Package ‘scDIFtest’

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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
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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 Un-ordered Groups is used.
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 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)
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, when item_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.
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