Package ‘maSAE’

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MaSAE-package  Mandallaz' Model-Assisted Small Area Estimators

Description

An S4 implementation of the unbiased extension of the model-assisted’ synthetic-regression estimator proposed by Mandallaz (2013), Mandallaz et al. (2013) and Mandallaz (2014). It yields smaller variances than the standard bias correction, the generalised regression estimator.

Details

This package provides Mandallaz’ extended synthetic-regression estimator for two- and three-phase sampling designs with or without clustering. See vignette("maSAE", package = "maSAE") and demo("maSAE", package = "maSAE") for introductions, "class?maSAE::saeObj" and "?maSAE::predict" for help on the main feature.

Note

Model-assisted estimators use models to improve the efficiency (i.e. reduce prediction error compared to design-based estimators) but need not assume them to be correct as in the model-based approach, which is advantageous in official statistics.

References


See Also

There are a couple packages for model-based small area estimation, see sae, rsae, hbsae and JoSAE. In 2016, Andreas Hill published forestinventory, another implementation of Mandallaz’ model-assisted small area estimators (see vignette("forestinventory_and_maASE", package = "maSAE") for a comparison).

Examples

```r
## Not run:
vignette("maSAE", package = "maSAE")

## End(Not run)
## Not run:
demo("design", package = "maSAE")

## End(Not run)
## Not run:
demo("maSAE", package = "maSAE")

## End(Not run)
```

**predict**

*Methods for Function* predict

Description

Calculate small area predictions and their variances.

Usage

```r
predict(object, ...)  
```

Arguments

- **object** a model object for which prediction is desired.
- **...** Arguments to be passed to methods.
- **version** set to "1.0.0" or set options(maSAE_version = "1.0.0") to use the functions from maSAE 1.0.0. See NEWS.md for 2.0.0.
- **use_lm** Rather for internal use, stick with the default.
Based on the structure of the saeObj given, predict decides, which predictor to use:
If a smallAreaMeans-data.frame covering all fixed effects is given, the exhaustive estimator \( \hat{y}_{g,\text{synth}} \) is calculated.
If a smallAreaMeans-data.frame not covering all fixed effects is given, the partially exhaustive estimator \( \hat{y}_{g,\text{greg}} \) is calculated.
If no smallAreaMeans-data.frame but s1 is given, the three-phase estimator \( \hat{y}_{g,\text{g3reg}} \) is calculated.
If neither smallAreaMeans nor s1 are given, the non-exhaustive estimator \( \hat{y}_{g,\text{psynth}} \) is calculated.
If a clustering variable is given, the cluster sampling design equivalents of the above estimators are used.
If version is not set to "1.0.0", the (pseudo) small and synthetic estimations and their variances are also calculated (see vignette("A_Taxonomy_of_Estimators",package = "maSAE"))

Value
A data frame containing predictions and variances for each small area, see Details above.

Methods
signature(object = saeObj) Calculate predictions and variances according to the auxiliary information given, see Details above.
signature(object = sadObj) Calculate design-based predictions and variances.

See Also
vignette(package = "maSAE")

Examples
```r
## design-based estimation
## load data
data("s2", package = "maSAE")
## create object
saeO <- maSAE::saObj(data = s2, f = y ~ NULL | g)
## design-based estimation for all small areas given by g
maSAE::predict(saeO)
## model-assisted estimation
## load data
data("s1", "s2", package = "maSAE")
str(s1)
s12 <- maSAE::bind_data(s1, s2)
## create object
saeO <- maSAE::saObj(data = s12, f = y ~ x1 + x2 + x3 | g, s2 = "phase2")
## small area estimation
maSAE::predict(saeO)
```
**s0**  
*Example s0 Data Set*

**Description**

Artificial null phase sampling data used for examples in **maSAE**.

**Usage**

```r
data(s0, package = "maSAE")
```

**Format**

A data frame with 9008 observations on the following 6 variables.

**Details**

- `clustid` See "?maSAE::s2"
- `x1` See "?maSAE::s2"
- `x2` See "?maSAE::s2"
- `x3` See "?maSAE::s2"
- `inclusion` See "?maSAE::s2"
- `g` See "?maSAE::s2"

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**s1**  
*Example s1 Data Set*

**Description**

Artificial first phase sampling data used for examples in **maSAE**.

**Usage**

```r
data(s1, package = "maSAE")
```

**Format**

A data frame with 786 observations on the following 6 variables.
Details

`clustid` See "?maSAE::s2"

`x1` See "?maSAE::s2"

`x2` See "?maSAE::s2"

`x3` See "?maSAE::s2"

`inclusion` See "?maSAE::s2"

`g` See "?maSAE::s2"

---

Example `s2` Data Set

Description

Artificial second phase sampling data used for examples in `maSAE`.

Usage

```r
data(s2, package = "maSAE")
```

Format

A data frame with 206 observations on the following 7 variables.

Details

`clustid` index giving the clusters.

`x1` a potential fixed effect.

`x2` another potential fixed effect.

`x3` yet another potential fixed effect.

`y` the predictand

`inclusion` a logical vector indicating whether or not to include the current observation. All TRUE.

`g` A factor defining the small areas 'a' and 'b'
sadObj-class

Small Area Design-based Objects

Description

A class for design-based estimation only.

Details

See "saeObj". The fixed effects part of $f$ has to be NULL: design-based estimation knows no fixed effects.

Slots

data See "saeObj".

$\mathbf{f}$ See "saeObj".

cluster See "saeObj".

include See "saeObj".

Extends

Class "savObj", directly.

Objects from the Class

Objects can be created by calls of the form $\text{new}("\text{sadObj}",\ldots)$ or via the constructor function "$\text{maSAE::saObj}".

Methods

predict

Note

The slots are described in "\text{class?maSAE::saeObj}", since this is the main class of the package.

See Also

"saeObj" "$\text{maSAE::saObj}$"

Other classes: characterOrNULL-class, saeObj-class, savObj-class

Examples

\text{showClass("sadObj")}
saeObj-class

Small Area Estimation Objects

Description

Class for small area estimation, the one you’re probably looking for.

Details

cluster optionally gives the name of a variable in slot data from which the cluster information for clustered sample designs is to be read. See Manadallaz 2013, p. 445 for Details.
include optionally gives the name of a variable in slot data from which the inclusion indicator for cluster points is to be read. See Manadallaz 2013, p. 445 for Details on $I_f$.
Also see the Details for predict.

Slots

smallAreaMeans An optional "data.frame" giving the true means of fixed effects for the small areas. Must have a column with the random effect defining the small areas in slot data.
s1 An optional "character" string giving the name of a variable in slot data indicating that an observation (a row in slot data) belongs to subset 1.
s2 An optional "character" string giving the name of a variable in slot data indicating that an observation (a row in slot data) belongs to subset 2.
data Object of class "data.frame" to use for prediction, typically consisting of a predictand and one or more predictors (zero or more fixed effects and one random effect defining the small areas). See Details for optional clustering variable and/or inclusion indicator.
f Object of class "formula" a linear mixed effects model formula.
cluster An optional "character" string giving the name of the clustering variable in slot data.
include An optional "character" string giving the name of the inclusion indicator in slot data.
auxiliaryWeights An optional "character" string giving the name of the auxiliary weights in slot data. You will need it, if your auxiliary data does not have full spatial support for each observation (for example when a shapefile does not completely cover all grid cells used to compute auxiliary data on). See vignette("forestinventory_vignette",package = "forestinventory") for details.

Extends

Class "savObj", directly.

Objects from the Class

Objects can be created by calls of the form new("saeObj",...) or via the constructor function "?maSAE::saObj" (recommended).
Methods

predict

References


See Also

"?stats::formula","class?maSAE::saObj","class?maSAE::savObj","?maSAE::saObj" and "?maSAE::predict"

Other classes: characterOrNULL-class, sadObj-class, savObj-class

Examples

showClass("saeObj")

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**saObj**  
A Constructor for Objects of Class sadObj and saeObj

Description

Simple wrapper to `new("sa[de]Obj")`. If missing, it adds an inclusion variable to data; it checks for missing in the clustering variable. Adds comments documenting changes made to the returned object.

Usage

```r
saObj(
  data,
  f,
  smallAreaMeans = NULL,
  s1 = NULL,
  s2 = NULL,
  cluster = NULL,
  include = NULL,
  auxiliaryWeights = NULL
)
```

Arguments

data  See "saeObj".

f  a linear mixed effects formula, but see Value.

smallAreaMeans  See "saeObj".
s1 See "saeObj".
s2 See "saeObj".
cluster See "saeObj".
include See "saeObj".
auxiliaryWeights See "saeObj".

Value
An object of class sadObj if f is of structure ‘x ~ NULL | g’, an object of class saeObj otherwise.

See Also
"saeObj", "sadObj".

Examples

```r
## load data
data("s2", package = "maSAE")
## create sadObj object
sad <- maSAE::saObj(data = s2, f = y ~ NULL | g)
class(sad)
## create saeObj object
s2$s2 <- TRUE
sae <- maSAE::saObj(data = s2, f = y ~ x1 + x2 + x3 | g, s2 = "s2")
class(sae)
```
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