`V23` Item 23

`V24` Item 24

`V25` Item 25

`V26` Item 26

`V27` Item 27

`V28` Item 28

`V29` Item 29

`V30` Item 30

`V31` Item 31

`V32` Item 32

`V33` Item 33

`V34` Item 34

`V35` Item 35

`V36` Item 36

`V37` Item 37

`V38` Item 38

`V39` Item 39

`V40` Item 40

`V41` Item 41

`V42` Item 42

`V43` Item 43

`V44` Item 44

`V45` Item 45

`V46` Item 46

`V47` Item 47

`V48` Item 48

`V49` Item 49

`V50` Item 50

Details

A dataset containing responses of 150 examinees to a total number of 50 items on three subscales (15, 15, 20 items respectively).

Examples

```
#read data
data(scored.data)
## maybe str(scored.data) ; plot(scored.data) ...
```

`test.data` *A list of objects that include both test information and subscores.*

Description

This list consists of four objects. The first three objects are item responses on the three subscales. The fourth object is the response data on the whole test.

Usage

```
data(test.data)
```

Format

The format is:

List of 4

$ subtest.1 :'data.frame': 150 obs. of 15 variables:

$ subtest.2 :'data.frame': 150 obs. of 15 variables:

$ subtest.3 :'data.frame': 150 obs. of 20 variables:

$ total.test:'data.frame': 150 obs. of 50 variables:

Details

Object 1: Responses of 150 participants to 15 items; Object 2: Responses of 150 participants to 15 items. Object 3: Responses of 150 participants to 20 items; Object 4: Responses of 150 participants to 20 items.

Examples

```
data(test.data)
```

`Wainer.score` *Estimating true subscores using Wainer's augmentation method*

Description

This function estimates subscores using Wainer's augmentation method (Wainer et. al., 2001). The central idea of this procedure is that, the estimation of subscores will be improved by shrinking the individual observed subscores towards some aggregate values (i.e., group mean subscores). The extent of the shrinkage depends on the closeness of the subscale being estimated with other subscales as well as reliabilities of all the subscales. Wainer's augmentation is a multivariate version of Kelly's formula (Kelly, 1947). For details of Wainer's augmentation subscoring method, please refer to Wainer et al. (2001).

Usage

```
Wainer.score(test.data)
```

Arguments

`test.data`	A list that contains datasets of all subtests and the total test, which can be obtained using function 'data.prep'.

Value

`summary`	It contains statistical summary of the augmented subscores (mean, sd, and reliability).
`Augmented.subscores`	It contains augmented subscores that are obtained using Wainer's method.

References

Wainer, H., Vevea, J., Camacho, F., Reeve, R., Rosa, K., Nelson, L., Swygert, K., & Thissen, D. (2001). "Augmented scores - "Borrowing strength" to compute scores based on small numbers of items" In Thissen, D. & Wainer, H. (Eds.), Test scoring (pp.343 - 387). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Examples

```
test.data<-data.prep(scored.data,c(3,15,15,20))

 Wainer.score(test.data)

 Wainer.score(test.data)$summary
 Wainer.score(test.data)$subscore.augmented
```

Index