Package 'DIFlasso'

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Type Package

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Description Performs DIFlasso as proposed by Tutz and Schauberger (2015) <doi:10.1007/s11336-013-9377-6>, a method to detect DIF (Differential Item Functioning) in Rasch Models. It can handle settings with many variables and also metric variables.

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DIFlasso-package *DIFlasso*

Description

A package to perform DIFlasso, a method to detect DIF (Differential Item Functioning) in Rasch Models. It can handle settings with many covariates and also metric covariates. The method is described is Tutz and Schauberger (2015). Also a refit function is provided.

Details

The main function is `DIFlasso`. The method assumes the DIFmodel from Tutz and Schauberger (2015) where a Group Lasso penalty is used for DIF detection. Computation is based on the function `grplasso`. `refitDIFlasso` provides a refit function for `DIFlasso`. Additionally, plot and print functions are provided.

Author(s)

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

See Also

`DIFlasso`, `refitDIFlasso`, `grplasso`

DIFlasso *A Penalty Approach to Differential Item Functioning in Rasch Models*

Description

A function to perform DIFlasso, a method to detect DIF (Differential Item Functioning) in Rasch Models. It can handle settings with many covariates and also metric covariates. The method is described in Tutz and Schauberger (2015).

Usage

```
DIFlasso(Y, X, l.lambda = 20, grouped = TRUE, trace = FALSE,
         df.type = c("YuanLin", "L2norm"))
```

Arguments

Y	Data frame (one row per person, one column per item) containing response. May only contain 0 or 1.
X	Data frame (one row per person, one column per covariate) containing covariates. Has to be standardized.
l.lambda	Length of the grid of tuning parameters for DIFlasso. Default is 20 different tuning parameters.
grouped	Should all parameters corresponding to one item be grouped? If grouped = FALSE, ordinary Lasso instead of GroupLasso is performed.
trace	Should the trace of the grplasso function be printed?
df.type	Specifies the type of degrees of freedom. Default is to the definition of degrees of freedom by Yuan and Lin (2006). If df.type = "L2norm", for every group (or parameter if grouped = FALSE), the ratio between the L2-norm of the penalized parameters and the parameters from the lowest tuning parameter is taken as degrees of freedom.

Details

The method assumes the DIFmodel from Tutz and Schauberger (2015) where a Group Lasso penalty is used for DIF detection. Computation is based on the function grplasso.

Value

theta	Estimated person abilities; one row per person, one column per tuning parameter
beta	Estimated item difficulties; one row per item, one column per tuning parameter
gamma	Estimated item-specific parameters; one row per item and covariate, one column per tuning parameter (first line: first item, first covariate; second line: first item, second covariate and so on)
P	Number of (valid) persons; removed persons are found in removed.persons
I	Number of items
m	Number of covariates
logLik	Log-likelihood
BIC	BIC
AIC	AIC
df	Degrees of freedom
refit.matrix	Design matrix for function refitDIFlasso
lambda	Sequence of tuning parameters used by grplasso
ref.item	Reference item
dif.mat	Estimates of the item-specific parameter estimates (at BIC-optimal lambda)
dif.items	Which items have been detected to be DIF items (at BIC-optimal lambda)?
names.y	Names of the items
names.x	Names of the covariates
removed.persons	Which persons have been removed because they either solved no item or all items?

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

Yuan, Ming and Lin, Yi (2006): *Model selection and estimation in regression with grouped variables*, Journal of the Royal Statistical Society B, 68(1), 49 - 67

See Also

refitDIFlasso, plot.DIFlasso, print.DIFlasso, grplasso

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

---

plot.DIFlasso *Plot Function for DIFlasso*

Description

Plots the estimates of the item-specific parameters of a DIFlasso object.

Usage

```
## S3 method for class 'DIFlasso'
plot(x, decreasing = TRUE, ...)
```

Arguments

x	DIFlasso object, created by DIFlasso
decreasing	Should the covariates be arranged by decreasing euclidian norm of their parameter estimates.
...	Further arguments to be passed to the plot function.

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

See Also

DIFlasso, print.DIFlasso

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

---

plot.DIFlasso.refit *Plot Function for refitDIFlasso*

Description

Plots the estimates of the item-specific parameters of a DIFlasso.refit object.

Usage

```
## S3 method for class 'DIFlasso.refit'
plot(x, decreasing = TRUE, ...)
```

Arguments

x	DIFlasso.refit object, created by refitDIFlasso
decreasing	Should the covariates be arranged by decreasing euclidian norm of their parameter estimates.
...	Further arguments to be passed to the plot function.

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

See Also

refitDIFlasso, print.DIFlasso.refit, DIFlasso

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

print.DIFlasso *Print Function for DIFlasso*

Description

Prints the most important output of a DIFlasso object.

Usage

```
## S3 method for class 'DIFlasso'
print(x, ...)
```

Arguments

x	DIFlasso object, created by DIFlasso
...	Further arguments to be passed to the print function.

Author(s)

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

See Also

DIFlasso, plot.DIFlasso

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

`print.DIFlasso.refit` *Print Function for refitDIFlasso*

Description

Prints the most important output of a DIFlasso.refit object.

Usage

```
## S3 method for class 'DIFlasso.refit'
print(x, ...)
```

Arguments

`x`	DIFlasso.refit object, created by `refitDIFlasso`
`...`	Further arguments to be passed to the `print` function.

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

See Also

`refitDIFlasso`, `plot.DIFlasso.refit`, `DIFlasso`

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

`refitDIFlasso` *Refit Function for DIFlasso*

Description

Performs the refit of a DIFlasso object. Only the items diagosed as DIF items will be used to perform a new fit of the final model.

Usage

```
refitDIFlasso(dif.obj)
```

Arguments

`dif.obj`	DIFlasso object, created by `DIFlasso`

Value

`theta`	Estimated person abilities after refit
`beta`	Estimated item difficulties after refit
`gamma`	Estimated item-specific parameters after refit; one row per covariate, one column per item
`P`	Number of persons
`I`	Number of items
`m`	Number of covariates
`ref.item`	Reference item
`dif.items`	Which items have been detected to be DIF items?
`names.y`	Names of the items
`names.x`	Names of the covariates

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References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

See Also

`print.DIFlasso.refit`, `plot.DIFlasso.refit`, `DIFlasso`

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

`simul.data` *Simulated Data Set*

Description

Simulated data set with 100 persons, 10 items and 3 (standardized) covariates. Items 1, 2 and 3 are DIF items.

Usage

```
data(simul.data)
```

Format

`Item1` Item 1, DIF item

`Item2` Item 2, DIF item

`Item3` Item 3, DIF item

`Item4` Item 4, non-DIF item

`Item5` Item 5, non-DIF item

`Item6` Item 6, non-DIF item

`Item7` Item 7, non-DIF item

`Item8` Item 8, non-DIF item

`Item9` Item 9, non-DIF item

`Item10` Item 10, non-DIF item

`CovBin1` Binary covariate (standardized)

`CovBin2` Binary covariate (standardized)

`CovMet` Metric covariate (standardized)

References

Tutz, Gerhard and Schauberger, Gunther (2015): *A Penalty Approach to Differential Item Functioning in Rasch Models*, Psychometrika, 80(1), 21 - 43

Examples

```
## Not run:
data(simul.data)

Y <- simul.data[,1:10]
X <- simul.data[,11:13]

m1 <- DIFlasso(Y = Y, X = X, trace = TRUE)
print(m1)
plot(m1)

m2 <- refitDIFlasso(m1)
print(m2)
plot(m2)

## End(Not run)
```

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