# Package ‘maSAE’

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**Type** Package

**Title** Mandallaz' Model-Assisted Small Area Estimators

**Version** 2.0.3


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**URL** [https://gitlab.com/fvafrCU/maSAE](https://gitlab.com/fvafrCU/maSAE)

**Depends** R (>= 3.6.0)

**Imports** methods, stats

**Suggests** devtools, forestinventory, JoSAE, knitr, microbenchmark, nlme, pkgload, rmarkdown, rprojroot, rsae, RUnit, R.rsp, sae, testthat

**VignetteBuilder** utils, knitr, R.rsp

**RoxygenNote** 7.1.1

**NeedsCompilation** no

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**R topics documented:**

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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.

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.

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.


**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.

**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")

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

```R
## Not run:
demo("maSAE", package = "maSAE")
```
Details

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 $\hat{\tilde{y}}_{g,\text{synth}}$ is calculated.
If a smallAreaMeans-data.frame not covering all fixed effects is given, the partially exhaustive estimator $\hat{\tilde{y}}_{g,\text{greg}}$ is calculated.
If no smallAreaMeans-data.frame but s1 is given, the three-phase estimator $\hat{\tilde{y}}_{g,\text{g3reg}}$ is calculated.
If neither smallAreaMeans nor s1 are given, the non-exhaustive estimator $\hat{\tilde{y}}_{g,\text{psynth}}$ 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

## ## 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"

---

**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"

---

s2  

Example s2 Data Set

Description

Artificial second phase sampling data used for examples in maSAE.

Usage

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

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".
  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 new("sadObj", ...) or via the constructor function "?maSAE::saObj".

Methods
predict

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

See Also
"saeObj" "?maSAE::saObj"
Other classes: characterOrNULL-class, saeObj-class, savObj-class

Examples
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::saeObj" (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

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

## 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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