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Type Package

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Description Contains tools for survey statistics (especially in educational assessment) for datasets with replication designs (jackknife, bootstrap, replicate weights; see Kolenikov, 2010; Pfefferman & Rao, 2009a, 2009b, <doi:10.1016/S0169-7161(09)70003-3>, <doi:10.1016/S0169-7161(09)70037-9>); Shao, 1996, <doi:10.1080/02331889708802523>). Descriptive statistics, linear and logistic regression, path models for manifest variables with measurement error correction and two-level hierarchical regressions for weighted samples are included. Statistical inference can be conducted for multiply imputed datasets and nested multiply imputed datasets and is in particularly suited for the analysis of plausible values (for details see George, Oberwimmer & Itzlinger-Bruneforth, 2016; Bruneforth, Oberwimmer & Robitzsch, 2016; Robitzsch, Pham & Yanagida, 2016). The package development was supported by BIFIE (Federal Institute for Educational Research, Innovation and Development of the Austrian School System; Salzburg, Austria).

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Enhances Hmisc, intsvy, LSAmitR

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License GPL (>= 2)

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NeedsCompilation yes

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`BIFIEsurvey-package` *Tools for Survey Statistics in Educational Assessment*

Description

Contains tools for survey statistics (especially in educational assessment) for datasets with replication designs (jackknife, bootstrap, replicate weights; see Kolenikov, 2010; Pfefferman & Rao, 2009a, 2009b, <doi:10.1016/S0169-7161(09)70003-3>, <doi:10.1016/S0169-7161(09)70037-9>); Shao, 1996, <doi:10.1080/02331889708802523>). Descriptive statistics, linear and logistic regression, path models for manifest variables with measurement error correction and two-level hierarchical regressions for weighted samples are included. Statistical inference can be conducted for multiply imputed datasets and nested multiply imputed datasets and is in particularly suited for the analysis of plausible values (for details see George, Oberwimmer & Itzlinger-Bruneforth, 2016; Bruneforth, Oberwimmer & Robitzsch, 2016; Robitzsch, Pham & Yanagida, 2016). The package development was supported by BIFIE (Federal Institute for Educational Research, Innovation and Development of the Austrian School System; Salzburg, Austria).

Details

The **BIFIEsurvey** package include basic descriptive functions for large scale assessment data to complement the more comprehensive **survey** package. The functions in this package were written in **Rcpp**.

The features of **BIFIEsurvey** include for designs with replicate weights (which includes Jackknife and Bootstrap as general approaches):

- Descriptive statistics: means and standard deviations (`BIFIE.univar`), frequencies (`BIFIE.freq`), crosstabs (`BIFIE.crosstab`)
- Linear regression (`BIFIE.linreg`)
- Logistic regression (`BIFIE.logistreg`)
- Path models with measurement error correction for manifest variables (`BIFIE.pathmodel`)
- Two-level regression for hierarchical data (`BIFIE.twolevelreg`; random slope model)
- Statistical inference for derived parameters (`BIFIE.derivedParameters`)
- Wald tests (`BIFIE.waldtest`) of model parameters based on replicated statistics
- User-defined R functions (`BIFIE.by`)

Author(s)

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Shao, J. (1996). Invited discussion paper: Resampling methods in sample surveys. *Statistics, 27*(3-4), 203-237.

See Also

See also the **survey**, **intsvy**, **EdSurvey**, **lavaan.survey**, **EVER** and the **eatRep** packages.

BIFIE.BIFIEdata2BIFIEcdata

Conversion and Selection of `BIFIEdata` *Objects*

Description

Functions for converting and selecting objects of class `BIFIEdata`. The function `BIFIE.BIFIEdata2BIFIEcdata` converts the `BIFIEdata` objects in a non-compact form (`cdata=FALSE`) into an object of class `BIFIEdata` in a compact form (`cdata=TRUE`). The function `BIFIE.BIFIE2data2BIFIEdata` takes the reverse operation.

The function `BIFIE.BIFIEdata2datalist` converts a (part) of the object of class `BIFIEdata` into a list of multiply-imputed datasets.

Usage

```
BIFIE.BIFIEdata2BIFIEcdata(bifieobj, varnames=NULL, impdata.index=NULL)

BIFIE.BIFIEcdata2BIFIEdata(bifieobj, varnames=NULL, impdata.index=NULL)

BIFIE.BIFIEdata2datalist(bifieobj, varnames=NULL, impdata.index=NULL,
    as_data_frame=FALSE)
```

Arguments

bifieobj	Object of class BIFIEdata
varnames	Variables chosen for the selection
impdata.index	Selected indices of imputed datasets
as_data_frame	Logical indicating whether list of length one should be converted into a data frame

Value

An object of class BIFIEdata saved in a non-compact or compact way, see value cdata.

See Also

BIFIE.data

Examples

```
#############################################################################
# EXAMPLE 1: BIFIEdata conversions using data.timss1 dataset
#############################################################################
data(data.timss1)
data(data.timssrep)

# create BIFIEdata object
bdat1 <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ])
summary(bdat1)

# convert BIFIEdata object bdat1 into a BIFIEcdata object with
#  only using the first three datasets and a variable selection
bdat2 <- BIFIEsurvey::BIFIE.BIFIEdata2BIFIEcdata( bifieobj=bdat1,
                varnames=bdat1$varnames[ c(1:7,10) ] )

# convert bdat2 into BIFIEdata object and only use the first three imputed datasets
bdat3 <- BIFIEsurvey::BIFIE.BIFIEcdata2BIFIEdata( bifieobj=bdat2, impdata.index=1:3)

# object summaries
summary(bdat1)
summary(bdat2)
summary(bdat3)

## Not run:
#############################################################################
# EXAMPLE 2: Extract unique elements in BIFIEdata object
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIEdata object
```

```
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ])
summary(bifieobj)

# define variables for which unique values should be extracted
vars <- c( "female", "books","ASMMAT" )
# convert these variables from BIFIEdata object into a list of datasets
bdatlist <- BIFIEsurvey::BIFIE.BIFIEdata2datalist( bifieobj, varnames=vars )
# look for unique values in first dataset for variables
values <- lapply( bdatlist[[1]], FUN=function(vv){
               sort( unique( vv ) ) } )
# number of unique values in first dataset
Nvalues <- lapply( bdatlist[[1]], FUN=function(vv){
               length( unique( vv ) ) } )
# number of unique values in all datasets
Nvalues2 <- lapply( vars, FUN=function(vv){
    #vv <- vars[1]
    unlist( lapply( bdatlist, FUN=function(dd){
               length( unique( dd[,vv]  ) )
                       }    )     )
                   } )
# --> for extracting the number of unique values using BIFIE.by and a user
#     defined function see Example 1, Model 3 in "BIFIE.by"

## End(Not run)
```

BIFIE.by *Statistics for User Defined Functions*

Description

Computes statistics for user defined functions.

Usage

```
BIFIE.by( BIFIEobj, vars, userfct, userparnames=NULL,
     group=NULL, group_values=NULL, se=TRUE, use_Rcpp=TRUE)

## S3 method for class 'BIFIE.by'
summary(object,digits=4,...)

## S3 method for class 'BIFIE.by'
coef(object,...)

## S3 method for class 'BIFIE.by'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
vars	Vector of variables for which statistics should be computed
userfct	User defined function. This function must include a matrix X and a weight vector w as arguments. The value of this function must be a vector.
userparnames	An optional vector of parameter names for the value of userfct.
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
use_Rcpp	Optional logical indicating whether the user defined function should be evaluated in **Rcpp**.
object	Object of class BIFIE.by
digits	Number of digits for rounding output
...	Further arguments to be passed

Value

A list with following entries

stat	Data frame with statistics defined in userfct
output	Extensive output with all replicated statistics
...	More values

See Also

survey::svyby

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

#*****************************
#*** Model 1: Weighted means (as a toy example)
userfct <- function(X,w){
        pars <- c( stats::weighted.mean( X[,1], w ),
                    stats::weighted.mean(X[,2], w )   )
```

```
        return(pars)
                        }
res1 <-  BIFIEsurvey::BIFIE.by( bifieobj, vars=c("ASMMAT", "migrant", "books"),
                userfct=userfct, userparnames=c("MW_MAT", "MW_Migr"),
                group="female" )
summary(res1)

# evaluate function in pure R implementation using the use_Rcpp argument
res1b <-  BIFIEsurvey::BIFIE.by( bifieobj, vars=c("ASMMAT", "migrant", "books" ),
                userfct=userfct, userparnames=c("MW_MAT", "MW_Migr"),
                group="female", use_Rcpp=FALSE )
summary(res1b)

#--- statistical inference for a derived parameter (see ?BIFIE.derivedParameters)
# define gender difference for mathematics score (divided by 100)
derived.parameters <- list(
        "gender_diff"=~ 0 + I( ( MW_MAT_female1 - MW_MAT_female0 ) / 100 )
                        )
# inference derived parameter
res1d <- BIFIEsurvey::BIFIE.derivedParameters( res1,
                derived.parameters=derived.parameters )
summary(res1d)

## Not run:
#*****************************
#**** Model 2: Robust linear model

# (1) start from scratch to formulate the user function for X and w
dat1 <- bifieobj$dat1
vars <- c("ASMMAT", "migrant", "books" )
X <- dat1[,vars]
w <- bifieobj$wgt
library(MASS)
# ASMMAT ~ migrant + books
mod <- MASS::rlm( X[,1] ~  as.matrix( X[, -1 ] ), weights=w )
coef(mod)
# (2) define a user function "my_rlm"
my_rlm <- function(X,w){
    mod <- MASS::rlm( X[,1] ~  as.matrix( X[, -1 ] ), weights=w )
    return( coef(mod) )
                }
# (3) estimate model
res2 <-  BIFIEsurvey::BIFIE.by( bifieobj, vars, userfct=my_rlm,
                group="female", group_values=0:1)
summary(res2)
# estimate model without computing standard errors
res2a <-  BIFIEsurvey::BIFIE.by( bifieobj, vars, userfct=my_rlm,
                group="female", se=FALSE)
summary(res2a)

# define a user function with formula language
my_rlm2 <- function(X,w){
    colnames(X) <- vars
```

```
    X <- as.data.frame(X)
    mod <- MASS::rlm( ASMMAT ~  migrant + books, weights=w, data=X)
    return( coef(mod) )
                }
# estimate model
res2b <-  BIFIEsurvey::BIFIE.by( bifieobj, vars, userfct=my_rlm2,
                group="female", group_values=0:1)
summary(res2b)


#*****************************
#**** Model 3: Number of unique values for variables in BIFIEdata

#*** define variables for which the number of unique values should be calculated
vars <- c( "female", "books","ASMMAT" )
#*** define a user function extracting these unqiue values
userfct <- function(X,w){
        pars <- apply( X, 2, FUN=function(vv){
                    length( unique(vv))  } )
        # Note that weights are (of course) ignored in this function
        return(pars)
                        }
#*** extract number of unique values
res3 <-  BIFIEsurvey::BIFIE.by( bifieobj, vars=vars, userfct=userfct,
             userparnames=paste0( vars, "_Nunique"),  se=FALSE )
summary(res3)
  ##   Statistical Inference for User Definition Function
  ##              parm Ncases  Nweight    est
  ##   1 female_Nunique   4668 78332.99    2.0
  ##   2  books_Nunique   4668 78332.99    5.0
  ##   3 ASMMAT_Nunique   4668 78332.99 4613.4
# number of unique values in each of the five imputed datasets
res3$output$parsrepM
  ##        [,1] [,2] [,3] [,4] [,5]
  ##   [1,]    2    2    2    2    2
  ##   [2,]    5    5    5    5    5
  ##   [3,] 4617 4619 4614 4609 4608

#*****************************
#**** Model 4: Estimation of a lavaan model with BIFIE.by

#* estimate model in lavaan

data0 <- data.timss1[[1]]
# define lavaan model
lavmodel <- "
  ASSSCI ~ likesc
  ASSSCI ~~ ASSSCI
  likesc ~ female
  likesc ~~ likesc
  female ~~ female
"
```

```
mod0 <- lavaan::lavaan(lavmodel, data=data0, sampling.weights="TOTWGT")
summary(mod0, stand=TRUE, fit.measures=TRUE)

#* construct input for BIFIE.by
vars <- c("ASSSCI","likesc","female","TOTWGT")
X <- data0[,vars]
mod0 <- lavaan::lavaan(lavmodel, data=X, sampling.weights="TOTWGT")
w <- data0$TOTWGT

#* define user function
userfct <- function(X,w){
  X1 <- as.data.frame(X)
  colnames(X1) <- vars
  X1$studwgt <- w
  mod0 <- lavaan::lavaan(lavmodel, data=X1, sampling.weights="TOTWGT")
  pars <- coef(mod0)
  # extract some fit statistics
  pars2 <- lavaan::fitMeasures(mod0)
  pars <- c(pars, pars2[c("cfi","tli")])
  return(pars)
}

#* test function
res0 <- userfct(X,w)
userparnames <- names(res0)

#* estimate lavaan model with replicated sampling weights
res1 <-  BIFIEsurvey::BIFIE.by( bifieobj, vars=vars, userfct=userfct,
                  userparnames=userparnames, use_Rcpp=FALSE )
summary(res1)

## End(Not run)
```

BIFIE.correl *Correlations and Covariances*

Description

Computes correlations and covariances

Usage

```
BIFIE.correl(BIFIEobj, vars, group=NULL, group_values=NULL, se=TRUE)

## S3 method for class 'BIFIE.correl'
summary(object,digits=4, ...)

## S3 method for class 'BIFIE.correl'
coef(object,type=NULL, ...)
```

```
## S3 method for class 'BIFIE.correl'
vcov(object,type=NULL, ...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
vars	Vector of variables for which statistics should be computed
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
object	Object of class BIFIE.correl
digits	Number of digits for rounding output
type	If type="cov", then covariances instead of correlations are extracted.
...	Further arguments to be passed

Value

A list with following entries

stat.cor	Data frame with correlation statistics
stat.cov	Data frame with covariance statistics
cor_matrix	List of estimated correlation matrices
cov_matrix	List of estimated covariance matrices
output	Extensive output with all replicated statistics
...	More values

See Also

stats::cov.wt, intsvy::timss.rho, intsvy::timss.rho.pv, Hmisc::rcorr, miceadds::ma.wtd.corNA

Examples

```
############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

# Correlations splitted by gender
res1 <- BIFIEsurvey::BIFIE.correl( bdat, vars=c("lang", "books", "migrant" ),
```

```
              group="female", group_values=0:1 )
summary(res1)

# Correlations splitted by gender: no statistical inference (se=FALSE)
res1a <- BIFIEsurvey::BIFIE.correl( bdat, vars=c("lang", "books", "migrant" ),
              group="female", group_values=0:1, se=FALSE)
summary(res1a)
```

`BIFIE.crosstab` *Cross Tabulation*

Description

Creates cross tabulations and computes some effect sizes.

Usage

```
BIFIE.crosstab( BIFIEobj, vars1, vars2, vars_values1=NULL, vars_values2=NULL,
     group=NULL, group_values=NULL, se=TRUE )

## S3 method for class 'BIFIE.crosstab'
summary(object,digits=3,...)

## S3 method for class 'BIFIE.crosstab'
coef(object,...)

## S3 method for class 'BIFIE.crosstab'
vcov(object,...)
```

Arguments

`BIFIEobj`	Object of class `BIFIEdata`
`vars1`	Row variable
`vars2`	Column variable
`vars_values1`	Optional vector of values of variable `vars1`
`vars_values2`	Optional vector of values of variable `vars2`
`group`	Optional grouping variable(s)
`group_values`	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
`se`	Optional logical indicating whether statistical inference based on replication should be employed.
`object`	Object of class `BIFIE.univar`
`digits`	Number of digits for rounding output
`...`	Further arguments to be passed

Value

A list with following entries

stat.probs	Statistics for joint and conditional probabilities
stat.marg	Statistics for marginal probabilities
stat.es	Statistics for effect sizes w (based on χ^2), Cramers V, Goodman's gamma, the PRE lambda measure and Kruskals tau.
output	Extensive output with all replicated statistics
...	More values

See Also

survey::svytable, Hmisc::wtd.table

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

#--- Model 1: cross tabulation
res1 <- BIFIEsurvey::BIFIE.crosstab( bifieobj, vars1="migrant",
               vars2="books", group="female" )
summary(res1)
```

BIFIE.data *Creates an Object of Class* BIFIEdata

Description

This function creates an object of class BIFIEdata. Finite sampling correction of statistical inferences can be conducted by specifying appropriate input in the fayfac argument.

Usage

```
BIFIE.data(data.list, wgt=NULL, wgtrep=NULL, fayfac=1, pv_vars=NULL,
     pvpre=NULL, cdata=FALSE, NMI=FALSE)

## S3 method for class 'BIFIEdata'
summary(object,...)
```

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

Arguments

data.list	List of multiply imputed datasets. Can be also a list of list of imputed datasets in case of nested multiple imputation. Then, the argument NMI=TRUE must be specified.
wgt	A string indicating the label of case weight or a vector containing all case weights.
wgtrep	Optional vector of replicate weights
fayfac	Fay factor for calculating standard errors, a numeric value. If finite sampling correction is requested, an appropriate vector input can be used (see Example 3).
pv_vars	Optional vector for names of plausible values, see BIFIE.data.jack.
pvpre	Optional vector for prefixes of plausible values, see BIFIE.data.jack.
cdata	An optional logical indicating whether the BIFIEdata object should be compactly saved. The default is FALSE.
NMI	Optional logical indicating whether data.list is obtained by nested multiple imputation.
object	Object of class BIFIEdata
x	Object of class BIFIEdata
...	Further arguments to be passed

Value

An object of class BIFIEdata saved in a non-compact or compact way, see value cdata. The following entries are included in the list:

datalistM	Stacked list of imputed datasets (if cdata=FALSE)
wgt	Vector with case weights
wgtrep	Matrix with replicate weights
Nimp	Number of imputed datasets
N	Number of observations in a dataset
dat1	Last imputed dataset
varnames	Vector with variable names
fayfac	Fay factor.
RR	Number of replicate weights
NMI	Logical indicating whether the dataset is nested multiply imputed.
cdata	Logical indicating whether the BIFIEdata object is in compact format (cdata=TRUE) or in a non-compact format (cdata=FALSE).
Nvars	Number of variables

`variables` Data frame including some informations about variables. All transformations are saved in the column `source`.

`datalistM_ind` Data frame with response indicators (if `cdata=TRUE`)

`datalistM_imputed` Data frame with imputed values (if `cdata=TRUE`)

See Also

See `BIFIE.data.transform` for data transformations on `BIFIEdata` objects.

For saving and loading `BIFIEdata` objects see `save.BIFIEdata`.

For converting PIRLS/TIMSS or PISA datasets into `BIFIEdata` objects see `BIFIE.data.jack`.

See the `BIFIEdata2svrepdesign` function for converting `BIFIEdata` objects to objects used in the **survey** package.

Examples

```
############################################################################
# EXAMPLE 1: Create BIFIEdata object with multiply-imputed TIMSS data
############################################################################
data(data.timss1)
data(data.timssrep)

bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ] )
summary(bdat)
# create BIFIEdata object in a compact way
bdat2 <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ], cdata=TRUE)
summary(bdat2)

## Not run:
############################################################################
# EXAMPLE 2: Create BIFIEdata object with one dataset
############################################################################
data(data.timss2)

# use first dataset with missing data from data.timss2
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss2[[1]], wgt=data.timss2[[1]]$TOTWGT)

## End(Not run)

############################################################################
# EXAMPLE 3: BIFIEdata objects with finite sampling correction
############################################################################

data(data.timss1)
data(data.timssrep)

#-----
# BIFIEdata object without finite sampling correction
```

```
bdat1 <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ] )
summary(bdat1)

#-----
# generate BIFIEdata object with finite sampling correction by adjusting
# the "fayfac" factor
bdat2 <- bdat1
#-- modify "fayfac" constant
fayfac0 <- bdat1$fayfac
# set fayfac=.75 for the first 50 replication zones (25% of students in the
# population were sampled) and fayfac=.20 for replication zones 51-75
# (meaning that 80% of students were sampled)
fayfac <- rep( fayfac0, bdat1$RR )
fayfac[1:50] <- fayfac0 * .75
fayfac[51:75] <- fayfac0 * .20
# include this modified "fayfac" factor in bdat2
bdat2$fayfac <- fayfac
summary(bdat2)
summary(bdat1)

#---- compare some univariate statistics
# no finite sampling correction
res1 <- BIFIEsurvey::BIFIE.univar( bdat1, vars="ASMMAT")
summary(res1)
# finite sampling correction
res2 <- BIFIEsurvey::BIFIE.univar( bdat2, vars="ASMMAT")
summary(res2)

## Not run:
#############################################################################
# EXAMPLE 4: Create BIFIEdata object with nested multiply imputed dataset
#############################################################################

data(data.timss4)
data(data.timssrep)

# nested imputed dataset, save it in compact format
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss4,
            wgt=data.timss4[[1]][[1]]$TOTWGT, wgtrep=data.timssrep[, -1 ],
            NMI=TRUE, cdata=TRUE )
summary(bdat)

## End(Not run)
```

BIFIE.data.boot *Create* BIFIE.data *Object based on Bootstrap*

Description

Creates a BIFIE.data object based on bootstrap designs. The sampling is done assuming independence of cases.

Usage

```
BIFIE.data.boot( data, wgt=NULL,  pv_vars=NULL,
         Nboot=500, seed=.Random.seed, cdata=FALSE)
```

Arguments

data	Data frame: Can be a single or a list of multiply imputed datasets
wgt	A string indicating the label of case weight.
pv_vars	An optional vector of plausible values which define multiply imputed datasets.
Nboot	Number of bootstrap samples for usage
seed	Simulation seed.
cdata	An optional logical indicating whether the BIFIEdata object should be compactly saved. The default is FALSE.

Value

Object of class BIFIEdata

See Also

BIFIE.data, BIFIE.data.jack

Examples

```
## Not run:
#############################################################################
# EXAMPLE 1: Bootstrap TIMSS data set
#############################################################################
data(data.timss1)

# bootstrap samples using weights
bifieobj1 <- BIFIEsurvey::BIFIE.data.boot( data.timss1, wgt="TOTWGT" )
summary(bifieobj1)

# bootstrap samples without weights
bifieobj2 <- BIFIEsurvey::BIFIE.data.boot( data.timss1  )
summary(bifieobj2)

## End(Not run)
```

BIFIE.data.jack *Create* BIFIE.data *Object with Jackknife Zones*

Description

Creates a BIFIE.data object for designs with jackknife zones, especially for TIMSS/PIRLS and PISA studies.

Usage

```
BIFIE.data.jack(data, wgt=NULL, jktype="JK_TIMSS", pv_vars=NULL,
     jkzone=NULL, jkrep=NULL, jkfac=NULL, fayfac=NULL,
     wgtrep="W_FSTR", pvpre=paste0("PV",1:5), ngr=100,
     seed=.Random.seed, cdata=FALSE)
```

Arguments

data	Data frame: Can be a single or a list of multiply-imputed datasets
wgt	A string indicating the label of case weight. In case of jktype="JK_TIMSS" the weight is specified as wgt="TOTWGT" as the default.
pv_vars	An optional vector of plausible values which define multiply-imputed datasets.
jktype	Type of jackknife procedure for creating the BIFIE.data object. jktype="JK_TIMSS" refers to TIMSS/PIRLS datasets up to 2011 data, jktype="JK_TIMSS2" refers to TIMSS/PIRLS datasets starting from 2015 data. The type "JK_GROUP" creates jackknife weights based on a user defined grouping, the type "JK_RANDOM" creates random groups. The number of random groups can be defined in ngr. The argument jktype="RW_PISA" converts PISA datasets into objects of class BIFIEdata.
jkzone	Jackknife zones. If jktype="JK_TIMSS", then jkzone="JKZONE".
jkrep	Jackknife replicate factors. If jktype="JK_TIMSS", then jkrep="JKREP".
jkfac	Factor for multiplying jackknife replicate weights. If jktype="JK_TIMSS", then jkfac=2.
fayfac	Fay factor for statistical inference. The default is set to NULL.
wgtrep	Variables in the dataset which refer to the replicate weights. In case of cdata=TRUE, the replicate weights are deleted from datalistM.
pvpre	Only applicable for jktype="RW_PISA". The vector contains the prefixes of the variables containing plausible values.
ngr	Number of randomly created groups in "JK_RANDOM".
seed	The simulation seed if "JK_RANDOM" is chosen. If seed=NULL, then the grouping is done according the order in the dataset.
cdata	An optional logical indicating whether the BIFIEdata object should be compactly saved. The default is FALSE.

Value

Object of class BIFIEdata

See Also

BIFIE.data, BIFIE.data.boot

Examples

```
#############################################################################
# EXAMPLE 1: Convert TIMSS dataset to BIFIE.data object
#############################################################################

data(data.timss3)

# define plausible values
pv_vars <- c("ASMMAT", "ASSSCI" )
# create BIFIE.data objects -> 5 imputed datasets
bdat1 <- BIFIEsurvey::BIFIE.data.jack( data=data.timss3,  pv_vars=pv_vars,
             jktype="JK_TIMSS"  )
summary(bdat1)

# create BIFIE.data objects -> all PVs are included in one dataset
bdat2 <- BIFIEsurvey::BIFIE.data.jack( data=data.timss3,  jktype="JK_TIMSS"  )
summary(bdat2)

#############################################################################
# EXAMPLE 2: Creation of Jackknife zones and replicate weights for data.test1
#############################################################################

data(data.test1)

# create jackknife zones based on random group creation
bdat1 <- BIFIEsurvey::BIFIE.data.jack( data=data.test1,  jktype="JK_RANDOM",
                   ngr=50 )
summary(bdat1)
stat1 <- BIFIEsurvey::BIFIE.univar( bdat1, vars="math",  group="stratum" )
summary(stat1)

# random creation of groups and inclusion of weights
bdat2 <- BIFIEsurvey::BIFIE.data.jack( data=data.test1,  jktype="JK_RANDOM",
               ngr=75, seed=987, wgt="wgtstud")
summary(bdat2)
stat2 <- BIFIEsurvey::BIFIE.univar( bdat2, vars="math",  group="stratum" )
summary(stat2)

# using idclass as jackknife zones
bdat3 <- BIFIEsurvey::BIFIE.data.jack( data=data.test1,  jktype="JK_GROUP",
               jkzone="idclass", wgt="wgtstud")
summary(bdat3)
stat3 <- BIFIEsurvey::BIFIE.univar( bdat3, vars="math",  group="stratum" )
summary(stat3)
```

```
# create BIFIEdata object with a list of imputed datasets
dataList <- list( data.test1, data.test1, data.test1 )
bdat4 <- BIFIEsurvey::BIFIE.data.jack( data=dataList,  jktype="JK_GROUP",
                jkzone="idclass", wgt="wgtstud")
summary(bdat4)

## Not run:
#############################################################################
# EXAMPLE 3: Converting a PISA dataset into a BIFIEdata object
#############################################################################

data(data.pisaNLD)

# BIFIEdata with cdata=FALSE
bifieobj <- BIFIEsurvey::BIFIE.data.jack( data.pisaNLD, jktype="RW_PISA", cdata=FALSE)
summary(bifieobj)
# BIFIEdata with cdata=TRUE
bifieobj1 <- BIFIEsurvey::BIFIE.data.jack( data.pisaNLD, jktype="RW_PISA", cdata=TRUE)
summary(bifieobj1)

## End(Not run)
```

`BIFIE.data.transform` *Data Transformation for* `BIFIEdata` *Objects*

Description

Computes a data transformation for `BIFIEdata` objects.

Usage

```
BIFIE.data.transform( bifieobj, transform.formula, varnames.new=NULL )
```

Arguments

`bifieobj`	Object of class `BIFIEdata`
`transform.formula`	R formula object for data transformation.
`varnames.new`	Optional vector of names for new defined variables.

Value

An object of class `BIFIEdata`. Additional values are

`varnames.added`	Added variables in data transformation
`varsindex.added`	Indices of added variables

Examples

```
library(miceadds)

#############################################################################
# EXAMPLE 1: Data transformations for TIMSS data
#############################################################################

data(data.timss2)
data(data.timssrep)
# create BIFIEdata object
bifieobj1 <- BIFIEsurvey::BIFIE.data( data.timss2, wgt=data.timss2[[1]]$TOTWGT,
            wgtrep=data.timssrep[,-1] )
# create BIFIEdata object in compact way (cdata=TRUE)
bifieobj2 <- BIFIEsurvey::BIFIE.data( data.timss2, wgt=data.timss2[[1]]$TOTWGT,
            wgtrep=data.timssrep[,-1], cdata=TRUE)

#*****************************
#*** Transformation 1: Squared and cubic book variable
transform.formula <- ~ I( books^2 ) + I( books^3 )
# as.character(transform.formula)
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj1,
                  transform.formula=transform.formula)
bifieobj$variables
# rename added variables
bifieobj$varnames[ bifieobj$varsindex.added ] <- c("books_sq", "books_cub")

# check descriptive statistics
res1 <- BIFIEsurvey::BIFIE.univar( bifieobj, vars=c("books_sq", "books_cub" ) )
summary(res1)

## Not run:
#*****************************
#*** Transformation 2: Create dummy variables for variable book
transform.formula <- ~ as.factor(books)
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
                    transform.formula=transform.formula )
##   Included 5 variables: as.factor(books)1 as.factor(books)2 as.factor(books)3
##        as.factor(books)4 as.factor(books)5
bifieobj$varnames[ bifieobj$varsindex.added ] <- paste0("books_D", 1:5)

#*****************************
#*** Transformation 3: Discretized mathematics score
hi3a <- BIFIEsurvey::BIFIE.hist( bifieobj, vars="ASMMAT" )
plot(hi3a)
transform.formula <- ~ I( as.numeric(cut( ASMMAT, breaks=seq(200,800,100) )) )
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
                 transform.formula=transform.formula, varnames.new="ASMMAT_discret")
hi3b <- BIFIEsurvey::BIFIE.hist( bifieobj, vars="ASMMAT_discret", breaks=1:7 )
plot(hi3b)
# check frequencies
fr3b <- BIFIEsurvey::BIFIE.freq( bifieobj, vars="ASMMAT_discret", se=FALSE )
summary(fr3b)
```

```
#*****************************
#*** Transformation 4: include standardization variables for book variable

# start with testing the transformation function on a single dataset
dat1 <- bifieobj$dat1
stats::weighted.mean( dat1[,"books"], dat1[,"TOTWGT"], na.rm=TRUE)
sqrt( Hmisc::wtd.var( dat1[,"books"], dat1[,"TOTWGT"], na.rm=TRUE) )
# z standardization
transform.formula <- ~ I( ( books - weighted.mean( books, TOTWGT, na.rm=TRUE) )/
                                sqrt( Hmisc::wtd.var( books, TOTWGT, na.rm=TRUE) ))
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
              transform.formula=transform.formula, varnames.new="z_books" )
# standardize variable books with M=500 and SD=100
transform.formula <- ~ I(
        500 + 100*( books - stats::weighted.mean( books, w=TOTWGT, na.rm=TRUE) ) /
              sqrt( Hmisc::wtd.var( books, weights=TOTWGT, na.rm=TRUE) )  )
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
             transform.formula=transform.formula, varnames.new="z500_books" )

# standardize variable books with respect to M and SD of ALL imputed datasets
res <- BIFIEsurvey::BIFIE.univar( bifieobj, vars="books" )
summary(res)
##       var  Nweight Ncases     M M_SE M_fmi M_VarMI M_VarRep    SD SD_SE SD_fmi
##   1 books 76588.72   4554 2.945 0.04     0       0    0.002 1.146 0.015      0
M <- round(res$output$mean1,5)
SD <- round(res$output$sd1,5)
transform.formula <- paste0( " ~ I( ( books - ",  M, " ) / ", SD, ")"  )
##   > transform.formula
##   [1] " ~ I( ( books - 2.94496 ) / 1.14609)"
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
                transform.formula=stats::as.formula(transform.formula),
                varnames.new="zall_books" )

# check statistics
res4 <- BIFIEsurvey::BIFIE.univar( bifieobj,
              vars=c("z_books", "z500_books", "zall_books") )
summary(res4)

#*****************************
#*** Transformation 5: include rank transformation for variable ASMMAT

# calculate percentage ranks using wtd.rank function from Hmisc package
dat1 <- bifieobj$dat1
100 * Hmisc::wtd.rank( dat1[,"ASMMAT"], w=dat1[,"TOTWGT"] ) / sum( dat1[,"TOTWGT"] )
# define an auxiliary function for calculating percentage ranks
wtd.percrank <- function( x, w ){
    100 * Hmisc::wtd.rank( x, w, na.rm=TRUE ) / sum( w, na.rm=TRUE )
}
wtd.percrank( dat1[,"ASMMAT"], dat1[,"TOTWGT"] )
# define transformation formula
transform.formula <- ~ I( wtd.percrank( ASMMAT, TOTWGT ) )
# add ranks to BIFIEdata object
```

```
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
               transform.formula=transform.formula,  varnames.new="ASMMAT_rk")
# check statistic
res5 <- BIFIEsurvey::BIFIE.univar( bifieobj, vars=c("ASMMAT_rk" ) )
summary(res5)

#*****************************
#*** Transformation 6: recode variable books

library(car)
# recode variable books according to "1,2=0, 3,4=1, 5=2"
dat1 <- bifieobj$dat1
# use Recode function from car package
car::Recode( dat1[,"books"], "1:2='0'; c(3,4)='1';5='2'")
# define transformation formula
transform.formula <- ~ I( car::Recode( books, "1:2='0'; c(3,4)='1';5='2'") )
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
               transform.formula=transform.formula,  varnames.new="book_rec" )
res6 <- BIFIEsurvey::BIFIE.freq( bifieobj, vars=c("book_rec" ) )
summary(res6)

#*****************************
#*** Transformation 7: include some variables aggregated to the school level

dat1 <- as.data.frame(bifieobj$dat1)
# at first, create school ID in the dataset by transforming the student ID
dat1$idschool <- as.numeric(substring( dat1$IDSTUD, 1, 5 ))
transform.formula <- ~ I( as.numeric( substring( IDSTUD, 1, 5 ) ) )
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
               transform.formula=transform.formula, varnames.new="idschool" )

#*** test function for a single dataset bifieobj$dat1
dat1 <- as.data.frame(bifieobj$dat1)
gm <- miceadds::GroupMean( data=dat1$ASMMAT, group=dat1$idschool, extend=TRUE)[,2]

# add school mean ASMMAT
tformula <- ~ I( miceadds::GroupMean( ASMMAT, group=idschool, extend=TRUE)[,2] )
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj, transform.formula=tformula,
                varnames.new="M_ASMMAT" )
# add within group centered mathematics values of ASMMAT
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
                transform.formula=~ 0 + I( ASMMAT - M_ASMMAT ),
                varnames.new="WC_ASMMAT" )

# add school mean books
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj,
                transform.formula=~ 0 + I( add.groupmean( books, idschool ) ),
                varnames.new="M_books" )

#*****************************
#*** Transformation 8: include fitted values and residuals from a linear model
# create new BIFIEdata object
data(data.timss1)
```

```
bifieobj3 <- BIFIEsurvey::BIFIE.data( data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[,-1] )

# specify transformation
transform.formula <- ~ I( fitted( stats::lm( ASMMAT ~ migrant + female ) ) ) +
                           I( residuals( stats::lm( ASMMAT ~ migrant + female ) ) )
  # Note that lm omits cases in regression by listwise deletion.
# add fitted values and residual to BIFIEdata object
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj3,
                 transform.formula=transform.formula )
bifieobj$varnames[ bifieobj$varsindex.added ] <- c("math_fitted1", "math_resid1")

#*****************************
#*** Transformation 9: Including principal component scores in BIFIEdata object

# define auxiliary function for extracting PCA scores
BIFIE.princomp <- function( formula, Ncomp ){
    X <- stats::princomp( formula, cor=TRUE)
    Xp <- X$scores[, 1:Ncomp ]
    return(Xp)
}
# define transformation formula
transform.formula <- ~ I( BIFIE.princomp( ~ migrant + female + books + lang + ASMMAT, 3 ))
# apply transformation
bifieobj <- BIFIEsurvey::BIFIE.data.transform( bifieobj3,
                transform.formula=transform.formula )
bifieobj$varnames[ bifieobj$varsindex.added ] <- c("pca_sc1", "pca_sc2","pca_sc3")
# check descriptive statistics
res9 <- BIFIEsurvey::BIFIE.univar( bifieobj, vars="pca_sc1", se=FALSE)
summary(res9)
res9$output$mean1M

# The transformation formula can also be conveniently generated by string operations
vars <- c("migrant", "female", "books", "lang" )
transform.formula2 <- as.formula( paste0( "~ 0 + I ( BIFIE.princomp( ~ ",
       paste0( vars, collapse="+" ),  ", 3 ) )") )
  ##   > transform.formula2
  ##   ~ I(BIFIE.princomp(~migrant + female + books + lang, 3))

#*****************************
#*** Transformation 10: Overwriting variables books and migrant
bifieobj4 <-  BIFIEsurvey::BIFIE.data.transform( bifieobj3,
                  transform.formula=~ I( 1*(books >=1 ) ) + I(2*migrant),
                  varnames.new=c("books","migrant") )
summary(bifieobj4)

## End(Not run)
```

BIFIE.derivedParameters

Statistical Inference for Derived Parameters

Description

This function performs statistical for derived parameters for objects of classes BIFIE.by, BIFIE.correl, BIFIE.crosstab, BIFIE.freq, BIFIE.linreg, BIFIE.logistreg and BIFIE.univar.

Usage

```
BIFIE.derivedParameters( BIFIE.method, derived.parameters, type=NULL)

## S3 method for class 'BIFIE.derivedParameters'
summary(object,digits=4,...)

## S3 method for class 'BIFIE.derivedParameters'
coef(object,...)

## S3 method for class 'BIFIE.derivedParameters'
vcov(object,...)
```

Arguments

BIFIE.method	Object of classes BIFIE.by, BIFIE.correl, BIFIE.crosstab, BIFIE.freq, BIFIE.linreg, BIFIE.logistreg or BIFIE.univar (see parnames in the Output of these methods for saved parameters)
derived.parameters	List with R formulas for derived parameters (see Examples for specification)
type	Only applies to BIFIE.correl. In case of type="cov" covariances instead of correlations are used for derived parameters.
object	Object of class BIFIE.derivedParameters
digits	Number of digits for rounding decimals in output
...	Further arguments to be passed

Details

The distribution of derived parameters is derived by the direct calculation using original resampled parameters.

Value

A list with following entries

stat	Data frame with statistics
coef	Estimates of derived parameters
vcov	Covariance matrix of derived parameters
parnames	Parameter names
res_wald	Output of Wald test (global test regarding all parameters)
...	More values

See Also

See also BIFIE.waldtest for multi-parameter tests.

See car::deltaMethod for the Delta method assuming that the multivariate distribution of the parameters is asymptotically normal.

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#            Inference for correlations and derived parameters
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

# compute correlations
res1 <- BIFIEsurvey::BIFIE.correl( bdat,
            vars=c("ASSSCI", "ASMMAT", "books", "migrant" )  )
summary(res1)
res1$parnames
  ##    [1] "ASSSCI_ASSSCI"   "ASSSCI_ASMMAT"   "ASSSCI_books"    "ASSSCI_migrant"
  ##    [5] "ASMMAT_ASMMAT"   "ASMMAT_books"    "ASMMAT_migrant"  "books_books"
  ##    [9] "books_migrant"   "migrant_migrant"

# define four derived parameters
derived.parameters <- list(
        # squared correlation of science and mathematics
        "R2_sci_mat"=~ I( 100* ASSSCI_ASMMAT^2  ),
        # partial correlation of science and mathematics controlling for books
        "parcorr_sci_mat"=~ I( ( ASSSCI_ASMMAT - ASSSCI_books * ASMMAT_books ) /
                            sqrt(( 1 - ASSSCI_books^2 ) * ( 1-ASMMAT_books^2 ) ) ),
        # original correlation science and mathematics (already contained in res1)
        "cor_sci_mat"=~ I(ASSSCI_ASMMAT),
        # original correlation books and migrant
        "cor_book_migra"=~ I(books_migrant)
        )

# statistical inference for derived parameters
res2 <- BIFIEsurvey::BIFIE.derivedParameters( res1, derived.parameters )
summary(res2)
```

BIFIE.ecdf *Empirical Distribution Function and Quantiles*

Description

Computes an empirical distribution function (and quantiles). If only some quantiles should be calculated, then an appropriate vector of `breaks` (which are quantiles) must be specified. Statistical inference is not conducted for this method.

Usage

```
BIFIE.ecdf( BIFIEobj, vars, breaks=NULL, quanttype=1, group=NULL, group_values=NULL )

## S3 method for class 'BIFIE.ecdf'
summary(object,digits=4,...)
```

Arguments

`BIFIEobj`	Object of class `BIFIEdata`
`vars`	Vector of variables for which statistics should be computed.
`breaks`	Optional vector of breaks. Otherwise, it will be automatically defined.
`quanttype`	Type of calculation for quantiles. In case of `quanttype=1`, a linear interpolation is used (which is `type='i/n'` in `Hmisc::wtd.quantile`), while for `quanttype=2` no interpolation is used.
`group`	Optional grouping variable
`group_values`	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
`object`	Object of class `BIFIE.ecdf`
`digits`	Number of digits for rounding output
`...`	Further arguments to be passed

Value

A list with following entries

`ecdf`	Data frame with probabilities and the empirical distribution function (See Examples).
`stat`	Data frame with empirical distribution function stacked with respect to variables, groups and group values
`output`	More extensive output
`...`	More values

See Also

`Hmisc::wtd.ecdf`, `Hmisc::wtd.quantile`

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

# ecdf
vars <- c( "ASMMAT", "books")
group <- "female" ; group_values <- 0:1
# quantile type 1
res1 <- BIFIEsurvey::BIFIE.ecdf( bifieobj,  vars=vars, group=group )
summary(res1)
res2 <- BIFIEsurvey::BIFIE.ecdf( bifieobj,  vars=vars, group=group, quanttype=2)
# plot distribution function
ecdf1 <- res1$ecdf
plot( ecdf1$ASMMAT_female0, ecdf1$yval, type="l")
plot( res2$ecdf$ASMMAT_female0, ecdf1$yval, type="l", lty=2)
plot( ecdf1$books_female0, ecdf1$yval, type="l", col="blue")
```

BIFIE.freq *Frequency Statistics*

Description

Computes absolute and relative frequencies.

Usage

```
BIFIE.freq(BIFIEobj, vars, group=NULL, group_values=NULL, se=TRUE)

## S3 method for class 'BIFIE.freq'
summary(object,digits=3,...)

## S3 method for class 'BIFIE.freq'
coef(object,...)

## S3 method for class 'BIFIE.freq'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata

vars	Vector of variables for which statistics should be computed
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
object	Object of class BIFIE.freq
digits	Number of digits for rounding output
...	Further arguments to be passed

Value

A list with following entries

stat	Data frame with frequency statistics
output	Extensive output with all replicated statistics
...	More values

See Also

survey::svytable, intsvy::timss.table, Hmisc::wtd.table

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

# Frequencies for three variables
res1 <- BIFIEsurvey::BIFIE.freq( bdat, vars=c("lang", "books", "migrant" )  )
summary(res1)

# Frequencies splitted by gender
res2 <- BIFIEsurvey::BIFIE.freq( bdat, vars=c("lang", "books", "migrant" ),
              group="female", group_values=0:1 )
summary(res2)

# Frequencies splitted by gender and likesc
res3 <- BIFIEsurvey::BIFIE.freq( bdat, vars=c("lang", "books", "migrant" ),
              group=c("likesc","female")  )
summary(res3)
```

BIFIE.hist *Histogram*

Description

Computes a histogram with same output as in graphics::hist. Statistical inference is not conducted for this method.

Usage

```
BIFIE.hist( BIFIEobj, vars, breaks=NULL, group=NULL, group_values=NULL  )

## S3 method for class 'BIFIE.hist'
summary(object,...)

## S3 method for class 'BIFIE.hist'
plot(x,ask=TRUE,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
vars	Vector of variables for which statistics should be computed.
breaks	Optional vector of breaks. Otherwise, it will be automatically defined.
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
object	Object of class BIFIE.hist
x	Object of class BIFIE.hist
ask	Optional logical whether it should be asked for new plots.
...	Further arguments to be passed

Value

A list with following entries

histobj	List with objects of class histogram
output	More extensive output
...	More values

See Also

graphics::hist

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

# histogram
res1 <- BIFIEsurvey::BIFIE.hist( bifieobj, vars="ASMMAT", group="female" )
# plot histogram for first group (female=0)
plot( res1$histobj$ASMMAT_female0, col="lightblue")
# plot both histograms after each other
plot( res1 )

# user-defined vector of breaks
res2 <- BIFIEsurvey::BIFIE.hist( bifieobj, vars="ASMMAT",
              breaks=seq(0,900,10), group="female" )
plot( res2, col="orange")
```

`BIFIE.lavaan.survey` *Fitting a Model in* **lavaan** *or in* **survey**

Description

The function `BIFIE.lavaan.survey` fits a structural equation model in **lavaan** using the **lavaan.survey** package (currently not on CRAN). Currently, only maximum likelihood estimation for normally distributed data is available.

The function `BIFIE.survey` fits a model defined in the **survey** package.

Usage

```
BIFIE.lavaan.survey(lavmodel, svyrepdes, lavaan_fun="sem",
    lavaan_survey_default=FALSE, fit.measures=NULL, ...)

## S3 method for class 'BIFIE.lavaan.survey'
summary(object, ...)

## S3 method for class 'BIFIE.lavaan.survey'
coef(object,...)

## S3 method for class 'BIFIE.lavaan.survey'
vcov(object,...)
```

```
BIFIE.survey(svyrepdes, survey.function, ...)

## S3 method for class 'BIFIE.survey'
summary(object, digits=3, ...)

## S3 method for class 'BIFIE.survey'
coef(object,...)

## S3 method for class 'BIFIE.survey'
vcov(object,...)
```

Arguments

lavmodel	Model string in **lavaan** syntax
svyrepdes	Replication design object of class BIFIEdata or replication design object from **survey** package (generated by BIFIEdata2svrepdesign or survey::svrepdesign)
lavaan_fun	Estimation funcion in **lavaan**. Can be "lavaan", "sem", "cfa" or "growth".
lavaan_survey_default	Logical indicating whether the **lavaan.survey** package should be used for statistical inference for multiply imputed datasets.
object	Object of class BIFIE.by
fit.measures	Optional vector of fit measures used in lavaan::fitMeasures function
...	Further arguments to be passed
survey.function	Function from the **survey** package
digits	Number of digits after decimal

Value

For BIFIE.lavaan.survey a list with following entries

lavfit	Object of class lavaan
fitstat	Fit statistics from **lavaan**

See Also

lavaan::lavaan, lavaan.survey::lavaan.survey

Examples

```
## Not run:
#############################################################################
# EXAMPLE 1: Multiply imputed datasets, TIMSS replication design
#############################################################################

library(lavaan)
data(data.timss2)
data(data.timssrep)
```

```
#--- create BIFIEdata object
bdat4 <- BIFIEsurvey::BIFIE.data( data=data.timss2, wgt="TOTWGT",
               wgtrep=data.timssrep[,-1], fayfac=1)
print(bdat4)

#--- create survey object with conversion function
svydes4 <- BIFIEsurvey::BIFIEdata2svrepdesign(bdat4)

#*** regression model
mod1 <- BIFIEsurvey::BIFIE.linreg(bdat4, formula=ASMMAT ~ ASSSCI )
mod2 <- mitools::MIcombine( with(svydes4, survey::svyglm( formula=ASMMAT ~ ASSSCI,
                      design=svydes4 )))
#--- regression with lavaan.survey package
lavmodel <- "ASMMAT ~ 1
             ASMMAT ~ ASSSCI"
mod3 <- BIFIEsurvey::BIFIE.lavaan.survey(lavmodel, svyrepdes=svydes4)
# inference included in lavaan.survey package
mod4 <- BIFIEsurvey::BIFIE.lavaan.survey(lavmodel, svyrepdes=svydes4,
                       lavaan_survey_default=TRUE)
summary(mod3)
# extract fit statistics
lavaan::fitMeasures(mod3$lavfit)

#--- use BIFIE.lavaan.survey function with BIFIEdata object
mod5 <- BIFIEsurvey::BIFIE.lavaan.survey(lavmodel, svyrepdes=bdat4)
summary(mod5)

# compare estimated parameters
coef(mod1); coef(mod2); coef(mod3); coef(mod4); coef(mod5)

# compare standard error estimates
se(mod1); BIFIEsurvey::se(mod2); BIFIEsurvey::se(mod3); BIFIEsurvey::se(mod4); BIFIEsurvey::se(mod5)

#############################################################################
# EXAMPLE 2: Examples BIFIE.survey function
#############################################################################

data(data.timss2)
data(data.timssrep)

#--- create BIFIEdata object
bdat <- BIFIEsurvey::BIFIE.data( data=data.timss2, wgt="TOTWGT",
              wgtrep=data.timssrep[,-1], fayfac=1)
print(bdat)

#--- survey object
sdat <- BIFIEsurvey::BIFIEdata2svrepdesign(bdat)
print(sdat)

#- fit models in survey
mod1 <- BIFIEsurvey::BIFIE.linreg(bdat, formula=ASMMAT~ASSSCI)
mod2 <- BIFIEsurvey::BIFIE.survey( sdat, survey.function=survey::svyglm,
```

```
                                    formula=ASMMAT~ASSSCI)
mod3 <- BIFIEsurvey::BIFIE.survey( bdat, survey.function=survey::svyglm,
                                     formula=ASMMAT~ASSSCI)
summary(mod1)
summary(mod2)
summary(mod3)

#############################################################################
# EXAMPLE 3: Nested multiply imputed datasets | linear regression
#############################################################################

library(lavaan)
data(data.timss4)
data(data.timssrep)

# nested imputed dataset
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss4,
            wgt=data.timss4[[1]][[1]]$TOTWGT, wgtrep=data.timssrep[, -1 ],  NMI=TRUE )
summary(bdat)

#*** BIFIEsurvey::BIFIE.linreg
mod1 <- BIFIEsurvey::BIFIE.linreg(bdat, formula=ASMMAT ~ migrant )

#*** survey::svyglm
mod2 <- BIFIEsurvey::BIFIE.survey(bdat, survey.function=survey::svyglm,
                                    formula=ASMMAT~migrant)

#*** lavaan.survey::lavaan.survey
lavmodel <- "ASMMAT ~ 1
             ASMMAT ~ migrant"
mod3 <- BIFIEsurvey::BIFIE.lavaan.survey(lavmodel, svyrepdes=bdat)

coef(mod1); coef(mod2); coef(mod3)
se(mod1); BIFIEsurvey::se(mod2), BIFIEsurvey::se(mod3)

## End(Not run)
```

`BIFIE.linreg` *Linear Regression*

Description

Computes linear regression.

Usage

```
BIFIE.linreg(BIFIEobj, dep=NULL, pre=NULL, formula=NULL,
    group=NULL, group_values=NULL, se=TRUE)

## S3 method for class 'BIFIE.linreg'
```

```
summary(object,digits=4,...)

## S3 method for class 'BIFIE.linreg'
coef(object,...)

## S3 method for class 'BIFIE.linreg'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
dep	String for the dependent variable in the regression model
pre	Vector of predictor variables. If the intercept should be included, then use the variable one for specifying it (see Examples).
formula	An R formula object which can be applied instead of providing dep and pre. Note that there is additional computation time needed for model matrix creation.
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
object	Object of class BIFIE.linreg
digits	Number of digits for rounding output
...	Further arguments to be passed

Value

A list with following entries

stat	Data frame with unstandardized and standardized regression coefficients, residual standard deviation and R^2
output	Extensive output with all replicated statistics
...	More values

See Also

Alternative implementations: survey::svyglm, intsvy::timss.reg, intsvy::timss.reg.pv, stats::lm

See BIFIE.logistreg for logistic regression.

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################
```

```
data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
             wgtrep=data.timssrep[, -1 ] )

#**** Model 1: Linear regression for mathematics score
mod1 <- BIFIEsurvey::BIFIE.linreg( bdat, dep="ASMMAT", pre=c("one","books","migrant"),
              group="female" )
summary(mod1)

## Not run:
# same model but specified with R formulas
mod1a <- BIFIEsurvey::BIFIE.linreg( bdat, formula=ASMMAT ~ books + migrant,
               group="female", group_values=0:1 )
summary(mod1a)

# compare result with lm function and first imputed dataset
dat1 <- data.timss1[[1]]
mod1b <- stats::lm( ASMMAT ~ 0 + as.factor(female) + as.factor(female):books +
                            as.factor(female):migrant,
                        data=dat1,  weights=dat1$TOTWGT )
summary(mod1b)

#**** Model 2: Like Model 1, but books is now treated as a factor
mod2 <- BIFIEsurvey::BIFIE.linreg( bdat, formula=ASMMAT ~ as.factor(books) + migrant)
summary(mod2)

############################################################################
# EXAMPLE 2: PISA data | Nonlinear regression models
############################################################################

data(data.pisaNLD)
data <- data.pisaNLD

#--- Create BIFIEdata object immediately using BIFIE.data.jack function
bdat <- BIFIEsurvey::BIFIE.data.jack( data.pisaNLD, jktype="RW_PISA", cdata=TRUE)
summary(bdat)

#*************************************************
#*** Model 1: linear regression
mod1 <- BIFIEsurvey::BIFIE.linreg( bdat, formula=MATH ~ HISEI )
summary(mod1)

#*************************************************
#*** Model 2: Cubic regression
mod2 <- BIFIEsurvey::BIFIE.linreg( bdat, formula=MATH ~ HISEI + I(HISEI^2) + I(HISEI^3) )
summary(mod2)

#*************************************************
#*** Model 3: B-spline regression
```

```
# test with design of HISEI values
dfr <- data.frame("HISEI"=16:90 )
des <- stats::model.frame( ~ splines::bs( HISEI, df=5 ), dfr )
des <- des$splines
plot( dfr$HISEI, des[,1], type="l", pch=1, lwd=2, ylim=c(0,1) )
for (vv in 2:ncol(des) ){
    lines( dfr$HISEI, des[,vv], lty=vv, col=vv, lwd=2)
}

# apply B-spline regression in BIFIEsurvey::BIFIE.linreg
mod3 <- BIFIEsurvey::BIFIE.linreg( bdat, formula=MATH ~ splines::bs(HISEI,df=5) )
summary(mod3)

#*** include transformed HISEI values for B-spline matrix in bdat
bdat2 <- BIFIEsurvey::BIFIE.data.transform( bdat, ~ 0 + splines::bs( HISEI, df=5 ))
bdat2$varnames[ bdat2$varsindex.added ] <- paste0("HISEI_bsdes",
            seq( 1, length( bdat2$varsindex.added ) ) )

#####################################################
#*** Model 4: Nonparametric regression using BIFIE.by

?BIFIE.by

#---- (1) test function with one dataset
dat1 <- bdat$dat1
vars <- c("MATH", "HISEI")
X <- dat1[,vars]
w <- bdat$wgt
X <- as.data.frame(X)
# estimate model
mod <- stats::loess( MATH ~ HISEI, weights=w, data=X )

# predict HISEI values
hisei_val <- data.frame( "HISEI"=seq(16,90) )
y_pred <- stats::predict( mod, hisei_val )
graphics::plot( hisei_val$HISEI, y_pred, type="l")

#--- (2) define loess function
loess_fct <- function(X,w){
    X1 <- data.frame( X, w )
    colnames(X1) <- c( vars, "wgt")
    X1 <- stats::na.omit(X1)
#    mod <- stats::lm( MATH ~ HISEI, weights=X1$wgt, data=X1 )
    mod <- stats::loess( MATH ~ HISEI, weights=X1$wgt, data=X1 )
    y_pred <- stats::predict( mod, hisei_val )
    return(y_pred)
}

#--- (3) estimate model
mod4 <-  BIFIEsurvey::BIFIE.by( bdat, vars, userfct=loess_fct )
summary(mod4)

# plot linear function pointwise and confidence intervals
```

```
graphics::plot( hisei_val$HISEI, mod4$stat$est, type="l", lwd=2,
        xlab="HISEI", ylab="PVMATH", ylim=c(430,670) )
graphics::lines( hisei_val$HISEI, mod4$stat$est - 1.96* mod4$stat$SE, lty=3 )
graphics::lines( hisei_val$HISEI, mod4$stat$est + 1.96* mod4$stat$SE, lty=3 )

## End(Not run)
```

BIFIE.logistreg *Logistic Regression*

Description

Computes logistic regression. Explained variance R^2 is computed by the approach of McKelvey and Zavoina.

Usage

```
BIFIE.logistreg(BIFIEobj, dep=NULL, pre=NULL, formula=NULL,
    group=NULL, group_values=NULL, se=TRUE, eps=1E-8, maxiter=100)

## S3 method for class 'BIFIE.logistreg'
summary(object,digits=4,...)

## S3 method for class 'BIFIE.logistreg'
coef(object,...)

## S3 method for class 'BIFIE.logistreg'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
dep	String for the dependent variable in the regression model
pre	Vector of predictor variables. If the intercept should be included, then use the variable one for specifying it (see Examples).
formula	An R formula object which can be applied instead of providing dep and pre. Note that there is additional computation time needed for model matrix creation.
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
eps	Convergence criterion for parameters
maxiter	Maximum number of iterations
object	Object of class BIFIE.logistreg
digits	Number of digits for rounding output
...	Further arguments to be passed

Value

A list with following entries

stat	Data frame with regression coefficients
output	Extensive output with all replicated statistics
...	More values

See Also

survey::svyglm, stats::glm

For linear regressions see BIFIE.linreg.

Examples

```
#############################################################################
# EXAMPLE 1: TIMSS dataset | Logistic regression
#############################################################################

data(data.timss2)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss2, wgt=data.timss2[[1]]$TOTWGT,
                     wgtrep=data.timssrep[, -1 ] )

#**** Model 1: Logistic regression - prediction of migrational background
res1 <- BIFIEsurvey::BIFIE.logistreg( BIFIEobj=bdat, dep="migrant",
           pre=c("one","books","lang"), group="female", se=FALSE )
summary(res1)

## Not run:
# same model, but with formula specification and standard errors
res1a <- BIFIEsurvey::BIFIE.logistreg( BIFIEobj=bdat,
              formula=migrant ~ books + lang, group="female"  )
summary(res1a)

#############################################################################
# SIMULATED EXAMPLE 2: Comparison of stats::glm and BIFIEsurvey::BIFIE.logistreg
#############################################################################

#*** (1) simulate data
set.seed(987)
N <- 300
x1 <- stats::rnorm(N)
x2 <- stats::runif(N)
ypred <- -0.75+.2*x1 + 3*x2
y <- 1*( stats::plogis(ypred) > stats::runif(N) )
data <- data.frame( "y"=y, "x1"=x1, "x2"=x2 )

#*** (2) estimation logistic regression using glm
mod1 <- stats::glm( y ~ x1 + x2, family="binomial")
```

```
#*** (3) estimation logistic regression using BIFIEdata
# create BIFIEdata object by defining 30 Jackknife zones
bifiedata <- BIFIEsurvey::BIFIE.data.jack( data, jktype="JK_RANDOM", ngr=30 )
summary(bifiedata)
# estimate logistic regression
mod2 <- BIFIEsurvey::BIFIE.logistreg( bifiedata, formula=y ~ x1+x2 )

#*** (4) compare results
summary(mod2)    # BIFIE.logistreg
summary(mod1)   # glm

## End(Not run)
```

`BIFIE.mva` *Missing Value Analysis*

Description

Conducts a missing value analysis.

Usage

```
BIFIE.mva( BIFIEobj, missvars, covariates=NULL, se=TRUE )

## S3 method for class 'BIFIE.mva'
summary(object,digits=4,...)
```

Arguments

`BIFIEobj`	Object of class `BIFIEdata`
`missvars`	Vector of variables for which missing value statistics should be computed
`covariates`	Vector of variables which work as covariates
`se`	Optional logical indicating whether statistical inference based on replication should be employed.
`object`	Object of class `BIFIE.correl`
`digits`	Number of digits for rounding output
`...`	Further arguments to be passed

Value

A list with following entries

`stat.mva`	Data frame with missing value statistics
`res_list`	List with extensive output split according to each variable in `missvars`
`...`	More values

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
BIFIEdata <- BIFIEsurvey::BIFIE.data( data.list=data.timss1,
                wgt=data.timss1[[1]]$TOTWGT, wgtrep=data.timssrep[, -1 ] )

# missing value analysis for "scsci" and "books" and three covariates
res1 <- BIFIEsurvey::BIFIE.mva( BIFIEdata, missvars=c("scsci", "books" ),
             covariates=c("ASMMAT", "female", "ASSSCI") )
summary(res1)

# missing value analysis without statistical inference and without covariates
res2 <- BIFIEsurvey::BIFIE.mva( BIFIEdata, missvars=c("scsci", "books"), se=FALSE)
summary(res2)
```

BIFIE.pathmodel *Path Model Estimation*

Description

This function computes a path model. Predictors are allowed to possess measurement errors. Known measurement error variances (and covariances) or reliabilities can be specified by the user. Alternatively, a set of indicators can be defined for each latent variable, and for each imputed and replicated dataset the measurement error variance is determined by means of calculating the reliability Cronbachs alpha. Measurement errors are handled by adjusting covariance matrices (see Buonaccorsi, 2010, Ch. 5).

Usage

```
BIFIE.pathmodel( BIFIEobj, lavaan.model, reliability=NULL, group=NULL,
        group_values=NULL, se=TRUE )

## S3 method for class 'BIFIE.pathmodel'
summary(object,digits=4,...)

## S3 method for class 'BIFIE.pathmodel'
coef(object,...)

## S3 method for class 'BIFIE.pathmodel'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
lavaan.model	String including the model specification in **lavaan** syntax. lavaan.model also allows the extended functionality in the TAM::lavaanify.IRT function.
reliability	Optional vector containing the reliabilities of each variable. This vector can also include only a subset of all variables.
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
object	Object of class BIFIE.pathmodel
digits	Number of digits for rounding output
...	Further arguments to be passed

Details

The following conventions are used as parameter labels in the output.

Y~X is the regression coefficient of the regression from Y on X.

X->Z->Y denotes the path coefficient from X to Y passing the mediating variable Z.

X-+>Y denotes the total effect (of all paths) from X to Y.

X-~>Y denotes the sum of all indirect effects from X to Y.

The parameter suffix _stand refers to parameters for which all variables are standardized.

Value

A list with following entries

stat	Data frame with unstandardized and standardized regression coefficients, path coefficients, total and indirect effects, residual variances, and R^2
output	Extensive output with all replicated statistics
...	More values

References

Buonaccorsi, J. P. (2010). *Measurement error: Models, methods, and applications*. CRC Press.

See Also

See the **lavaan** and **lavaan.survey** package.

For the lavaan syntax, see lavaan::lavaanify and TAM::lavaanify.IRT

Examples

```
## Not run:
#############################################################################
# EXAMPLE 1: Path model data.bifie01
#############################################################################

data(data.bifie01)
dat <- data.bifie01
# create dataset with replicate weights and plausible values
bifieobj <- BIFIEsurvey::BIFIE.data.jack( data=dat,  jktype="JK_TIMSS",
               jkzone="JKCZONE", jkrep="JKCREP", wgt="TOTWGT",
               pv_vars=c("ASMMAT","ASSSCI") )

#*************************************************************
#*** Model 1: Path model
lavmodel1 <- "
     ASMMAT ~ ASBG07A + ASBG07B  + ASBM03 + ASBM02A + ASBM02E
     # define latent variable with 2nd and 3rd item in reversed scoring
     ASBM03=~ 1*ASBM03A + (-1)*ASBM03B + (-1)*ASBM03C + 1*ASBM03D
     ASBG07A ~ ASBM02E
     ASBG07A ~~ .2*ASBG07A    # measurement error variance of .20
     ASBM02E ~~ .45*ASBM02E     # measurement error variance of .45
     ASBM02E ~ ASBM02A + ASBM02B
        "
#--- Model 1a: model calculated by gender
mod1a <- BIFIEsurvey::BIFIE.pathmodel( bifieobj, lavmodel1, group="female" )
summary(mod1a)

#--- Model 1b: Input of some known reliabilities
reliability <- c( "ASBM02B"=.6, "ASBM02A"=.8 )
mod1b <- BIFIEsurvey::BIFIE.pathmodel( bifieobj, lavmodel1, reliability=reliability)
summary(mod1b)

#*************************************************************
#*** Model 2: Linear regression with errors in predictors

# specify lavaan model
lavmodel2 <- "
     ASMMAT ~ ASBG07A + ASBG07B + ASBM03A
     ASBG07A ~~ .2*ASBG07A
        "
mod2 <- BIFIEsurvey::BIFIE.pathmodel( bifieobj, lavmodel2  )
summary(mod2)

## End(Not run)
```

BIFIE.twolevelreg *Two Level Regression*

Description

This function computes the hierarchical two level model with random intercepts and random slopes. The full maximum likelihood estimation is conducted by means of an EM algorithm (Raudenbush & Bryk, 2002).

Usage

```
BIFIE.twolevelreg( BIFIEobj, dep, formula.fixed, formula.random, idcluster,
   wgtlevel2=NULL, wgtlevel1=NULL, group=NULL, group_values=NULL,
   recov_constraint=NULL, se=TRUE, globconv=1E-6, maxiter=1000 )

## S3 method for class 'BIFIE.twolevelreg'
summary(object,digits=4,...)

## S3 method for class 'BIFIE.twolevelreg'
coef(object,...)

## S3 method for class 'BIFIE.twolevelreg'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
dep	String for the dependent variable in the regression model
formula.fixed	An R formula for fixed effects
formula.random	An R formula for random effects
idcluster	Cluster identifier. The cluster identifiers must be sorted in the BIFIE.data object.
wgtlevel2	Name of Level 2 weight variable
wgtlevel1	Name of Level 1 weight variable. This is optional. If it is not provided, wgtlevel is calculated from the total weight and wgtlevel2.
group	Optional grouping variable
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
recov_constraint	Matrix for constraints of random effects covariance matrix. The random effects are numbered according to the order in the specification in formula.random. The first column in recov_constraint contains the row index in the covariance matrix, the second column the column index and the third column the value to be fixed.
se	Optional logical indicating whether statistical inference based on replication should be employed. In case of se=FALSE, standard errors are computed as maximum likelihood estimates under the assumption of random sampling of level 2 clusters.
globconv	Convergence criterion for maximum parameter change

maxiter	Maximum number of iterations
object	Object of class BIFIE.twolevelreg
digits	Number of digits for rounding output
...	Further arguments to be passed

Details

The implemented random slope model can be written as

$$y_{ij} = \boldsymbol{X}_{ij}\boldsymbol{\gamma} + \boldsymbol{Z}_{ij}\boldsymbol{u}_j + \varepsilon_{ij}$$

where y_{ij} is the dependent variable, $\boldsymbol{X}_{ij}$ includes the fixed effects predictors (specified by formula.fixed) and $\boldsymbol{Z}_{ij}$ includes the random effects predictors (specified by formula.random). The random effects $\boldsymbol{u}_j$ follow a multivariate normal distribution.

The function also computes a variance decomposition of explained variance due to fixed and random effects for the within and the between level. This variance decomposition is conducted for the predictor matrices $\boldsymbol{X}$ and $\boldsymbol{Z}$. It is assumed that $\boldsymbol{X}_{ij} = \boldsymbol{X}_j^B + \boldsymbol{X}_{ij}^W$. The different sources of variance are computed by formulas as proposed in Snijders and Bosker (2012, Ch. 7).

Value

A list with following entries

stat	Data frame with coefficients and different sources of variance.
output	Extensive output with all replicated statistics
...	More values

References

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks: Sage.

Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks: Sage.

See Also

The lme4::lmer function in the **lme4** package allows only weights at the first level.

See the **WeMix** package (and the function WeMix::mix) for estimation of mixed effects models with weights at different levels.

Examples

```
## Not run:
library(lme4)

#############################################################################
# EXAMPLE 1: Dataset data.bifie01 | TIMSS 2011
#############################################################################
```

```
data(data.bifie01)
dat <- data.bifie01
set.seed(987)

# create dataset with replicate weights and plausible values
bdat1 <- BIFIEsurvey::BIFIE.data.jack( data=dat, jktype="JK_TIMSS", jkzone="JKCZONE",
            jkrep="JKCREP", wgt="TOTWGT", pv_vars=c("ASMMAT","ASSSCI") )

# create dataset without plausible values and ignoring weights
bdat2 <- BIFIEsurvey::BIFIE.data.jack( data=dat, jktype="JK_RANDOM", ngr=10 )
#=> standard errors from ML estimation

#*********************************************
# Model 1: Random intercept model

#--- Model 1a: without weights, first plausible value
mod1a <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat2, dep="ASMMAT01",
                formula.fixed=~ 1, formula.random=~ 1, idcluster="idschool",
                wgtlevel2="one", se=FALSE )
summary(mod1a)

#--- Model 1b: estimation in lme4
mod1b <- lme4::lmer( ASMMAT01 ~ 1 + ( 1 | idschool), data=dat, REML=FALSE)
summary(mod1b)

#--- Model 1c: Like Model 1a but for five plausible values and ML inference
mod1c <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat1, dep="ASMMAT",
                formula.fixed=~ 1, formula.random=~ 1, idcluster="idschool",
                wgtlevel2="one",  se=FALSE )
summary(mod1c)

#--- Model 1d: weights and sampling design and all plausible values
mod1d <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat1, dep="ASMMAT",
                formula.fixed=~ 1, formula.random=~ 1, idcluster="idschool",
                wgtlevel2="SCHWGT" )
summary(mod1d)

#*********************************************
# Model 2: Random slope model

#--- Model 2a: without weights
mod2a <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat2, dep="ASMMAT01",
                formula.fixed=~  female +  ASBG06A, formula.random=~ ASBG06A,
                idcluster="idschool", wgtlevel2="one",  se=FALSE )
summary(mod2a)

#--- Model 2b: estimation in lme4
mod2b <- lme4::lmer( ASMMAT01 ~ female +  ASBG06A + ( 1 + ASBG06A | idschool),
                    data=dat, REML=FALSE)
summary(mod2b)

#--- Model 2c: weights and sampling design and all plausible values
```

```
mod2c <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat1, dep="ASMMAT",
                formula.fixed=~  female +  ASBG06A, formula.random=~ ASBG06A,
                idcluster="idschool", wgtlevel2="SCHWGT", maxiter=500, se=FALSE)
summary(mod2c)

#--- Model 2d: Uncorrelated intecepts and slopes

# constraint for zero covariance between intercept and slope
recov_constraint <- matrix( c(1,2,0), ncol=3 )
mod2d <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat2, dep="ASMMAT01",
                formula.fixed=~ female +  ASBG06A, formula.random=~ ASBG06A,
                idcluster="idschool", wgtlevel2="one",  se=FALSE,
                recov_constraint=recov_constraint )
summary(mod2d)

#--- Model 2e: Fixed entries in the random effects covariance matrix

# two constraints for random effects covariance
# Cov(Int, Slo)=0  # zero slope for intercept and slope
# Var(Slo)=10      # slope variance of 10
recov_constraint <- matrix( c(1,2,0,
                      2,2,10), ncol=3, byrow=TRUE)
mod2e <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat2, dep="ASMMAT01",
                formula.fixed=~  female +  ASBG06A, formula.random=~ ASBG06A,
                idcluster="idschool", wgtlevel2="one",  se=FALSE,
                recov_constraint=recov_constraint )
summary(mod2e)

#############################################################################
# SIMULATED EXAMPLE 2: Two-level regression with random slopes
#############################################################################

#--- (1) simulate data
set.seed(9876)
NC <- 100    # number of clusters
Nj <- 20     # number of persons per cluster
iccx <- .4   # intra-class correlation predictor
theta <- c( 0.7, .3 )    # fixed effects
Tmat <- diag( c(.3, .1 ) ) # variances of random intercept and slope
sig2 <- .60    # residual variance
N <- NC*Nj
idcluster <- rep( 1:NC, each=Nj )
dat1 <- data.frame("idcluster"=idcluster )
dat1$X <- rep( stats::rnorm( NC, sd=sqrt(iccx) ), each=Nj ) +
                stats::rnorm( N, sd=sqrt( 1 - iccx) )
dat1$Y <- theta[1] + rep( stats::rnorm(NC, sd=sqrt(Tmat[1,1] ) ), each=Nj ) +
      theta[2] + rep( stats::rnorm(NC, sd=sqrt(Tmat[2,2])), each=Nj ) * dat1$X +
      stats::rnorm(N, sd=sqrt(sig2) )

#--- (2) create design object
bdat1 <- BIFIEsurvey::BIFIE.data.jack( data=dat1, jktype="JK_GROUP", jkzone="idcluster")
summary(bdat1)
```

```
#*** Model 1: Random slope model (ML standard errors)

#- estimation using BIFIE.twolevelreg
mod1a <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat1, dep="Y",
                formula.fixed=~ 1+X, formula.random=~ 1+X, idcluster="idcluster",
                wgtlevel2="one",  se=FALSE )
summary(mod1a)

#- estimation in lme4
mod1b <- lme4::lmer( Y ~ X + ( 1+X | idcluster), data=dat1, REML=FALSE  )
summary(mod1b)

#- using Jackknife for inference
mod1c <- BIFIEsurvey::BIFIE.twolevelreg( BIFIEobj=bdat1, dep="Y",
                formula.fixed=~ 1+X, formula.random=~ 1+X, idcluster="idcluster",
                wgtlevel2="one",  se=TRUE )
summary(mod1c)

# extract coefficients
coef(mod1a)
coef(mod1c)
# covariance matrix
vcov(mod1a)
vcov(mod1c)

## End(Not run)
```

BIFIE.univar *Univariate Descriptive Statistics (Means and Standard Deviations)*

Description

Computes some univariate descriptive statistics (means and standard deviations).

Usage

```
BIFIE.univar(BIFIEobj, vars, group=NULL, group_values=NULL, se=TRUE)

## S3 method for class 'BIFIE.univar'
summary(object,digits=3,...)

## S3 method for class 'BIFIE.univar'
coef(object,...)

## S3 method for class 'BIFIE.univar'
vcov(object,...)
```

Arguments

BIFIEobj	Object of class BIFIEdata
vars	Vector of variables for which statistics should be computed
group	Optional grouping variable(s)
group_values	Optional vector of grouping values. This can be omitted and grouping values will be determined automatically.
se	Optional logical indicating whether statistical inference based on replication should be employed.
object	Object of class BIFIE.univar
digits	Number of digits for rounding output
...	Further arguments to be passed

Value

A list with following entries

stat	Data frame with univariate statistics
stat_M	Data frame with means
stat_SD	Data frame with standard deviations
output	Extensive output with all replicated statistics
...	More values

See Also

See BIFIE.univar.test for a test of equal means and effect sizes η and d.

Descriptive statistics without statistical inference can be estimated by the collection of miceadds::ma.wtd.statNA functions from the **miceadds** package.

Further descriptive functions:

survey::svymean, intsvy::timss.mean, intsvy::timss.mean.pv, stats::weighted.mean, Hmisc::wtd.mean, miceadds::ma.wtd.meanNA

survey::svyvar, Hmisc::wtd.var, miceadds::ma.wtd.sdNA, miceadds::ma.wtd.covNA

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )
```

```
# compute descriptives for plausible values
res1 <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT","ASSSCI","books") )
summary(res1)

# split descriptives by number of books
res2 <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT","ASSSCI"), group="books",
            group_values=1:5)
summary(res2)

#############################################################################
# EXAMPLE 2: TIMSS dataset with missings
#############################################################################

data(data.timss2)
data(data.timssrep)

# use first dataset with missing data from data.timss2
bdat1 <- BIFIEsurvey::BIFIE.data( data.list=data.timss2[[1]], wgt=data.timss2[[1]]$TOTWGT,
               wgtrep=data.timssrep[, -1 ])

# some descriptive statistics without statistical inference
res1a <- BIFIEsurvey::BIFIE.univar( bdat1, vars=c("ASMMAT","ASSSCI","books"), se=FALSE)
# descriptive statistics with statistical inference
res1b <- BIFIEsurvey::BIFIE.univar( bdat1, vars=c("ASMMAT","ASSSCI","books") )
summary(res1a)
summary(res1b)

# split descriptives by number of books
res2 <- BIFIEsurvey::BIFIE.univar( bdat1, vars=c("ASMMAT","ASSSCI"), group="books")
# Note that if group_values is not specified as an argument it will be
# automatically determined by the observed frequencies in the dataset
summary(res2)
```

`BIFIE.univar.test` *Analysis of Variance and Effect Sizes for Univariate Statistics*

Description

Computes a Wald test which tests equality of means (univariate analysis of variance). In addition, the d and η effect sizes are computed.

Usage

```
BIFIE.univar.test(BIFIE.method, wald_test=TRUE)

## S3 method for class 'BIFIE.univar.test'
summary(object,digits=4,...)
```

Arguments

BIFIE.method	Object of class BIFIE.univar
wald_test	Optional logical indicating whether a Wald test should be performed.
object	Object of class BIFIE.univar.test
digits	Number of digits for rounding output
...	Further arguments to be passed

Value

A list with following entries

stat.F	Data frame with F statistic for Wald test
stat.eta	Data frame with η effect size and its inference
stat.dstat	Data frame with Cohen's d effect size and its inference
...	More values

See Also

BIFIE.univar

Examples

```
############################################################################
# EXAMPLE 1: Imputed TIMSS dataset - One grouping variable
############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
           wgtrep=data.timssrep[, -1 ] )

#**** Model 1: 3 variables splitted by book
res1 <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT", "ASSSCI","scsci"),
                    group="books")
summary(res1)
# analysis of variance
tres1 <- BIFIEsurvey::BIFIE.univar.test(res1)
summary(tres1)

#**** Model 2: One variable splitted by gender
res2 <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT"), group="female" )
summary(res2)
# analysis of variance
tres2 <- BIFIEsurvey::BIFIE.univar.test(res2)
summary(tres2)

## Not run:
```

```
#**** Model 3: Univariate statistic: math
res3 <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT") )
summary(res3)
tres3 <- BIFIEsurvey::BIFIE.univar.test(res3)

############################################################################
# EXAMPLE 2: Imputed TIMSS dataset - Two grouping variables
############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
                  wgtrep=data.timssrep[, -1 ] )

#**** Model 1: 3 variables splitted by book and female
res1 <- BIFIEsurvey::BIFIE.univar(bdat, vars=c("ASMMAT", "ASSSCI","scsci"),
                  group=c("books","female"))
summary(res1)

# analysis of variance
tres1 <- BIFIEsurvey::BIFIE.univar.test(res1)
summary(tres1)

# extract data frame with Cohens d statistic
dstat <- tres1$stat.dstat

# extract d values for gender comparisons with same value of books
# -> 'books' refers to the first variable
ind <- which(
  unlist( lapply( strsplit( dstat$groupval1, "#"), FUN=function(vv){vv[1]}) )==
  unlist( lapply( strsplit( dstat$groupval2, "#"), FUN=function(vv){vv[1]}) )
        )
dstat[ ind, ]

## End(Not run)
```

`BIFIE.waldtest` *Wald Tests for BIFIE Methods*

Description

This function performs a Wald test for objects of classes `BIFIE.by`, `BIFIE.correl`, `BIFIE.crosstab`, `BIFIE.freq`, `BIFIE.linreg`, `BIFIE.logistreg` and `BIFIE.univar`.

Usage

```
BIFIE.waldtest(BIFIE.method, Cdes, rdes, type=NULL)
```

```
## S3 method for class 'BIFIE.waldtest'
summary(object,digits=4,...)
```

Arguments

BIFIE.method	Object of classes BIFIE.by, BIFIE.correl, BIFIE.crosstab, BIFIE.freq, BIFIE.linreg, BIFIE.logistreg or BIFIE.univar (see parnames in the Output of these methods for saved parameters)
Cdes	Design matrix C (see Details)
rdes	Design vector r (see Details)
type	Only applies to BIFIE.correl. In case of type="cov" covariances instead of correlations are used for parameter tests.
object	Object of class BIFIE.waldtest
digits	Number of digits for rounding output
...	Further arguments to be passed

Details

The Wald test is conducted for a parameter vector $\boldsymbol{\theta}$, specifying the hypothesis $C\boldsymbol{\theta} = r$. Statistical inference is performed by using the D_1 and the D_2 statistic (Enders, 2010, Ch. 8).

For objects of class bifie.univar, only hypotheses with respect to means are implemented.

Value

A list with following entries

stat.D	Data frame with D_1 and D_2 statistic, degrees of freedom and p value
...	More values

References

Enders, C. K. (2010). *Applied missing data analysis*. Guilford Press.

See Also

survey::regTermTest, survey::anova.svyglm, car::linearHypothesis

Examples

```
#############################################################################
# EXAMPLE 1: Imputed TIMSS dataset
#############################################################################

data(data.timss1)
data(data.timssrep)

# create BIFIE.dat object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
```

```
            wgtrep=data.timssrep[, -1 ] )

#******************
#*** Model 1: Linear regression
res1 <- BIFIEsurvey::BIFIE.linreg( bdat, dep="ASMMAT", pre=c("one","books","migrant"),
          group="female" )
summary(res1)

#*** Wald test which tests whether sigma and R^2 values are the same
res1$parnames    # parameter names
pn <- res1$parnames ; PN <- length(pn)
Cdes <- matrix(0,nrow=2, ncol=PN)
colnames(Cdes) <- pn
# equality of R^2  ( R^2(female0) - R^2(female1)=0 )
Cdes[ 1, c("R^2_NA_female_0", "R^2_NA_female_1" ) ] <- c(1,-1)
# equality of sigma ( sigma(female0) - sigma(female1)=0)
Cdes[ 2, c("sigma_NA_female_0", "sigma_NA_female_1" ) ] <- c(1,-1)
# design vector
rdes <- rep(0,2)
# perform Wald test
wmod1 <- BIFIEsurvey::BIFIE.waldtest( BIFIE.method=res1, Cdes=Cdes, rdes=rdes )
summary(wmod1)

## Not run:
#******************
#*** Model 2: Correlations

# compute some correlations
res2a <- BIFIEsurvey::BIFIE.correl( bdat, vars=c("ASMMAT","ASSSCI","migrant","books"))
summary(res2a)

# test whether r(MAT,migr)=r(SCI,migr) and r(MAT,books)=r(SCI,books)
pn <- res2a$parnames; PN <- length(pn)
Cdes <- matrix( 0, nrow=2, ncol=PN )
colnames(Cdes) <- pn
Cdes[ 1, c("ASMMAT_migrant", "ASSSCI_migrant") ] <- c(1,-1)
Cdes[ 2, c("ASMMAT_books", "ASSSCI_books") ] <- c(1,-1)
rdes <- rep(0,2)
# perform Wald test
wres2a <- BIFIEsurvey::BIFIE.waldtest( res2a, Cdes, rdes )
summary(wres2a)

#******************
#*** Model 3: Frequencies

# Number of books splitted by gender
res3a <- BIFIEsurvey::BIFIE.freq( bdat, vars=c("books"), group="female" )
summary(res3a)

# test whether book(cat4,female0)+book(cat5,female0)=book(cat4,female1)+book(cat5,female5)
pn <- res3a$parnames
PN <- length(pn)
Cdes <- matrix( 0, nrow=1, ncol=PN )
```

```
colnames(Cdes) <- pn
Cdes[ 1, c("books_4_female_0", "books_5_female_0",
    "books_4_female_1", "books_5_female_1" ) ] <- c(1,1,-1,-1)
rdes <- c(0)
# Wald test
wres3a <- BIFIEsurvey::BIFIE.waldtest( res3a, Cdes, rdes )
summary(wres3a)

#******************
#*** Model 4: Means

# math and science score splitted by gender
res4a <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT","ASSSCI"), group="female")
summary(res4a)

# test whether there are significant gender differences in math and science
#=> multivariate ANOVA
pn <- res4a$parnames
PN <- length(pn)
Cdes <- matrix( 0, nrow=2, ncol=PN )
colnames(Cdes) <- pn
Cdes[ 1, c("ASMMAT_female_0", "ASMMAT_female_1"  ) ] <- c(1,-1)
Cdes[ 2, c("ASSSCI_female_0", "ASSSCI_female_1"  ) ] <- c(1,-1)
rdes <- rep(0,2)
# Wald test
wres4a <- BIFIEsurvey::BIFIE.waldtest( res4a, Cdes, rdes )
summary(wres4a)

## End(Not run)
```

`BIFIEdata.select` *Selection of Variables and Imputed Datasets for Objects of Class* `BIFIEdata`

Description

This function select variables and some (or all) imputed datasets of an object of class `BIFIEdata` and saves the resulting object also of class `BIFIEdata`.

Usage

```
BIFIEdata.select(bifieobj, varnames=NULL, impdata.index=NULL)
```

Arguments

`bifieobj`	Object of class `BIFIEdata`
`varnames`	Variables chosen for the selection
`impdata.index`	Selected indices of imputed datasets

Value

An object of class BIFIEdata saved in a non-compact or compact way, see value cdata

See Also

See BIFIE.data for creating BIFIEdata objects.

Examples

```
#############################################################################
# EXAMPLE 1: Some manipulations of BIFIEdata objects created from data.timss1
#############################################################################
data(data.timss1)
data(data.timssrep)

# create BIFIEdata
bdat1 <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ])
summary(bdat1)

# create BIFIEcdata object
bdat2 <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
            wgtrep=data.timssrep[, -1 ], cdata=TRUE )
summary(bdat2)

# selection of variables for BIFIEdata object
bdat1a <- BIFIEsurvey::BIFIEdata.select( bdat1, varnames=bdat1$varnames[ 1:7 ] )
# selection of variables and 1st, 2nd and 4th imputed datasets of BIFIEcdata object
bdat2a <- BIFIEsurvey::BIFIEdata.select( bdat2, varnames=bdat2$varnames[ 1:7 ],
                impdata.index=c(1,2,4) )
summary(bdat1a)
summary(bdat2a)
```

BIFIEdata2svrepdesign *Conversion of a* BIFIEdata *Object into a* svyrep *Object in the* **survey** *Package (and the other way around)*

Description

The function BIFIEdata2svrepdesign converts of a BIFIEdata object into a svyrep object in the **survey** package.

The function svrepdesign2BIFIEdata converts a svyrep object in the **survey** package into an object of class BIFIEdata.

Usage

```
BIFIEdata2svrepdesign(bifieobj, varnames=NULL, impdata.index=NULL)

svrepdesign2BIFIEdata(svrepdesign, varnames=NULL, cdata=FALSE)
```

Arguments

bifieobj	Object of class BIFIEdata
varnames	Optional vector with variable names
impdata.index	Selected indices of imputed datasets
svrepdesign	Object of class svyrep.design or svyimputationList
cdata	Logical inducating whether BIFIEdata object should be saved in compact format

Value

Function BIFIEdata2svrepdesign: Object of class svyrep.design or svyimputationList

Function svrepdesign2BIFIEdata: Object of class BIFIEdata

See Also

See the BIFIE.data function for creating objects of class BIFIEdata in **BIFIEsurvey**.

See the survey::svrepdesign function in the **survey** package.

Examples

```
## Not run:
#############################################################################
# EXAMPLE 1: One dataset, TIMSS replication design
#############################################################################

data(data.timss3)
data(data.timssrep)

#--- create BIFIEdata object
bdat3 <- BIFIEsurvey::BIFIE.data.jack(data.timss3, jktype="JK_TIMSS")
summary(bdat3)

#--- create survey object directly in survey package
dat3a <- as.data.frame( cbind( data.timss3, data.timssrep ) )
RR <- ncol(data.timssrep) - 1       # number of jackknife zones
svydes3a <- survey::svrepdesign(data=dat3a, weights=~TOTWGT,type="JKn",
                repweights='w_fstr[0-9]', scale=1,  rscales=rep(1,RR), mse=TRUE )
print(svydes3a)

#--- create survey object by converting the BIFIEdata object to survey
svydes3b <- BIFIEsurvey::BIFIEdata2svrepdesign(bdat3)

#--- convert survey object into BIFIEdata object
bdat3e <- BIFIEsurvey::svrepdesign2BIFIEdata(svrepdesign=svydes3b)

#*** compare results for the mean in Mathematics scores
mod1a <- BIFIEsurvey::BIFIE.univar( bdat3, vars="ASMMAT1")
mod1b <- survey::svymean( ~ ASMMAT1, design=svydes3a )
```

```
mod1c <- survey::svymean( ~ ASMMAT1, design=svydes3b )
lavmodel <- "ASMMAT1 ~ 1"
mod1d <- BIFIEsurvey::BIFIE.lavaan.survey(lavmodel, svyrepdes=svydes3b)

#- coefficients
coef(mod1a); coef(mod1b); coef(mod1c); coef(mod1d)[1]
#- standard errors
survey::SE(mod1a); survey::SE(mod1b); survey::SE(mod1c); sqrt(vcov(mod1d)[1,1])

#############################################################################
# EXAMPLE 2: Multiply imputed datasets, TIMSS replication design
#############################################################################

data(data.timss2)
data(data.timssrep)

#--- create BIFIEdata object
bdat4 <- BIFIEsurvey::BIFIE.data( data=data.timss2, wgt="TOTWGT",
              wgtrep=data.timssrep[,-1], fayfac=1)
print(bdat4)

#--- create object with imputed datasets in survey
datL <- mitools::imputationList( data.timss2 )
RR <- ncol(data.timssrep) - 1
weights <- data.timss2[[1]]$TOTWGT
repweights <-  data.timssrep[,-1]
svydes4a <- survey::svrepdesign(data=datL, weights=weights, type="other",
               repweights=repweights, scale=1,  rscales=rep(1,RR), mse=TRUE)
print(svydes4a)

#--- create BIFIEdata object with conversion function
svydes4b <- BIFIEsurvey::BIFIEdata2svrepdesign(bdat4)

#--- reconvert survey object into BIFIEdata object
bdat4c <- BIFIEsurvey::svrepdesign2BIFIEdata(svrepdesign=svydes4b)

#*** compare results for a mean
mod1a <- BIFIEsurvey::BIFIE.univar(bdat4, vars="ASMMAT")
mod1b <- mitools::MIcombine( with(svydes4a, survey::svymean( ~ ASMMAT, design=svydes4a )))
mod1c <- mitools::MIcombine( with(svydes4b, survey::svymean( ~ ASMMAT, design=svydes4b )))

# results
coef(mod1a); coef(mod1b); coef(mod1c)
survey::SE(mod1a); survey::SE(mod1b); survey::SE(mod1c)

## End(Not run)
```

BIFIEsurvey-utilities *Utility Functions in* **BIFIEsurvey**

Description

Utility functions in **BIFIEsurvey**.

Usage

```
## Rubin rules for combining multiple imputation estimates
bifiesurvey_rcpp_rubin_rules(estimates, variances)

## computation of replication variance
bifiesurvey_rcpp_replication_variance(pars, pars_repl, fay_factor)

## statistical inference for nested multiple imputation
BIFIE_NMI_inference_parameters( parsM, parsrepM, fayfac, RR, Nimp, Nimp_NMI,
      comp_cov=FALSE)
```

Arguments

estimates	Vector
variances	Vector
pars	Matrix
pars_repl	Matrix
fay_factor	Vector
parsM	Matrix
parsrepM	Matrix
fayfac	Vector
RR	Numeric
Nimp	Integer
Nimp_NMI	Integer
comp_cov	Logical

---

bifietable *An* **Rcpp** *Based Version of the* table *Function*

Description

This is an **Rcpp** based version of the base::table function.

Usage

```
bifietable(vec, sort.names=FALSE)
```

Arguments

vec	A numeric or character vector
sort.names	An optional logical indicating whether values in the character vector should also be sorted in the table output

Value

Same output like base::table

See Also

base::table

Examples

```
data(data.timss1)
table( data.timss1[[1]][,"books"] )
BIFIEsurvey::bifietable( data.timss1[[1]][,"books"] )
```

---

data.bifie *Example Datasets for the* **BIFIEsurvey** *Package*

Description

Some example datasets.

Usage

```
data(data.bifie01)
```

Format

- The dataset data.bifie01 contains data of 4th Grade Austrian students from the TIMSS 2011 study.

data.pisaNLD *Some PISA Datasets*

Description

Some PISA datasets.

Usage

```
data(data.pisaNLD)
```

Format

The dataset `data.pisaNLD` is a data frame with 3992 observations on 405 variables which is a part of the Dutch PISA 2006 data.

Source

Downloaded from doi:10.18637/jss.v020.i05 (Fox, 2007).

References

Fox, J.-P. (2007). Multilevel IRT Modeling in practice with the package mlirt. *Journal of Statistical Software, 20*(5), 1-16. doi:10.18637/jss.v020.i05

Examples

```
## Not run:
library(mitools)
library(survey)
library(intsvy)

#############################################################################
# EXAMPLE 1: Dutch PISA 2006 dataset
#############################################################################

data(data.pisaNLD)
data <- data.pisaNLD

#--- Create object of class BIFIEdata

# list variables with plausible values: These must be named
# as pv1math, pv2math, ..., pv5math, ...
pv_vars <- toupper( c("math", "math1", "math2", "math3", "math4",
             "read", "scie", "prob") )
# create 5 datasets including different sets of plausible values
dfr <- NULL
VV <- length(pv_vars)
Nimp <- 5           # number of plausible values
```

```
for (vv in 1:VV){
      vv1 <- pv_vars[vv]
      ind.vv1 <- which( colnames(data) %in% paste0("PV", 1:Nimp, vv1) )
      dfr2 <- data.frame( "variable"=paste0("PV", vv1), "var_index"=vv,
          "data_index"=ind.vv1, "impdata_index"=1:Nimp )
      dfr <- rbind( dfr, dfr2 )
}

sel_ind <- setdiff( 1:( ncol(data) ), dfr$data_index )
data0 <- data[, sel_ind ]
V0 <- ncol(data0)
newvars <- seq( V0+1, V0+VV )
datalist <- as.list( 1:Nimp )
for (ii in 1:Nimp ){
    dat1 <- data.frame( data0, data[, dfr[ dfr$impdata_index==ii, "data_index" ]])
    colnames(dat1)[ newvars ] <- paste0("PV",pv_vars)
    datalist[[ii]] <- dat1
}

# dataset with replicate weights
datarep <- data[, grep( "W_FSTR", colnames(data) ) ]
RR <- ncol(datarep)     # number of replicate weights

# create BIFIE object
bifieobj <- BIFIEsurvey::BIFIE.data( datalist, wgt=data[, "W_FSTUWT"],
                wgtrep=datarep, fayfac=1 / RR / ( 1 - .5 )^2 )
# For PISA: RR=80 and therefore fayfac=1/20=.05
summary(bifieobj)

#--- Create BIFIEdata object immediately using BIFIE.data.jack function
bifieobj1 <- BIFIEsurvey::BIFIE.data.jack( data.pisaNLD, jktype="RW_PISA", cdata=TRUE)
summary(bifieobj1)

#--- Create object in survey package
datL <- mitools::imputationList(list( datalist[[1]],datalist[[2]],
                datalist[[3]],datalist[[4]],datalist[[5]]) )
pisades <- survey::svrepdesign(ids=~ 1, weights=~W_FSTUWT, data=datL,
                  repweights="W_FSTR[0-9]+", type="Fay", rho=0.5, mse=TRUE)
print(pisades)

#+++++++++++++++ some comparisons with other packages ++++++++++++++++++++++++++++++++

#**** Model 1: Means for mathematics and reading
# BIFIEsurvey package
mod1a <- BIFIEsurvey::BIFIE.univar( bifieobj, vars=c("PVMATH", "PVREAD") )
summary(mod1a)

# intsvy package
mod1b <- intsvy::pisa.mean.pv(pvlabel="MATH", data=data.pisaNLD )
mod1b

# survey package
mod1c <- with( pisades, survey::svymean(PVMATH~1, design=pisades) )
```

```
res1c <- mitools::MIcombine(mod1c)
summary(res1c)

#**** Model 2: Linear regression
# BIFIEsurvey package
mod2a <- BIFIEsurvey::BIFIE.linreg( bifieobj, dep="PVMATH",
              pre=c("one","ANXMAT","HISEI"))
summary(mod2a)

# intsvy package
mod2b <- intsvy::pisa.reg.pv(pvlabel="MATH", x=c("ANXMAT","HISEI"), data=data.pisaNLD)
mod2b

# survey package
mod2c <- with( pisades, survey::svyglm(PVMATH~ANXMAT+HISEI, design=pisades) )
res2c <- mitools::MIcombine(mod2c)
summary(res2c)

## End(Not run)
```

`data.test1` *Some Datasets for Testing Purposes*

Description

Some datasets for testing purposes.

Usage

```
data(data.test1)
```

Format

The dataset `data.test1` is a dataset with a stratified clustered sample of 2101 students nested within 89 classes and 4 strata. The format is

```
'data.frame': 2101 obs. of 16 variables:
$ idstud : num 10101 10102 10103 10104 10105 ...
$ idclass: num 101 101 101 101 101 101 101 101 101 101 ...
$ math : num 108 107 101 91 157 ...
$ engl : num 95.2 133.3 94.9 97.6 142.3 ...
$ germ : num 125 150 107 113 139 ...
$ stratum: num 1 1 1 1 1 1 1 1 1 1 ...
$ female : int 1 1 1 1 0 0 0 0 0 0 ...
$ age : num 14.6 14.3 14.8 14.6 14.5 ...
$ hisei : int 43 43 43 67 51 30 30 51 68 70 ...
$ paredu : int 2 2 1 4 5 2 1 5 7 7 ...
$ books : int 4 2 3 3 5 3 2 4 3 5 ...
$ satisf : int 5 4 6 7 6 5 7 3 6 6 ...
```

```
$ migrant: int 1 0 0 1 0 0 0 0 0 0 ...
$ wgtstud: num 20.9 20.9 20.9 20.9 20.9 ...
$ jkzone : num 101 101 101 101 101 101 101 101 101 101 ...
$ jkrep : num 0 0 0 0 0 0 0 0 0 0 ...
```

`data.timss` *Dataset TIMSS 2011*

Description

Example dataset TIMSS 2011

Usage

```
data(data.timss1)
data(data.timss1.ind)
data(data.timss2)
data(data.timssrep)
data(data.timss3)
data(data.timss4)
```

Format

The dataset `data.timss1` is a list containing 5 imputed datasets. The dataset `data.timss1.ind` contains response indicators of these 5 imputed datasets in `data.timss1`.

The dataset `data.timss2` is a list containing 5 datasets in which only plausible values are imputed, but student covariates are missing.

The dataset `data.timssrep` contains replicate weights of students.

The dataset `data.timss3` is a TIMSS dataset with some missing student covariates and all 5 plausible values contained in one file.

The dataset `data.timss4` is a list containing nested multiply imputed datasets, with 5 between-nest and 4 within-nest imputations.

Examples

```
## Not run:
library(survey)
library(lavaan.survey)
library(intsvy)
library(mitools)

#############################################################################
# EXAMPLE 1: TIMSS dataset data.timss3 (one dataset including all PVs)
#############################################################################

data(data.timss2)
```

```
data(data.timss3)
data(data.timssrep)

# Analysis based on official 'single' datasets (data.timss3)
# There are 5 plausible values, but student covariates are not imputed.

#--- create object of class BIFIE data
bdat3 <- BIFIEsurvey::BIFIE.data(data.timss3, wgt=data.timss3$TOTWGT,
             wgtrep=data.timssrep[,-1], fayfac=1)
summary(bdat3)
# This BIFIEdata object contains one dataset in which all
# plausible values are included. This object can be used
# in analysis without plausible values.
# Equivalently, one can define bdat3 much simpler by
bdat3 <- BIFIEsurvey::BIFIE.data.jack(data.timss3, jktype="JK_TIMSS")
summary(bdat3)

#--- In the following, the object bdat4 is defined with 5 datasets
# referring to 5 plausible values.
bdat4 <- BIFIEsurvey::BIFIE.data.jack(data.timss3, pv_vars=c("ASMMAT","ASSSCI"),
              jktype="JK_TIMSS")
summary(bdat4)

#--- create object in survey package
dat3a <- as.data.frame( cbind( data.timss2[[1]], data.timssrep ) )
RR <- ncol(data.timssrep) - 1       # number of jackknife zones
svydes3 <- survey::svrepdesign(data=dat3a, weights=~TOTWGT, type="JKn",
                repweights='w_fstr[0-9]', scale=1,  rscales=rep(1,RR), mse=TRUE)
summary(svydes3)

#--- create object with imputed datasets in survey
datL <- data.timss2
# include replicate weights in each dataset
for (ii in 1:5){
    dat1 <- datL[[ii]]
    dat1 <- cbind(  dat1, data.timssrep[,-1] )
    datL[[ii]] <- dat1
}
datL <- mitools::imputationList(list( datL[[1]],datL[[2]],datL[[3]],datL[[4]],datL[[5]]))
svydes4 <- survey::svrepdesign(data=datL, weights=~TOTWGT, type="JKn",
                  repweights='w_fstr[0-9]', scale=1,  rscales=rep(1,RR), mse=TRUE)
summary(svydes4)

#--- reconstruct data.timss3 for intsvy package. Plausible values must be labeled
# as PV01, PV02, ... and NOT PV1, PV2, ...
data.timss3a <- data.timss3
colnames(data.timss3a) <- gsub( "ASMMAT", "ASMMAT0", colnames(data.timss3a) )
colnames(data.timss3a) <- gsub( "ASSSCI", "ASSSCI0", colnames(data.timss3a) )

#***************************
# Model 1: Linear regression (no grouping variable)

#--- linear regression in survey
```

```
mod1a <-  survey::svyglm( scsci ~ migrant + books, design=svydes3)
summary(mod1a)

#--- regression with pirls.reg (intsvy)
mod1b <- intsvy::pirls.reg( y="scsci", x=c("migrant", "books" ), data=data.timss3)
mod1b

#---- regression with BIFIEsurvey
mod1c <- BIFIEsurvey::BIFIE.linreg( bdat3, dep="scsci", pre=c("one","migrant","books"))
summary(mod1c)

#--- regression with lavaan.survey package
lavmodel <- "
    scsci ~ migrant + books
    scsci ~ 1
    scsci ~~ scsci
        "
# fit in lavaan
lavaan.fit <- lavaan::lavaan( lavmodel, data=data.timss3, estimator="MLM")
summary(lavaan.fit)
# using all replicated weights
mod1d <- lavaan.survey::lavaan.survey(lavaan.fit=lavaan.fit, survey.design=svydes3 )
summary(mod1d)

#***************************
# Model 2: Linear regression (grouped by female)

#--- linear regression in survey
mod2a <- survey::svyglm( scsci ~ 0 + as.factor(female) + as.factor(female):migrant
               + as.factor(female):books, design=svydes3)
summary(mod2a)

#--- regression with pirls.reg (intsvy)
mod2b <- intsvy::pirls.reg( y="scsci", x=c("migrant", "books" ),
                 by="female", data=data.timss3)
mod2b[["0"]]   # regression coefficients female=0
mod2b[["1"]]   # regression coefficients female=1

#--- regression with BIFIEsurvey
mod2c <- BIFIEsurvey::BIFIE.linreg( bdat3, dep="scsci",
               pre=c("one","migrant","books"), group="female")
summary(mod2c)

#--- regression with lavaan.survey package
lavmodel <- "
    scsci ~ migrant + books
    scsci ~ 1
    scsci ~~ scsci
        "
# fit in lavaan
lavaan.fit <- lavaan::lavaan( lavmodel, data=data.timss3, group="female", estimator="MLM")
summary(lavaan.fit)
mod2d <- lavaan.survey::lavaan.survey(lavaan.fit=lavaan.fit, survey.design=svydes3 )
```

```
summary(mod2d)

#***************************
# Model 3: Linear regression with mathematics PVs
library(mitools)

#--- linear regression in survey
mod3a <- with(svydes4,  survey::svyglm( ASMMAT ~ migrant + books, design=svydes4 ) )
res3a <- mitools::MIcombine(mod3a)
summary(res3a)

#--- regression with pirls.reg.pv (intsvy)
mod3b <- intsvy::pirls.reg.pv( pvlabel="ASMMAT", x=c("migrant", "books" ),
             data=data.timss3a)

#--- regression with BIFIEsurvey
mod3c <- BIFIEsurvey::BIFIE.linreg( bdat4, dep="ASMMAT", pre=c("one","migrant","books"))
summary(mod3c)

#--- regression with lavaan.survey package
lavmodel <- "
    ASMMAT ~ migrant + books
    ASMMAT ~ 1
    ASMMAT ~~ ASMMAT
        "
# fit in lavaan
lavaan.fit <- lavaan::lavaan( lavmodel, data=data.timss3a, group="female", estimator="MLM")
summary(lavaan.fit)
mod3d <- lavaan.survey::lavaan.survey(lavaan.fit=lavaan.fit, survey.design=svydes4 )
summary(mod3d)

############################################################################
# EXAMPLE 2: TIMSS dataset data.timss4 | Nested multiply imputed dataset
############################################################################

data(data.timss4)
data(data.timssrep)

#**** create BIFIEdata object
bdat <- BIFIEsurvey::BIFIE.data( data.list=data.timss4, wgt=data.timss4[[1]][[1]]$TOTWGT,
               wgtrep=data.timssrep[, -1 ], NMI=TRUE, cdata=TRUE )
summary(bdat)

#**** Model 1: Linear regression for mathematics score
mod1 <- BIFIEsurvey::BIFIE.linreg( bdat, dep="ASMMAT", pre=c("one","books","migrant"))
summary(mod1)

#*** Model 2: Univariate statistics ?BIFIEsurvey::BIFIE.univar
mod2 <- BIFIEsurvey::BIFIE.univar( bdat, vars=c("ASMMAT","ASSSCI","books") )
summary(mod2)

## End(Not run)
```

save.BIFIEdata *Saving, Writing and Loading* BIFIEdata *Objects*

Description

These functions save (save.BIFIEdata), write (write.BIFIEdata) or load (load.BIFIEdata) objects of class BIFIEdata.

The function load.BIFIEdata.files allows the creation of BIFIEdata objects by loading separate files of imputed datasets, replicate weights and a possible indicator dataset.

Usage

```
save.BIFIEdata(BIFIEdata, name.BIFIEdata, cdata=TRUE, varnames=NULL)

write.BIFIEdata( BIFIEdata, name.BIFIEdata, dir=getwd(), varnames=NULL,
    impdata.index=NULL, type="Rdata", ... )

load.BIFIEdata(filename, dir=getwd() )

load.BIFIEdata.files( files.imp, wgt, file.wgtrep, file.ind=NULL,
    type="Rdata",varnames=NULL, cdata=TRUE, dir=getwd(), ... )
```

Arguments

BIFIEdata	Object of class BIFIEdata
name.BIFIEdata	Name of BIFIEdata set to be saved
cdata	An optional logical indicating whether the dataset should be saved in a 'compact way'
varnames	Vector of variable names which should be saved. The default is to use all variables.
dir	Directory in which data files should be saved. The default is the working directory.
impdata.index	Vector of indices for selecting imputed datasets
type	Type of saved data. Options are Rdata (function base::save, csv (function utils::write.csv), csv2 (function utils::write.csv2), table (function utils::write.table), sav (function foreign::read.spss for reading sav files and function sjlabelled::write_spss for writing sav files).
...	Additional arguments to be passed to base::save, utils::write.csv, utils::write.csv2, utils::write.table, foreign::read.spss, sjlabelled::write_spss
filename	File name of BIFIEdata object
files.imp	Vector of file names of imputed datasets
wgt	Variable name of case weight
file.wgtrep	File name for dataset with replicate weights
file.ind	Optional. File name for dataset with response data indicators

Value

Saved R object and a summary in working directory or a loaded R object.

See Also

For creating objects of class BIFIEdata see BIFIE.data.

base::save, base::load

Examples

```
## Not run:
#############################################################################
# EXAMPLE 1: Saving and loading BIFIE data objects
#############################################################################
data(data.timss1)
data(data.timssrep)

bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt=data.timss1[[1]]$TOTWGT,
                wgtrep=data.timssrep[, -1 ] )
summary(bifieobj)

# save bifieobj in a compact way
BIFIEsurvey::save.BIFIEdata( BIFIEdata=bifieobj, name.BIFIEdata="timss1_cdata" )
# save bifieobj in a non-compact way
BIFIEsurvey::save.BIFIEdata( BIFIEdata=bifieobj, name.BIFIEdata="timss1_data", cdata=FALSE)

# load this object with object name "bdat2"
bdat2 <- BIFIEsurvey::load.BIFIEdata( filename="timss1_data.Rdata" )
summary(bdat2)

# save bifieobj with selected variables
BIFIEsurvey::save.BIFIEdata( bifieobj, name.BIFIEdata="timss1_selectvars_cdata",
                    varnames=bifieobj$varnames[ c(1:7,13,12,9) ] )
# the same object, but use the non-compact way of saving
BIFIEsurvey::save.BIFIEdata( bifieobj, name.BIFIEdata="timss1_selectvars_data", cdata=FALSE,
                    varnames=bifieobj$varnames[ c(1:7,13,12,9) ] )

# load object timss1_cdata (in compact data format)
bdat3 <- BIFIEsurvey::load.BIFIEdata( filename="timss1_cdata.Rdata" )
summary(bdat3)
# save selected variables of object bdat3
BIFIEsurvey::save.BIFIEdata( bdat3, name.BIFIEdata="timss1_selectvars2_cdata",
                    varnames=bifieobj$varnames[ c(1:4,12,8) ] )

#############################################################################
# EXAMPLE 2: Writing BIFIEdata objects
#############################################################################

data(data.timss2)
data(data.timssrep)

# create compactBIFIEdata
```

```
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss2, wgt=data.timss2[[1]]$TOTWGT,
               wgtrep=data.timssrep[, -1 ], cdata=TRUE)
summary(bifieobj)

# save imputed datasets in format csv2
BIFIEsurvey::write.BIFIEdata( bifieobj, name.BIFIEdata="timss2_save1", type="csv2", row.names=FALSE)

# save imputed datasets of BIFIEdata object in format table without column names
# and code missings as "."
BIFIEsurvey::write.BIFIEdata( bifieobj, name.BIFIEdata="timss2_save2", type="table",
                 col.names=FALSE, row.names=FALSE, na="." )

# save imputed datasets of  BIFIEdata object in format csv and select some variables
# and only the first three datasets
varnames <- c("IDSTUD","TOTWGT","female","books","lang","ASMMAT")
BIFIEsurvey::write.BIFIEdata( bifieobj, name.BIFIEdata="timss2_save3", type="csv",
                  impdata.index=1:3, varnames=varnames)

# save imputed datasets of BIFIEdata object in format Rdata, the R binary format
BIFIEsurvey::write.BIFIEdata( bifieobj, name.BIFIEdata="timss2_save4", type="Rdata"  )

# save imputed datasets in sav (SPSS) format
BIFIEsurvey::write.BIFIEdata( bifieobj, name.BIFIEdata="timss2_save5", type="sav" )

#############################################################################
# EXAMPLE 3: Loading BIFIEdata objects saved in separate files
#                   (no indicator dataset)
#############################################################################

# We assume that Example 2 is applied and we build on the saved files
# from this example.

#***--- read Rdata format
# extract files with imputed datasets and replicate weights
files.imp <- miceadds::grep.vec( c("timss2_save4__IMP", ".Rdata" ),
            list.files(getwd())  )$x
file.wgtrep <- miceadds::grep.vec( c("timss2_save4__WGTREP", ".Rdata" ),
            list.files(getwd())  )$x
# select some variables in varnames
varnames <- scan( nlines=1, what="character")
   IDSTUD   TOTWGT books lang migrant likesc  ASMMAT

# load files and create BIFIEdata object
bifieobj1 <- BIFIEsurvey::load.BIFIEdata.files( files.imp, wgt="TOTWGT", file.wgtrep,
                        type="Rdata", varnames=varnames )
summary(bifieobj1)

#***--- read csv2 format
files.imp <- miceadds::grep.vec( c("timss2_save1__IMP", ".csv" ),
                        list.files(getwd()) )$x
file.wgtrep <- miceadds::grep.vec( c("timss2_save1__WGTREP", ".csv" ),
                        list.files(getwd()) )$x
bifieobj2 <- BIFIEsurvey::load.BIFIEdata.files( files.imp, wgt="TOTWGT",
```

```
                    file.wgtrep, type="csv2" )
summary(bifieobj2)

#***--- read sav format
files.imp <- miceadds::grep.vec( c("timss2_save5__IMP", ".sav" ),
                        list.files(getwd()) )$x
file.wgtrep <- miceadds::grep.vec( c("timss2_save5__WGTREP", ".sav" ),
                        list.files(getwd()) )$x
bifieobj3 <- BIFIEsurvey::load.BIFIEdata.files( files.imp, wgt="TOTWGT",
                file.wgtrep, type="sav", to.data.frame=TRUE, use.value.labels=FALSE)
summary(bifieobj3)

#############################################################################
# EXAMPLE 4: Loading BIFIEdata objects saved in separate files
#                   (with an indicator dataset)
#############################################################################

data(data.timss1)
data(data.timss1.ind)
data(data.timssrep)

# create BIFIEdata object at first
bifieobj <- BIFIEsurvey::BIFIE.data( data.list=data.timss1, wgt="TOTWGT",
            wgtrep=data.timssrep[, -1 ] )
summary(bifieobj)

#--- save datasets for the purpose of the following example
write.BIFIEdata( BIFIEdata=bifieobj, name.BIFIEdata="timss1_ex", type="Rdata" )
# save indicator dataset
save( data.timss1.ind, file="timss1_ex__IND.Rdata" )

# grep file names
files.imp <- miceadds::grep.vec( c("timss1_ex__IMP", ".Rdata" ),
                    list.files(getwd()) )$x
file.wgtrep <- miceadds::grep.vec( c("timss1_ex__WGTREP", ".Rdata" ),
                    list.files(getwd()) )$x
file.ind <- miceadds::grep.vec( c("timss1_ex__IND", ".Rdata" ),
                    list.files(getwd()) )$x
# define variables for selection
varnames <- c("IDSTUD","TOTWGT","female","books","lang","ASMMAT")
# read files using indicator dataset
bifieobj2 <- BIFIEsurvey::load.BIFIEdata.files( files.imp, wgt="TOTWGT",
                  file.wgtrep=file.wgtrep, file.ind=file.ind, type="Rdata",
                  varnames=varnames)
summary(bifieobj2)

# read files without indicator dataset
bifieobj3 <- BIFIEsurvey::load.BIFIEdata.files( files.imp, wgt="TOTWGT",
                file.wgtrep=file.wgtrep, type="Rdata", varnames=varnames)
summary(bifieobj3)

# compare some descriptive statistics
res2 <- BIFIEsurvey::BIFIE.univar( bifieobj2, vars=c("books", "ASMMAT", "lang") )
```

```
res3 <- BIFIEsurvey::BIFIE.univar( bifieobj3, vars=c("books", "ASMMAT", "lang") )
summary(res2)
summary(res3)

## End(Not run)
```

---

se *Standard Errors of Estimated Parameters*

Description

Outputs vector of standard errors of an estimated parameter vector.

Usage

```
se(object)
```

Arguments

object	Object for which S3 method vcov can be applied

Value

Vector

See Also

survey::SE

Examples

```
############################################################################
# EXAMPLE 1: Toy example with lm function
############################################################################

set.seed(906)
N <- 100
x <- seq(0,1,length=N)
y <- .6*x + stats::rnorm(N, sd=1)
mod <- stats::lm( y ~ x )
coef(mod)
vcov(mod)
se(mod)
summary(mod)
```

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