Package: scDIFtest (via r-universe)

October 29, 2024

Type Package

Title Item-Wise Score-Based DIF Detection

Version 0.1.1

Description Detection of item-wise Differential Item Functioning (DIF) in fitted 'mirt', 'multipleGroup' or 'bfactor' models using score-based structural change tests. Under the hood the sctest() function from the 'strucchange' package is used.

Imports sandwich, strucchange, mirt, zoo,

Suggests mvtnorm, psychotree, knitr, rmarkdown, testthat

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.0

VignetteBuilder knitr

Repository https://ddebeer.r-universe.dev

RemoteUrl https://github.com/ddebeer/scdiftest

RemoteRef HEAD

RemoteSha 37cd2dc2adfe0f00a84e36eeda48bce209504bc1

Contents

scDIFtest *A score-based item-wise DIF test*

Description

A function that executes item-wise score-based DIF tests. After fitting an IRT model with mirt, the fitted object can be used to assess and test measurement invariance, using sctest. However, by default, all parameters of the fitted model are tested simultaneously. This function applies the sctest to test for item-wise DIF, in an efficient way.

Usage

```
scDIFtest(
  object,
  DIF_covariate = NULL,
  functional = NULL,
  item_selection = NULL,
  decorrelate = TRUE,
  ...
)
```

Arguments

object	a fitted model object of class SingleGroupClass-class or MultipleGroupClass-class, resulting from an IRT analysis using the mirt-package.
DIF_covariate	a vector with the person covariate to use for the DIF-test. The covariate can be categorical, ordered categorical or numerical.
functional	a character specifying the functional (or test statistic) to be used. See details for more information.
item_selection	either NULL or an integer vector selecting the item numbers. When items = NULL (the default), the DIF test is done for all items.
decorrelate	a logical. Should the process be decorrelated?
...	other arguments passed to the sctest method.

Details

For more information about the functional see the documentation of sctest.default or sctest.formula. When functional = NULL (which is the default), the functional is chosen based on the class of DIF_covariate. In this case, for integer and numeric vectors the Double Maximum ("DM") is used; for ordered vectors the Maximum Lagrange Multiplier Test for Ordered Groups ("maxLMo") is used; and for factor, character, and logical vectors the Lagrange Multiplier Test for Unordered Groups is used.

Value

An object of class `scDIFtest` scDIFtest-Methods, which is a list with three elements

tests A named list with a number of elements equal to the number of the items for which DIF should be detected. Each element contains information both about the test `single_test` as well as the `efpFunctional`

info A named list with two elements. `test_info` contains information such as used test statistic and the used covariate. `item_info` contains information about the items such as the item types as well as the column numbers of the score matrix that correspond to the estimated parameters of the items.

gefp The Generalized Empirical M-Fluctuation Process (`gefp`) based on the complete model with all the estimated parameters (see `gefp`).

Examples

```
library(mirt)
library(scDIFtest)
### data and model
dat <- expand.table(LSAT7)
nObs <- dim(dat)[1]
mod <- mirt(dat, 1, itemtype = "2PL", constr = list(c(2, 1)))

### DIF along a metric variable
###  the default test statistic is the Double Maximum (dm)
metric <- rnorm(nObs)
DIF_metric <- scDIFtest(mod, DIF_covariate = metric)
DIF_metric
plot(DIF_metric, 1)

### DIF along an ordered categorical variable
###  the default test statistic is the Maximum Lagrange Multiplier Test
###  for Ordered Groups (maxlmo)
ordered <- ordered(sample(1:5, size = nObs, replace = TRUE))
DIF_ordered <- scDIFtest(mod, DIF_covariate = ordered)
summary(DIF_ordered)

### Note that the Generalized Empirical M-Fluctuation Process (gefp) based on all
###  the estimated parameters in the model is an element of the resulting
###  scDIFtest object. This means that one can use this gefp to test the
###  general hypothesis of measurement invariance with respect to the
###  chosen covariate.
 strucchange::sctest(DIF_metric$gefp)
 strucchange::sctest(DIF_ordered$gefp)
```

scDIFtest-Methods *Methods for the scDIFtest-class*

Description

print, summary, and plot methods for objects of the scDIFtest-class, as returned by scDIFtest. See details for more information about the methods.

Usage

```
## S3 method for class 'scDIFtest'
print(x, item_selection = NULL, ...)

## S3 method for class 'scDIFtest'
summary(object, method = "fdr", ...)

## S3 method for class 'scDIFtest'
plot(x, item_selection = NULL, ...)
```

Arguments

x	an object of class scDIFtest
item_selection	either NULL or an integer vector selecting the item numbers. When items = NULL (the default), the DIF test is done for all items.
...	other arguments passed to the method.
object	an object of class scDIFtest
method	one of the strings in p.adjust.methods.

Details

The print method, whenitem_selection = NULL, gives a summary of all the tests that were executed (i.e., for all items). When specific items are selected, the print method is called repeatedly for each individual sctest corresponding with the selected items.

The summary method computes a data frame with a row for each item that was included in the test. The columns are:

item_type The estimated IRT model per item

n_est_pars The number of estimated parameters per item

stat The value for the used statistic per item

p_value The p-value per item

p_fdr The corrected p-value controlling the false discovery rate (Benjamini & Hochberg, 1995). See p.adjust for details.

The plot method call the plot method repeatedly for the gepf that corresponds with the executed score test for each of the selected items. When no items are selected, the plot method results in an error.

References

Benjamini, Y., and Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society Series B, 57,* 289-300.

Index