Package 'swgee'

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Type Package

Title Simulation Extrapolation Inverse Probability Weighted
Generalized Estimating Equations

Version 1.4

Date 2019-03-20

Imports stats, graphics, gee, geepack, mvtnorm,

LazyLoad yes

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Description Simulation extrapolation and inverse probability weighted generalized estimating equations method for longitudinal data with missing observations and measurement error in covariates. References: Yi, G. Y. (2008) <doi:10.1093/biostatistics/kxm054>; Cook, J. R. and Stefanski, L. A. (1994) <doi:10.1080/01621459.1994.10476871>; Little, R. J. A. and Rubin, D. B. (2002, ISBN:978-0-471-18386-0).

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swgee-package	*Simulation Extrapolation Inverse Probability Weighted Generalized Estimating Equations*

Description

Simulation extrapolation and inverse probability weighted generalized estimating equations method for longitudinal data with missing observations and measurement error in covariates. References: Yi, G. Y. (2008) <doi:10.1093/biostatistics/kxm054>; Cook, J. R. and Stefanski, L. A. (1994) <doi:10.1080/01621459.1994.10476871>; Little, R. J. A. and Rubin, D. B. (2002, ISBN:978-0-471-18386-0).

Details

The DESCRIPTION file:

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Author:	Juan Xiong <jxiong@szu.edu.cn>, Grace Y. Yi <yyi@uwaterloo.ca>
Maintainer:	Juan Xiong <jxiong@szu.edu.cn>
Description:	Simulation extrapolation and inverse probability weighted generalized estimating equations method for longitu
License:	GPL-3

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summary.swgee           summary.swgee
swgee                   Simulation Extrapolation Inverse Probability
                        Weighted Generalized Estimating Equations
swgee-package           Simulation Extrapolation Inverse Probability
                        Weighted Generalized Estimating Equations
```

Implementation of the SIMEX inverse probability weighted GEE method for longitudinal data with missing observations and measurement error in covariates

Author(s)

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References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

See Also

geeglm

BMI   *BMI dataset*

Description

a subset of the the Framingham Heart Study Data. The data set consists of measurements of 100 patients from a series of exams with 5 assessments for each individual. Individual's obesity status, age, systolic blood pressure (SBP) and cholesterol level (CHOL) are collected at each assessment.

Usage

```
data("BMI")
```

Format

A data frame with 500 observations on the following 7 variables.

id a numeric vector for subject id

visit a numeric vector for assessment time

age a numeric vector of age

sbp a numeric vector of systolic blood pressure

chol a numeric vector of cholesterol level

bbmi an indicator of obesity status(1=yes, 0=no)

O an indicator of observed measurement(1=yes, 0=no)

Details

The author thanks Boston University and the National Heart, Lung, and Blood Institute (NHLBI) for providing the data set from the Framingham Heart Study (No. N01-HC-25195) in the illustration. The Framingham Heart Study is conducted and supported by the NHLBI in collaboration with Boston University. This package was not prepared in collaboration with investigators of the Framingham Heart Study and does not necessarily reflect the opinions or views of the Framingham Heart Study, Boston University, or NHLBI.

Source

Strug, L., Sun, L. and Corey, M. (2003). The genetics of cross-sectional and longitudinal body mass index. *BMC Genetics* 4 (Suppl 1), S14

Yoo, Y. J., Huo, Y., Ning, Y., Gordon, D., Finch, S. and Mendell, N. R. (2003). Power of maximum HLOD tests to detect linkage to obesity genes. *BMC Genetics* 4 (Suppl 1), S16.

References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

Examples

```
data(BMI)
```

---

getsimexest   *getsimexest*

Description

extract the estimates for every lambda

Usage

```
getsimexest(indata)
```

Arguments

indata   swgee object from the function swgee

Details

internal function for the extrapolation step

Author(s)

Juan Xiong<jxiong@szu.edu.cn>, Grace Y. Yi<yyi@uwaterloo.ca>

References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

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plot.swgee	*plot.swgee*

Description

Produce the plot of the quadratic extrapolation curve for any covariables with measurement error in the swgee model

Usage

```
## S3 method for class 'swgee'
## S3 method for class 'swgee'
plot(x, covariate, ...)
```

Arguments

x	object of class 'swgee'
covariate	covariates specified in the formula
...	further arguments passed to or from other functions.

Value

Plot the simulation and extrapolation step

Author(s)

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References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

Examples

```
require(gee)
require(mvtnorm)
data(BMI)
bmidata <- BMI

rho <- 0
sigma1 <- 0.5
sigma2 <- 0.5

sigma <- matrix(0,2,2)
sigma[1,1] <- sigma1*sigma1
sigma[1,2] <- rho*sigma1*sigma2
sigma[2,1] <- sigma[1,2]
sigma[2,2] <- sigma2*sigma2

set.seed(1000)
##swgee method ##########
output2 <- swgee(bbmi~sbp+chol+age, data = bmidata, id = id,
            family = binomial(link="logit"),corstr = "independence",
            missingmodel = O~bbmi+sbp+chol+age, SIMEXvariable = c("sbp","chol"),
            SIMEX.err = sigma, repeated = FALSE, B = 20, lambda = seq(0, 2, 0.5))

summary(output2)

plot(output2,"sbp")
```

---

print.summary.swgee   *print.summary.swgee*

Description

Summary method for class "swgee"

Usage

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

Arguments

x	object of class 'swgee'
...	further arguments passed to or from other functions.

Value

Print summary nicely

Author(s)

Juan Xiong<jxiong@szu.edu.cn>, Grace Y. Yi<yyi@uwaterloo.ca>

References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

---

print.swgee	*print.swgee*

Description

Summary method for class "swgee"

Usage

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

Arguments

x	object of class 'swgee'
...	further arguments passed to or from other functions.

Value

Print swgee object nicely

Author(s)

Juan Xiong<jxiong@szu.edu.cn>, Grace Y. Yi<yyi@uwaterloo.ca>

References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

summary.swgee	*summary.swgee*

Description

Summary method for class "swgee"

Usage

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

Arguments

object   object of class 'swgee'

...   further arguments passed to or from other functions.

Details

The function summary.swgee computes and returns a list of summary statistics of the response process and missing process

Value

summary estimates for parameters associated with response process and missing process

Author(s)

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References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

Carrol, R.J., Ruppert, D., Stefanski, L.A. and Crainiceanu, C. (2006) Measurement error in nonlinear models: A modern perspective., Second Edition. London: Chapman and Hall.

Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

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swgee | *Simulation Extrapolation Inverse Probability Weighted Generalized Estimating Equations*

Description

Implementation of the SIMEX inverse probability weighted GEE method for longitudinal data with missing observations and measurement error in covariates

Usage

```
swgee(formula, data = parent.frame(), id, family = family,
    corstr = "independence", missingmodel, SIMEXvariable, SIMEX.err,
    repeated = FALSE, repind = NULL, B = 50, lambda = seq(0, 2, 0.5))
```

Arguments

formula	specifies the model to be fitted, with the variables coming with data. This argument has the same format as the formula argument in the function geeglm from package **geepack**, of the form response ~ predictors. See documentation of geeglm and formula for details.
data	an optional data frame in which to interpret the variables occurring in the formula, along with the id variable.
id	a vector which identifies the clusters. The length of id should be the same as the number of observations. Data are assumed to be sorted so that observations on a cluster are contiguous rows for all entities in the formula.
family	a family object as the family argument in the function gee from package **gee**. Families supported in swgee are gaussian, binomial, poisson, Gamma, and quasi. See documentation of gee and family for details.
corstr	a character string specifying the correlation structure. The following are permitted: "independence", "fixed", "stat_M_dep", "non_stat_M_dep", "exchangeable", "AR-M" and "unstructured".
missingmodel	specifies the misisng model to be fitted, of the form O~ predictors, where O is the missing data indicator.
SIMEXvariable	a vector of characters containing the name of the covariates subject to measurement error.
SIMEX.err	specifies the covariance matrix of measurement errors in error model.
repeated	This is the indicator if there are repeated measurements for the covariates with measurement error. The default value is FALSE.
repind	This is the index of the repeated measurement variables for each covariate with measurement error. It has an R list form. If repeated = TRUE, repind must be specified.
B	the number of simulated samples for the simulation step. The default is set to be 50.
lambda	a vector of lambdas for which the simulation step should be done.

Details

The quadratic extrapolation method is implemented as described in Cook and Stefanski

Value

call	the function call
family	family
corstr	correlation structure
SIMEXvariable	a vector of characters containing the name of the covariates subject to measurement error
B	the number of iterations
beta	the coefficients associated with the response process
alpha	the coefficients associated with the missing process
simex.plot	the estimates for every B and lambda

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References

Cook, J.R. and Stefanski, L.A. (1994) Simulation-extrapolation estimation in parametric measurement error models. *Journal of the American Statistical Association*, 89, 1314-1328.

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Yi, G. Y. (2008) A simulation-based marginal method for longitudinal data with dropout and mismeasured covariates. *Biostatistics*, 9, 501-512.

See Also

geeglm

Examples

```
require(gee)
data(BMI)
bmidata <- BMI

rho <- 0
sigma1 <- 0.5
sigma2 <- 0.5

sigma <- matrix(0,2,2)
sigma[1,1] <- sigma1*sigma1
sigma[1,2] <- rho*sigma1*sigma2
sigma[2,1] <- sigma[1,2]
sigma[2,2] <- sigma2*sigma2
```

```
set.seed(1000)
##naive method, ignore missingness and measurement error
output1 <- gee(bbmi~sbp+chol+age, id = id, data = bmidata,
            family = binomial(link="logit"), corstr = "independence")


##swgee method ##########
output2 <- swgee(bbmi~sbp+chol+age, data = bmidata, id = id,
            family = binomial(link="logit"),corstr = "independence",
            missingmodel = O~bbmi+sbp+chol+age, SIMEXvariable = c("sbp","chol"),
            SIMEX.err = sigma, repeated = FALSE, B = 20, lambda = seq(0, 2, 0.5))

summary(output2)
```

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