Package ‘capm’

April 19, 2019

Type Package

Title Companion Animal Population Management

Depends R (>= 3.4)

Imports deSolve, FME, survey, ggplot2, dplyr, tidyr, magrittr, grid, stats, circlize, utils, sf


License GPL (>= 2)

LazyLoad yes

URL http://oswaldosantos.github.io/capm

Version 0.13.10

Date 2019-04-19

RoxygenNote 6.1.1

NeedsCompilation no

Author Oswaldo Santos Baquero [aut, cre],
Marcos Amaku [ctb],
Fernando Ferreira [ctb]

Maintainer Oswaldo Santos Baquero <baquero@usp.br>

Repository CRAN

Date/Publication 2019-04-19 17:30:02 UTC
The capm Package

Description


Details

Package: capm
Type: Package
Version: 0.13.10
Date: 2019-04-19
Depends: R (>= 3.4)
Calculate2StageSampleSize

Two-stage cluster sampling size and composition (Deprecated)

Description

Calculates sample size and composition to estimate a total from a two-stage cluster sampling design. This function is deprecated, see details.

Usage

Calculate2StageSampleSize(psu.ssu = NULL, psu.x = NULL,
    conf.level = 0.95, error = 0.1, cost = 4, minimum.ssu = 15)

Arguments

- **psu.ssu**: data.frame with all primary sampling units (PSU). First column contains PSU unique identifiers. Second column contains numeric PSU sizes.
- **psu.x**: data.frame. Each row corresponds to a secondary sampling unit (SSU) included in a pilot study. First column contains the PSU identifiers to which the ssu belongs to. Second column contains the totals observed in the ssu and must be numeric.
- **conf.level**: the confidence level required. It must be numeric between 0 and 1 inclusive.
- **error**: the maximum relative difference between the estimate and the unknown population value. It must be numeric between 0 and 1 inclusive.
- **cost**: the ratio of the cost of sampling a PSU to the cost of sampling a SSU.
- **minimum.ssu**: integer to define the minimum number of SSU to be selected per PSU. If the calculated number of SSU to be selected is lesser than minimum.ssu, it is redefined as minimum.ssu. To avoid any lower threshold, define minimum.ssu as equal to 0.
Details

It is assumed that PSU from the pilot are selected with probability proportional to size (PPS) and with replacement. SSU are assumed to be selected via simple (systematic) random sampling. PSU must have the same identifiers in \texttt{psu.ssu} and in \texttt{psu.x}. This function is deprecated because a study (Baquero et. al, 2018a) showed that the calculated sample size are too large for practical purposes. The same study found predefined sample compositions that result in estimates with precision equivalent to that achieved with the algorithm implemented in this function. The predefined sample compositions are (PSU * SSU): 65 \* 15, 50 \* 20, and 30 \* 30. If possible, take larger samples.

Value

Matrix with the sample size and composition and with variability estimates.

References


http://oswaldosantos.github.io/capm

---

CalculateGlobalSens  

\textit{Global sensitivity analysis}

Description

Wrapper for \texttt{sensRange} function, which calculates sensitivities of population sizes to parameters used in one of the following functions: \texttt{SolveIASA}, \texttt{SolveSI} or \texttt{Solvetc}.

Usage

\begin{verbatim}
CalculateGlobalSens(model.out = NULL, ranges = NULL, sensv = NULL,
                  all = FALSE)
\end{verbatim}

Arguments

- \texttt{model.out}  
  output from one of the previous function or a \texttt{list} with equivalent structure.
- \texttt{ranges}  
  output from the \texttt{SetRanges} function applied to the \texttt{pars} argument used in the function specified in \texttt{model.out}.
- \texttt{sensv}  
  string with the name of the output variables for which the sensitivity are to be estimated.
- \texttt{all}  
  logical. If \texttt{FALSE}, sensitivity ranges are calculated for each parameter. If \texttt{TRUE}, sensitivity ranges are calculated for the combination of all a parameters.
Details

When all is equal to TRUE, dist argument in `sensRange` is defined as "latin" and when equal to FALSE, as "grid". The num argument in `sensRange` is defined as 100.

Value

A data.frame (extended by summary.sensRange when all == TRUE) containing the parameter set and the corresponding values of the sensitivity output variables.

References


See Also

`sensRange`.

Examples

```r
## IASA model

## Parameters and initial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
                        destination.label = "Pinhais",
                        total.estimate = 50444)

# Solve for point estimates.
solve_iasa_pt <- SolveIASA(pars = dogs_iasa$pars,
                           init = dogs_iasa$init,
                           time = 0:15,
                           alpha.owned = TRUE,
                           method = 'rk4')

## Set ranges 10 % greater and lesser than the
## point estimates.
rg_solve_iasa <- SetRanges(pars = dogs_iasa$pars)

## Calculate global sensitivity of combined parameters.
## To calculate global sensitivity to each parameter, set
## all as FALSE.
glob_all_solve_iasa <- CalculateGlobalSens(
                          model.out = solve_iasa_pt,
                          ranges = rg_solve_iasa,
```
CalculateLocalSens

Description

Wrapper for sensFun function, which estimates local effect of all model parameters on population size, applying the so-called sensitivity functions. The set of parameters used in any of the following functions can be assessed: SolveIASA, SolveSI or SolveTC.

Usage

CalculateLocalSens(model.out = NULL, sensv = "n")

Arguments

- model.out: output from one of the previous functions or a list with equivalent structure.
- sensv: string with the name of the output variables for which sensitivity are to be estimated.

Details

For further arguments of sensFun, defaults are used. See the help page of this function for details. Methods for class "sensFun" can be used.

Value

A data.frame of class sensFun containing the sensitivity functions. There is one row for each sensitivity variable at each independent time. The first column x, contains the time value; the second column var, the name of the observed variable; and remaining columns have the sensitivity parameters.

References


See Also

sensRange.
Examples

```r
## IASA model

## Parameters and intial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
    destination.label = "Pinhais",
    total.estimate = 50444)

# Solve for point estimates.
solve_iasa.pt <- SolveIASA(pars = dogs_iasa$pars,
    init = dogs_iasa$init,
    time = 0:15,
    alpha.owned = TRUE,
    method = 'rk4')

## Calculate local sensitivities to all parameters.
local_solve_iasa2 <- CalculateLocalSens(
    model.out = solve_iasa.pt, sensv = "n2")
local_solve_iasa1 <- CalculateLocalSens(
    model.out = solve_iasa.pt, sensv = "n1")
```

---

**CalculatePopChange**  
*Population change.*

### Description

Calculate the change in population size between two times. When only one time is specified, the population size at that time is returned.

### Usage

```
CalculatePopChange(model.out = NULL, variable = NULL, t1 = NULL,
    t2 = NULL, ratio = TRUE)
```

### Arguments

- **model.out**: output from one of the following functions or a list with equivalent structure: `SolveIASA, SolveSI, SolveTC` or `CalculateGlobalSens`. When the last function is used, its all argument must be `TRUE`.
- **variable**: string with the name of the the output variable for which the change are to be calculated (see the variable argument for `PlotModels`).
- **t1**
- **t2**
- **ratio**: logical. When `TRUE`, the calculated change is based on population size at `t2` divided by population size at `t1`. When `FALSE`, the calculated change is based on population size at `t2` minus population size at `t1`. 

CalculateSimpleSampleSize

Value

Value representing the ratio (if ratio is TRUE) or the difference (if ratio is FALSE) between population size at time t2 and t1. If only one time is specified, the value is the population size at that time.

References


http://oswaldosantos.github.io/capm

Examples

```r
# IASA model

# Parameters and initial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
                        destination.label = "Pinhais",
                        total.estimate = 50444)

# Solve for point estimates.
solve_iasa_pt <- SolveIASA(pars = dogs_iasa$pars,
                           init = dogs_iasa$init,
                           time = 0:15,
                           alpha.owned = TRUE,
                           method = 'rk4')

# Calculate the population change (ratio) between times 0 and 15.
CalculatePopChange(solve_iasa_pt, variable = 'N1', t2 = 15, t1 = 0)

# Calculate the population change (difference) between times 0 and 15.
CalculatePopChange(solve_iasa_pt, variable = 'N1', t2 = 15,
                   t1 = 0, ratio = FALSE)

# Calculate the population sizes at time 15.
CalculatePopChange(solve_iasa_pt, variable = 'N1', t2 = 15)
```

CalculateSimpleSampleSize

Simple random sample size

Description

Calculates sample size to estimate a total from a simple sampling design.
Usage

```
CalculateSimpleSampleSize(x = NULL, N = NULL, conf.level = 0.95,
                           error = 0.1)
```

Arguments

- **x**: `vector` with variable collected in a pilot and to be estimated. If `x` is a scalar, it is used as the relative variance of the variable to be estimated \((\frac{(N - 1)}{N} \times \text{sd}(x)^2) / \text{mean}(x)^2\).
- **N**: `numeric` indicating the number of sampling units in the population.
- **conf.level**: the confidence level required. It must be `numeric` between 0 and 1 inclusive.
- **error**: the maximum relative difference between the estimate and the unknown population value. It must be `numeric` between 0 and 1 inclusive.

Value

numeric sample size rounded up to nearest integer.

References


http://oswaldosantos.github.io/capm

Examples

```r
# Using a pilot sample from a population with 10000 sampling units.
pilot <- rpois(50, 0.8)
CalculateSimpleSampleSize(x = pilot, N = 10000,
                         conf.level = 0.95, error = 0.1)

# Using expected mean and standard deviation for a population
# with 10000 sampling units.
mean_x <- mean(pilot)
sd_x <- sd(pilot)
N <- 10000
V <- \((\frac{(N - 1)}{N} \times \text{sd}(x)^2) / \text{mean}(x)^2\)
CalculateSimpleSampleSize(x = V, N = 10000, conf.level = 0.95, error = 0.1)
```

---

**CalculateStratifiedSampleSize**

*Stratified random sample size*

Description

Calculates sample size to estimate a total from a stratified random sampling design.
CalculateStratifiedSampleSize

Usage

CalculateStratifiedSampleSize(strata = NULL, x = NULL, conf.level = 0.95, error = 0.1)

Arguments

strata vector, matrix or data.frame. If vector, named elements represent the size of
the strata. If matrix or data.frame, first column represent the size of each strata,
second column represent the expected mean in each strata and third column
represent the expected variance in each strata. Each row is a strata and must be
named.

x data.frame representing a pilot sample. First column has the variable to be
estimated and second column has the strata membership of each observation.
Needed when strata is a vector.

conf.level the confidence level required. It must be numeric between 0 and 1 inclusive.

error the maximum relative difference between the estimate and the unknown popu-
lation value. It must be numeric between 0 and 1 inclusive.

Value

numeric sample size rounded up to nearest integer.

References

Levy P and Lemeshow S (2008). Sampling of populations: methods and applications, Fourth edi-
tion. John Wiley and Sons, Inc.

http://oswaldosantos.github.io/capm

Examples

# Using a pilot sample from a population with 10000 sampling units.
strata <- rep(c("rural", "urban"), c(100, 9900))
pilot <- data.frame(c(rpois(5, 1.3), rpois(45, 0.8)),
rep(c("rural", "urban"), c(5, 45)))
CalculateStratifiedSampleSize(strata, pilot)

# Using expected mean and variance for a population with
# 10000 sampling units.
str_n <- c(rural = 100, urban = 9900)
str_mean <- c(rural = 1.4, urban = 0.98)
str_var <- c(rural = 1.48, urban = 1.02)
CalculateStratifiedSampleSize(cbind(str_n, str_mean, str_var))
Description

Data described and analyzed by Baquero et al., 2018.

Usage

cats

Format

Data frame with 195 observations (cats) and 22 variables:

- **interview_id**  Interview’s ID.
- **census_tract_id** Census tract’s ID.
- **name**  Cat’s name.
- **species**  Animal’s species
- **sex**  Cat’s sex.
- **age**  Cat’s age. An age equal to 0 means that the cat had less than 1 year.
- **sterilized**  Cat’s reproductive status.
- **sterilized_ly**  For sterilized cats, indicates if the cat was sterilized during the last year.
- **go_out_on_the_street_alone**  Indicates if the cat had access to the street without supervision (free-roaming).
- **acquisition**  Acquisition type.
- **acquired_ly**  Indicates if the cat was acquired during the last year.
- **acquired_sterilized**  Indicates if the cat was sterilized when acquired.
- **acquisition_city**  City of acquisition.
- **acquisition_state**  State of acquisition.
- **lost_animals**  Indicates if the cat was acquired during the year following the lost of another cat
- **births_ly**  Litter size if the bitch had the litter during the last year.
- **name3**  Dog’s name (cats not present anymore in the household).
- **species3**  Animal’s species (animals not present anymore in the household).
- **sex3**  Dog’s sex (cats not present anymore in the household).
- **age3**  Dog’s age (cats not present anymore in the household). An age equal to 0 means that the dog had less than 1 year.
- **sterilized3**  Dog’s reproductive status (cats not present anymore in the household).
- **fate3**  Dog’s fate.

References

Description

Data described and analyzed by Baquero et al., 2018.

Usage

cluster_sample

Format

Data frame with 1230 observations (households) and 14 variables:

- `interview_id` Interview’s ID.
- `census_tract_id` Census tract’s ID.
- `interviewer` Interviewer’s name.
- `date` Interview’s date.
- `address` Household’s address.
- `interview` Interview status.
- `interviewee` Interviewee’s name.
- `number_of_dogs` Number of dogs.
- `number_of_cats` Number of cats.
- `number_of_persons` Number of persons.
- `cell_phone` Interviewee’s cell phone.
- `e_mail` Interviewee’s e-mail.
- `reasons_for_not_sterilize` Interviewee’s reported reason for not sterilizing her/his animal.
- `reasons_for_not_sterilize_others` Other reasons for not sterilizing her/his animal.

References

Description

A wrapper for `svydesign` function from the survey package, to define one of the following survey designs: two-stage cluster, simple (systematic) or stratified. In the first case, weights are calculated considering a sample with probability proportional to size and with replacement for the first stage and a simple random sampling for the second stage. Finite population correction is specified as the population size for each level of sampling.

Usage

```r
DesignSurvey(sample = NULL, psu.ssu = NULL, psu.col = NULL, ssu.col = NULL, cal.col = NULL, n = NULL, strata = NULL, cal.N = NULL, ...)
```

Arguments

- **sample**: `data.frame` with sample observations. For two-stage cluster designs, one of the columns must contain unique identifiers for PSU and another column must contain unique identifiers for Secondary Sampling Units (SSU).

- **psu.ssu**: `data.frame` with all Primary Sampling Units (PSU). First column contains PSU unique identifiers. Second column contains numeric PSU sizes. It is used only for two-stage cluster designs.

- **psu.col**: the column of sample containing the psu identifiers (for two-stage cluster designs). It is used only for two-stage cluster designs.

- **ssu.col**: the column of sample containing the ssu identifiers (for two-stage cluster designs). It is used only for two-stage cluster designs.

- **cal.col**: the column of sample with the variable to calibrate estimates. It must be used together with `cal.N`.

- **n**: for simple designs, a numeric value representing the total of sampling units in the population. For a stratified design, it is a column of sample indicating, for each observation, the total of sampling units in its respective strata. `N` is ignored in two-stage cluster designs.

- **strata**: for stratified designs, a column of sample indicating the strata membership of each observation.

- **cal.N**: population total for the variable to calibrate the estimates. It must be used together with `cal.col`.

- **...**: further arguments passed to `svydesign` function.
Details

For two-stage cluster designs, a PSU appearing in both psu.ssu and in sample must have the same identifier. SSU identifiers must be unique but can appear more than once if there is more than one observation per SSU. sample argument must have just the variables to be estimated plus the variables required to define the design (two-stage cluster or stratified). cal.col and cal.N are needed only if estimates will be calibrated. The calibration is based on a population total.

Value

An object of class survey.design.

References


Examples

data("cluster_sample")
data("psu_ssu")

## Calibrated two-stage cluster design
design <- DesignSurvey(na.omit(cluster_sample),
    psu.ssu = psu_ssu,
    psu.col = "census_tract_id",
    ssu.col = "interview_id",
    cal.col = "number_of_persons",
    cal.N = 129445)

## Simple design
# If data in cluster_sample were from a simple design:
design <- DesignSurvey(na.omit(cluster_sample),
    N = sum(psu_ssu$hh),
    cal.N = 129445)

## Stratified design
# Simulate strata and assume that the data in cluster_design came # from a stratified design
ccluster_sample$strat <- sample(c("urban", "rural"),
    nrow(cluster_sample),
    prob = c(.95, .05),
    replace = TRUE)
cluster_sample$strat_size <- round(sum(psu_ssu$h) * .95)
cluster_sample$strat_size[cluster_sample$strat == "rural"] <-
    round(sum(psu_ssu$h) * .05)
design <- DesignSurvey(cluster_sample,
    N = "strat_size",
    strata = "strat",
    cal.col = "number_of_persons",
    cal.N = 129445)
**Description**

Data described and analyzed by Baquero et al., 2018.

**Usage**

dogs

**Format**

Data frame with 1252 observations (dogs) and 22 variables:

- **interview_id**  Interview’s ID.
- **census_tract_id**  Census tract’s ID.
- **name**  Dog’s name.
- **species**  Animal’s species
- **sex**  Dog’s sex.
- **age**  Dog’s age. An age equal to 0 means that the dog had less than 1 year.
- **sterilized**  Dog’s reproductive status.
- **sterilized_ly**  For sterilized dogs, indicates if the dog was sterilized during the last year.
- **go_out_on_the_street_alone**  Indicates if the dog had access to the street without supervision (free-roaming).
- **acquisition**  Acquisition type.
- **acquired_ly**  Indicates if the dog was acquired during the last year.
- **acquired_sterilized**  Indicates if the dog was sterilized when acquired.
- **acquisition_city**  City of acquisition.
- **acquisition_state**  State of acquisition.
- **lost_animals**  Indicates if the dog was acquired during the year following the lost of another dog
- **births_ly**  Litter size if the bitch had the litter during the last year.
- **name3**  Dog’s name (dogs not present anymore in the household).
- **species3**  Animal’s species (animals not present anymore in the household).
- **sex3**  Dog’s sex (dogs not present anymore in the household).
- **age3**  Dog’s age (dogs not present anymore in the household). An age equal to 0 means that the dog had less than 1 year.
- **sterilized3**  Dog’s reproductive status (dogs not present anymore in the household).
- **fate3**  Dog’s fate.
References


FreqTab

Frequency table of categorical variables

Description

Calculates and sort the count and relative frequency of categories.

Usage

FreqTab(data = NULL, variables = NULL, rnd = 3, decreasing = TRUE, use.na = FALSE)

Arguments

data  
data.frame with categorical variables.
variables  
ame or position of categorical variables. If more than one variable is provided, contingency frequencies are calculated.
rnd  
the number of decimal places (round) or significant digits (signif) to be used.
decreasing  
logical. If TRUE, frequencies will be sorted in decreasing order, if FALSE, they will be sorted in increasing order.
use.na  
logical. If FALSE (default), missing values are omitted.

Value

data.frame.

References


See Also

table and sort.

Examples

data(cluster_sample)
FreqTab(cluster_sample$number_of_dogs)

data(dogs)
FreqTab(dogs, c("species", "sex"))
Description

Calculates initial values and parameters for the IASA model, from survey data collected with the questionnaire described by Bquero at al., 2018.

Usage

```r
getDataIASA(data = NULL, sex.col = "sex", female.label = "female", 
              male.label = "male", sterilized.col = "sterilized", 
              sterilized.label = "yes", sterilized.ly.col = "sterilized_ly", 
              sterilized.ly.label = "yes", births.ly.col = "births_ly", 
              species3.col = "species3", species.label = "dog", 
              sex3.col = "sex2", fate.col = "fate", died.label = "died", 
              lost.label = "lost", acquisition.col = "acquisition", 
              acquired.ly.col = "acquired_ly", acquired.ly.label = "yes", 
              adopted.label = "adopted", bought.label = "bought", 
              acquisition.source.col = "acquisition_city", 
              acquired.sterilized.col = "acquired_sterilized", 
              destination.label = NULL, total.estimate = NULL, k1.scale = 5, 
              h1 = 1, N2.scale = 0.05, f2.scale = 0.9, fs2.scale = 0.1, 
              m2.scale = 0.95, ms2.scale = 0.05, b2.scale = 1.5, 
              df2.scale = 1.2, dm2.scale = 1.2, sf2.scale = 0.3, 
              sm2.scale = 0.3, k2.scale = 2, h2 = 0.5)
```

Arguments

- **data**: `data.frame` with survey data.
- **sex.col**: name or index of the column with the *sex* variable.
- **female.label**: string with the *female* category in `sex.col`.
- **male.label**: string with the *male* category in `sex.col`.
- **sterilized.col**: name or index of the column with the *sterilized* variable.
- **sterilized.label**: string with the *sterilized* category (ex. yes) in `sterilized.col`.
- **sterilized.ly.col**: name or index of the column with the *sterilized last year* variable.
- **sterilized.ly.label**: string with the *sterilized during the last year* category (ex. yes) in `sterilized.ly.col`.
- **births.ly.col**: name or index of the column with the *births during the last year* variable.
- **species3.col**: name or index of the column with the *species* variable from the third questionnaire’s section (animals that left the household).
- **species.label**: string with the *species* category of interest (ex. dog) in `species3.col`. 
sex3.col name or index of the column with the *sex* variable form the third questionnaire's section (animals that left the household).

fate.col name or index of the column with the *fate* variable.

died.label string with the *died* category in fate.col.

lost.label string with the *lost* category in fate.col.

acquisition.col name or index of the column with the *acquisition* variable.

acquired.ly.col name or index of the column with the *acquisition during the last year* variable.

acquired.ly.label string with the *acquisition during the last year* category (ex. yes) in acquisition.ly.col.

adopted.label string with the *adopted* category in acquisition.ly.col.

bought.label string with the *bought* category in acquisition.ly.col.

acquisition.source.col name or index of the column with the *source* variable (ex. city).

acquired.sterilized.col name or index of the column with the *sterilized when acquired* variable.

destination.label string with the *destination* category (ex. city) in acquisition.source.ly.col.

total.estimate number representing the estimated total population size.

k1.scale scale to define the carrying capacity of the owned population as k1 = k.scale * total.estimate.

N2.scale scale to define the unowned population size as N2 = N2.scale * total.estimate.

f2.scale scale to define the female unowned population size as f2 = f2.scale * f1.

fs2.scale scale to define the sterilized female unowned population size as fs2 = fs2.scale * fs1.

m2.scale scale to define the sterilized male unowned population as m2 = m2.scale * m1.

ms2.scale scale to define the sterilized male unowned population size as ms2 = ms2.scale * ms1.

b2.scale scale to define the birth function of the unowned population as b2 = f2 \* b1 / f1 \* b2.scale.

df2.scale scale to define the death rate of the female unowned population as df2 = df2.scale * df1.

dm2.scale scale to define the death rate of the male unowned population as dm2 = dm2.scale * dm1.

sf2.scale scale to define the sterilized female unowned population size as sf2 = sf2.scale * sf1.

sm2.scale scale to define the sterilized male unowned population size as sm2 = sm2.scale * sm1.

k2.scale scale to define the carrying capacity of the unowned population as k2 = k2.scale * N2.

h2 number representing the mean harem size in the unowned population.
Details

If column and category names in data match arguments’ defaults, the function call is simplified as in the example below.

Value

list with two vectors: init (initial values) and pars (parameters).

References


Examples

data(dogs)
GetDataIASA(dogs, destination.label = "Pinhais", total.estimate = 5044)

---

MapkmlPSU

Creates *.kml files of a subset of polygons from a polygon shapefile

Description

Subset the polygons specified in psu and creates *.kml files of these polygons.

Usage

MapkmlPSU(shape = NULL, psu = NULL, id = NULL, path = "./psu_maps/")

Arguments

shape string with the path of a polygon shapefile or an object of class sf (see examples).
psu polygons to subset.
id column of the *.dbf file with the values to be matched against.
path class character with the path in which maps will be saved. If the path already exists, it will be overwritten.

Details

If there are *.kml files in the working directory, the new created files will overwrite it in case of name matching.
shape must receive a shapefile with appropriate coordinate reference system, otherwise, MapkmlPSU report an error.
Value

*.kml files of the subsetted polygons.

References

http://oswaldosantos.github.io/capm

Examples

data("psu_ssu")

# Take a sample of 5 PSU.
(selected_psu <- SamplePPS(psu_ssu = psu_ssu, psu = 5))

## Define shape from shapefile.
shp_path <- system.file("extdata/35SEE250GC_SIR.shp", package="capm")
# The code above used a shapefile available in the
# capm package.
# You might want to write a code like:
# shp.path <- 'path_to_the_folder_with_the_shapefile'

# Create *.kml files of 10 polygons.
## Not run:
MapkmIPSU(shape = shp_path,
    psu = selected_psu[, "selected_psu"],
    id = "CD_GEOCODI")

## Define the shape argument as an object x of class sf.
x <- read_sf(shp_path)
MapkmIPSU(shape = x, psu = selected_psu[, "selected_psu"], id = "CD_GEOCODI")

## End(Not run)

---

PlotGlobalSens

Plot results of GlobalSens function

Description

Plot results of of CalculateGlobalSens function.

Usage

PlotGlobalSens(global.out = NULL, x.label = "Time", y.label = "Population", legend.label = "Sensitivity range", qt.label = "Qt 0.05 - 0.95", sd.label = "mean +/- sd ", inner.color = "DarkRed", outer.color = "LightBlue")
Arguments

global.out output from `CalculateGlobalSens` function.
x.label string with the name for the x axis.
y.label string with the name for the y axis.
legend.label string with the name for the legend.
qt.label string with the name for the envelope calculated using the quantiles 0.05 and 0.95.
sd.label string with the name for the envelope calculated using the mean +- standard deviation ranges.
inner.color any valid specification of a color for the inner envelope.
outer.color any valid specification of a color for the outer envelope.

Details

Font size of saved plots is usually different to the font size seen in graphic browsers. Before changing font sizes, see the final result in saved (or preview) plots.

Other details of the plot can be modified using appropriate functions from `ggplot2` package.

References


http://oswaldosantos.github.io/capm

See Also

`plot.deSolve`.

Examples

```r
## IASA model

## Parameters and intial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
  destination.label = "Pinhais",
  total.estimate = 50444)

# Solve for point estimates.
solve_iasa_pt <- SolveIASA(pars = dogs_iasa$pars,
  init = dogs_iasa$init,
  time = 0:15,
  alpha.owned = TRUE,
  method = 'rk4')

## Set ranges 10 % greater and lesser than the ## point estimates.
```
rg_solve_iasa <- SetRanges(pars = dogs_iasa$pars)

## Calculate global sensitivity of combined parameters.  
## To calculate global sensitivity to each parameter, set  
## all as FALSE.  
glob_all_solve_iasa <- CalculateGlobalSens(
  model.out = solve_iasa_pt,
  ranges = rg_solve_iasa,
  sensv = "n2", all = TRUE)
PlotGlobalSens(glob_all_solve_iasa)

PlotHHxSpecies <- function(dat = NULL, species = NULL, proportion = TRUE, 
                          x.label = "Individuals per household", 
                          y.label = "Proportion of households", legend = TRUE) {
  data.frame with households as observation unit and columns with the number
   of individuals of the species of interest.
  names or positions of columns with species data.
  logical. If TRUE (default), the y axis will represent proportions, if FALSE, it
   would represent raw counts.
  title for x axis.
  title for y axis.
  logical. If TRUE (default), the legend will be showed, if FALSE, it will be
   removed.
}

Description

Dodged bar plot of the distribution of households according to the number of inhabitants of one or
more species.

Usage

PlotHHxSpecies(dat = NULL, species = NULL, proportion = TRUE, 
               x.label = "Individuals per household", 
               y.label = "Proportion of households", legend = TRUE)

Arguments

dat   data.frame with households as observation unit and columns with the number
  of individuals of the species of interest.
species names or positions of columns with species data.
proportion logical. If TRUE (default), the y axis will represent proportions, if FALSE, it
   would represent raw counts.
x.label title for x axis.
y.label title for y axis.
legend logical. If TRUE (default), the legend will be showed, if FALSE, it will be
   removed.

References

demography and population management in Pinhais, Brazil. Preventive Veterinary Medicine.

See Also

geom_bar.
Examples

```r
data(cluster_sample)
PlotImmigrationFlow(cluster_sample, c("number_of_persons",
    "number_of_dogs",
    "number_of_cats"))
```

Description

Plot immigration flows from many sources to one destination.

Usage

```r
PlotImmigrationFlow(data = NULL, source = NULL, destination = NULL,
  n.sources = 5L, agg.sources.prefix = "Other ",
  agg.sources.suffix = " sources", cls = NULL, start.degree = 0L,
  sources.label.dist = 0.15, sources.label.size = 0.75,
  ticks.label.size = 0.7)
```

Arguments

- **data** `data.frame` with sources and destination.
- **source** data's column name or index with places' names. Sources' names and destination's name must be in this column.
- **destination** destination's name.
- **n.sources** number of sources to plot. If smaller than the total number of sources source, the less frequent sources are aggregated.
- **agg.sources.prefix** string. If n.sources is smaller than the total number of sources, agg.sources.prefix is used to label the aggregated sources.
- **agg.sources.suffix** character. If n.sources is smaller than the total number of sources, agg.sources.prefix is used to label the aggregated sources.
- **cls** Optional character vector with n.sources + 1 colors.
- **start.degree** The starting degree from which the circle begins to draw. It is passed to the start.degree argument of circlize::circos.par function.
- **sources.label.dist** Data point on y-axis to separate the sources' labels from the circle. It is passed to the y argument of circlize::circos.text function.
- **sources.label.size** Font size for sources' labels. It is passed to the cex argument of circlize::circos.text function.
ticks.label.size

Font size for sources' labels. It is passed to the labels.cex argument of circlize::circos.axis function.

Details

The numbers around the circle indicate the number of animals.

References


Examples

data(dogs)
cls <- c("blue3", "orange", "skyblue", "darkgreen", "yellow3", "black")
PlotImmigrationFlow(dogs, "acquisition_city", "Pinhais",
                   cls = cls, agg.sources.suffix = "cities")

PlotLocalSens

Plot results of CalculateLocalSens function

Description

Plot results of the CalculateLocalSens function.

Usage

PlotLocalSens(local.out = NULL, x.sens = "Time",
               y.sens = "Sensitivity", y.ind = c("L1", "L2", "Mean", "Min", "Max"),
               bar.colors = "DarkRed", label.size = 10, x.axis.angle = 90,
               type = 1)

Arguments

local.out output from CalculateLocalSens function.
x.sens string with the name for the x axis.
y.sens string with the name for the y axis of the sensitivity functions (when type = 6).
y.ind string with the name for the y axis of the parameter importance indices.
bar.colors any valid specification of a color.
label.size a number to specify the size of axes labels and text.
x.axis.angle  
a number with angle of rotation for x axis text. Passed to `angle` argument of `element_text`.

type  
a number to define the type of graphical output. 1: importance index L1; 2: importance index L2; 3: mean of sensitivity functions; 5: minimum of sensitivity functions; and 5: maximum of sensitivity functions; 6: sensitivity functions and all importance indices are plotted.

Details

Font size of saved plots is usually different to the font size seen in graphic browsers. Before changing font sizes, see the final result in saved (or preview) plots.

References


http://oswaldosantos.github.io/capm

See Also

plot.sensFun.

Examples

```r
## IASA model
## Parameters and intial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
                        destination.label = "Pinhais",
                        total.estimate = 58444)
# Solve for point estimates.
solve_iasa_pt <- SolveIASA(pars = dogs_iasa$pars,
                          init = dogs_iasa$init,
                          time = 0:15,
                          alpha.owned = TRUE,
                          method = 'rk4')
## Calculate local sensitivities to all parameters.
local_solve_iasa2 <- CalculateLocalSens(
                        model.out = solve_iasa_pt, sensv = "n2")
## Plot local sensitivities
PlotLocalSens(local_solve_iasa2)
```
Description

Plot results of one of the following functions: SolveIASA, SolveSI or SolveTC.

Usage

PlotModels(model.out = NULL, variable = NULL, col = "red", col1 = c("cadetblue!", "yellow", "red"), col2 = c("blue", "darkgreen", "darkred"), x.label = "Years", y.label = NULL, legend.label = NULL, pop = NULL)

Arguments

- `model.out`: output of one of the function previously mentioned.
- `variable`: string to specify the variable to be plotted.
  - For `SolveSI` function:
    - "n" (population size).
    - "q" (proportion of sterilized animals).
  - For `SolveIASA` function using only point estimates:
    - "f1" (owned intact females).
    - "fs1" (owned sterilized females).
    - "m1" (owned intact males).
    - "ms1" (owned sterilized males).
    - "f2" (unowned intact females).
    - "fs2" (unowned sterilized females).
    - "m2" (unowned intact males).
    - "ms2" (unowned sterilized males).
    - "n1" (owned intact animals).
    - "ns1" (owned sterilized animals).
    - "n2" (unowned intact animals).
    - "ns2" (unowned sterilized animals).
    - "N1" (owned animals).
    - "N2" (unowned animals).
    - "N" (total population).
  - For `SolveIASA` function using *range arguments:
    - "f" (intact females).
    - "fs" (sterilized females).
    - "m" (intact males).
    - "ms" (sterilized males).
    - "n" (intact animals).
"ns" (sterilized animals).
"N" (Total population stratified by reproductive status).
For **`solveTC`** function:
"n" (fertile animals).
"g" (sterilized animals).
"u" (cumulative of sterilized animals)

- **`col`** string indicating the color of plotted line, when `s.range` is NULL.
- **`col1`** character vector indicating the color of lowest (highest) population sizes (proportion of sterilized animals), when `s.range` is not NULL.
- **`col2`** character vector indicating the color of highest (lowest) population sizes (proportion of sterilized animals), when `s.range` is not NULL.
- **`x.label`** string with the name for x axis.
- **`y.label`** string with the name for y axis.
- **`legend.label`** string with the name of the legend, for plots of **`solveIASA`** output.
- **`pop`** value indicating the output of **`solveIASA`** to be plotted. When NULL (default), plots for owned and unowned populations under scenarios created by immigration rate are created. If 1, the plots of owned population for the minimum immigration rate are plotted. When 2, the plots of unowned population for the minimum immigration rate are plotted. If 3, the plots of owned population for the maximum immigration rate are plotted. When 4, the plots of owned population for the maximum immigration rate are plotted.

**Details**

Font size of saved plots is usually different to the font size seen in graphic browsers. Before changing font sizes, see the final result in saved (or preview) plots.

Other details of the plot can be modified using appropriate functions from **ggplot2** package.

**References**


[http://oswaldosantos.github.io/capm](http://oswaldosantos.github.io/capm)

**See Also**

**`plot.deSolve`**.

**Examples**

```r
## IASA model

## Parameters and initial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
                       destination.label = "Pinhais",
total.estimate = 50444)
```
# Solve for point estimates.
solve_iasa_pt <- SolveIASA(pars = dogs_iasa$pars,
                           init = dogs_iasa$init,
                           time = 0:15,
                           alpha.owned = TRUE,
                           method = 'rk4')
solve_iasa_rg <- SolveIASA(pars = dogs_iasa$pars,
                           init = dogs_iasa$init,
                           time = 0:10,
                           alpha.owned = TRUE,
                           s.range = seq(0, .4, l = 15),
                           a.range = c(0, .2),
                           alpha.range = c(0, .05),
                           v.range = c(0, .1),
                           method = 'rk4')

## Plot unowned population sizes using point estimates
## Not run:
PlotModels(solve_iasa_pt, variable = "ns2")

## Plot all scenarios and change the label for the scenarios.
## Not run
PlotModels(solve_iasa_rg, variable = "ns")

## End(Not run)

---

**PlotPopPyramid**

### Description
Displays two opposed horizontal barplots (pyramid).

### Usage
`PlotPopPyramid(dat = NULL, age.col = NULL, sex.col = NULL,
                 str.col = NULL, str.tip = NULL, x.label = "Count",
                 stage.label = "Years", legend.label = "Sterilized",
                 inner.color = "LightBlue", outer.color = "DarkRed",
                 label.size = 13)`

### Arguments
- **dat** `data.frame`
- **age.col** `dat` column that has a `numeric vector` representing ages or stage categories.
- **sex.col** `dat` column that has two unique values representing the sex of individuals (see Details).
str.col | dat column that has two unique values representing the reproductive status of individuals (see Details).
--- | ---
str.tip | string with the category of str.col to place at tip of the bars.
x.label | string to be used as a label for the x axis. If undefined, x.label is equal to "Total" (see Details).
stage.label | a string to be used as a label for the ages or stage categories. If undefined, stage.label is equal to "Years" (see Details).
legend.label | a string to be used as a label for the legend. If undefined, legend.label is equal to "Sterilized".
inner.color | any valid specification of a color. When str.col is not NULL, inner.color is the color of inner bars.
outer.color | any valid way specification of a color. When str.col is NULL, outer.color is the default color. When str.col is not NULL, outer.color is the outer color of bars.
label.size | string to define the font size for labels.

Details

PlotPopPyramid is mainly intended for companion animals population pyramids, although it can display other types of opposed bar charts.

The bars to the left of the x axis correspond to sort(unique(dat[, sex.col]))[1]. If str.col is not NULL, bars will be stacked, with sort(unique(dat[, str.col]))[1] as their base.

On the top of the plot, it is displayed the total number of observations of each dat[, sex.col] unique value. This unique values are used as labels.

The legend labels are equal to the dat[, str.col] unique values.

Font size of saved plots is usually different to the font size seen in graphic browsers. Before changing font sizes, see the final result in saved (or preview) plots.

Other details of the plot can be modified using appropriate functions from ggplot2 package (see examples).

Value

Two opposed horizontal barplots.

Note

In companion animals population surveys, some age categories might be empty. One difference between PlotPopPyramid and prpyramid.plot is that the first does not drop empty age categories.

References

Examples

data(dogs)

PlotPopPyramid(dogs,
    age.col = "age",
    sex.col = "sex",
    str.col = "sterilized")

PlotPopPyramid(dogs,
    age.col = "age",
    sex.col = "sex")

## Merge age categories
pp_age <- cut(c(dogs$age, dogs$age3),
    breaks = c(0, 1, 3, 5, 7, 9, 11, 13, 15,
        max(c(dogs$age, dogs$age3), na.rm = TRUE)),
    labels = c("<1", "1-3", "3-5", "5-7", "7-9",
        "9-11", "11-13", "13-15", ">15"),
    include.lowest = TRUE)
pp_sex <- c(dogs$sex, dogs$sex3)
pp_ster <- c(dogs$sterilized, dogs$sterilized3)
pp <- data.frame(age = pp_age, sex = pp_sex, sterilized = pp_ster)

PlotPopPyramid(pp,
    age.col = "age",
    sex.col = "sex",
    str.col = "sterilized")

PlotPopPyramid(pp,
    age.col = "age",
    sex.col = "sex")


census_tract_id  Census track’s ID.

hh  Number of households.
Source

http://www.ibge.gov.br/

References


SamplePPS  Sampling with probability proportional to size and with replacement

Description

Select Primary Sampling Units (PSU) with probability proportional to size and with replacement.

Usage

SamplePPS(psu.ssu = NULL, psu = NULL, write = FALSE, ...)

Arguments

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>psu.ssu</td>
<td><code>data.frame</code> with all PSU. First column contains PSU unique identifiers. Second column contains <code>numeric</code> PSU sizes.</td>
</tr>
<tr>
<td>psu</td>
<td>the number of PSU to be selected.</td>
</tr>
<tr>
<td>write</td>
<td>logical. If TRUE, a *.csv file containing the PSU and their Secondary Sampling Units (SSU) is writed in the current working directory.</td>
</tr>
<tr>
<td>...</td>
<td>further arguments passed to <code>write.table</code> function.</td>
</tr>
</tbody>
</table>

Value

`data.frame`. First column contains the selected PSU identifiers, coerced by `as.character`, to avoid scientific notation in case the identifiers be large numbers of `class numeric`. Second column contain PSU sizes, a variable needed for second stage sampling with `SampleSystematic`.

References


http://oswaldosantos.github.io/capm

See Also

`SampleSystematic`. 
**SampleSystematic**

**Simple and stratified systematic sampling**

**Description**

Select sampling units using simple or stratified systematic sampling. In the context of two-stage cluster sampling, select Secondary Sampling Units (SSU) in one or more Primary Sampling Units (PSU), using systematic sampling.

**Usage**

```r
SampleSystematic(psu.ssu = NULL, su = NULL, N = NULL, write = FALSE, ...)
```

**Arguments**

- `psu.ssu` : `data.frame` with all PSU. First column contains PSU unique identifiers. Second column contains numeric PSU sizes. It is used only for the second stage of a two-stage cluster design (see details).
- `su` : numeric indicating the number of sampling units to be selected. If `su` has more than one element, stratified sampling is applied and `psu.ssu` is ignored (see details).
- `N` : numeric indicating the number of sampling units in the population. It is intended for simple or stratified sampling designs and when used, `psu.ssu` is ignored (see details).
- `write` : logical. If TRUE, a *.csv file containing the PSU and their SSU is written in the current working directory.
- `...` : further arguments passed to `write.table` function.

**Details**

When `N` is defined, `psu.ssu` is ignored. If `N` has one element, `su` must too and the result is a simple systematic selection. If `N` has more than one element, `su` must have the same number of elements and each ordered pair represent an strata. Thus, when `N` has more than one element, the result is a stratified sampling with systematic selection within each strata (see examples).

**Examples**

```r
data(psu.ssu)

# Take a sample of 10 PSU.
SamplePPS(psu.ssu = psu.ssu, psu = 10, write = FALSE)
```
Value

A matrix. For the second stage in a two-stage cluster sampling, the names of columns are the identifiers of selected psu, coerced by `as.character` to avoid scientific notation in case the identifiers be of `class numeric`. The rows correspond to the selected SSU within each PSU. For simple systematic sampling, the rows correspond to the selected sampling units. For stratified sampling, each column represent an strata and the rows correspond to the selected sampling units in each strata.

References


See Also

SamplePPS.

Examples

data(psu_ssu)

## Two-stage cluster sampling
selected_psu <- SamplePPS(psu.ssu = psu_ssu, psu = 10)

# Take a systematic sampling of 5 SSU within each selected PSU.
SampleSystematic(selected_psu, 5, write = FALSE)

## Simple systematic sampling
SampleSystematic(su = 5, N = 100)

## Stratified systematic sampling
SampleSystematic(su = c("urban" = 50, "rural" = 10),
               N = c("urban" = 4000, "rural" = 150))

Description

Define the minimum and maximum values for parameters whose global sensitivities are to be assessed with `CalculateGlobalSens` or `sensRange` functions.

Usage

SetRanges(pars = NULL, range = 0.1)
Arguments

- `pars`: the same `pars` vector used in one of the following functions: `SolveSI` or `SolveIASA`.
- `range`: scale factor to define the minimum and maximum for each parameter. The default is 0.1, which sets the minimum and maximum as 10 percent lesser and greater than the `pars` values.

Value

- `data.frame` with the complete set of parameter ranges.

References


http://oswaldosantos.github.io/capm

See Also

- `sensRange` and `SolveSI`.

Examples

```r
## IASA model

## Parameters and initial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
                         destination.label = "Pinhais",
                         total.estimate = 50444)

## Set ranges 10 % greater and lesser than the
## point estimates.
rg_solve_iasa <- SetRanges(pars = dogs_iasa$pars)
```

Description

- `SolveIASA`: Modelling of immigration, abandonment, sterilization and adoption of companion animals.

- System of ordinary differential equations to simulate the effect of immigration of owned dogs, abandonment, sterilization of owned and unowned dogs and adoption, on population dynamics.
Usage

SolveIASA(pars = NULL, init = NULL, time = NULL,
  alpha.owned = TRUE, immigration.reference = "N1", s.range = NULL,
  a.range = NULL, alpha.range = NULL, v.range = NULL, s.fm = TRUE,
  ...)}

Arguments

pars a named vector of length 21, with point estimates of model parameters (see details).

init a named vector of length 8, with point estimates of model parameters (see details).

time time sequence for which output is wanted; the first value of times must be the initial time.

alpha.owned logical. If TRUE (default), adoption rate is relative to the owned population (proportion of the owned population). If FALSE, it is relative to the unowned population.

immigration.reference character indicating the value of reference to calculate the immigration rate. If "N1" (default), the total of immigrants is the product of the owned population size times the immigration rate (N1 \* v). If k1, it is the product of the owned carrying capacity times the immigration rate (k1 \* v).

s.range optional sequence (between 0 and 1) of the sterilization rates to be simulated.

a.range optional vector of length 2, with range (ie, confidence interval) of abandonment rates to be assessed. If given, the rates evaluated are those specified by the argument plus the point estimate given in pars.

alpha.range optional vector of length 2, with range (ie, confidence interval) of adoption rates to be assessed. If given, the rates evaluated are those specified by the argument plus the point estimate given in pars.

v.range optional vector of length 2, with range of values of immigration rates to be assessed.

s.fm logical. If TRUE, s.range is used for females and males and if FALSE, it is used for only females (for males, the point estimate given in pars is used.)

... further arguments passed to ode function.

Details

The implemented model is described by Baquero, et. al., 2016 and the function is a wrapper around the defaults of ode function, whose help page must be consulted for details.

The pars argument must contain named values, using the following conventions: 1: owned animals; 2: unowned animals; f: females; m: males. Then:

b1 and b2: number of births.
df1, dm1, df2 and dm2: death rate.
sf1, sm1, sf2 and sm2: sterilization rate.
k1 and k2: carrying capacity.
h1 and h2: mean harem size.
a: abandonment rate.
alpha: adoption rate.
v: immigration rate.
z: proportion of sterilized immigrants.

The init argument must contain named values for the initial number of animals, using the following conventions: 1: owned animals; 2: unowned animals; f: females; m: males; and s: sterilized. Then, the names are:
f1, fs1, m1, ms1, f2, fs2, m2 and ms2.

If any range is specified (e.g s.range), the remaining ranges must be specified too (a.range, alpha.range and v.range). The function is a wrapper around the defaults of ode function, whose help page must be consulted for details. An exception is the method argument, which here has "rk4" as a default.

Value

list. The first element, name, is a string with the name of the function, the second element, model, is the model function. The third, fourth and fifth elements are vectors (pars, init, time, respectively) containing the pars, init and time arguments of the function. The sixth element results is a data.frame with up to as many rows as elements in time. The first column contain the time and subsequent columns contain the size of specific subpopulations, named according to conventions above. The group column differentiate between owned and unowned. When *.range arguments are given, the last fourth columns specify their instances.

Note

Logistic growth models are not intended for scenarios in which population size is greater than carrying capacity and growth rate is negative.

References


http://oswaldosantos.github.io/capm

See Also

ode.
Examples

```r
## Parameters and initial conditions.
data(dogs)
dogs_iasa <- GetDataIASA(dogs,
    destination.label = "Pinhais",
    total.estimate = 50444)

# Solve for point estimates.
solve_iasa_pt <- SolveIASA(pars = dogs_iasa$pars,
    init = dogs_iasa$init,
    time = 0:15,
    alpha.owned = TRUE,
    method = "rk4")
solve_iasa_rg <- SolveIASA(pars = dogs_iasa$pars,
    init = dogs_iasa$init,
    time = 0:10,
    alpha.owned = TRUE,
    s.range = seq(0, .4, l = 15),
    a.range = c(0, .2),
    alpha.range = c(0, .05),
    v.range = c(0, .1),
    method = "rk4")
```

**Description**

System of ordinary differential equations to simulate the effect of sterilization and immigration on population dynamics.

**Usage**

`SolveSI(pars = NULL, init = NULL, time = NULL, dd = "b", im = 0,
    s.range = NULL, ...)`

**Arguments**

- **pars** vector of length 4. The values are point estimates of birth rate, death rate, carrying capacity and sterilization rate. The names of this values must be "b", "d", "k" and "s", respectively.
- **init** vector of length 2. The values are initial population size and initial proportion of sterilized animals. The names of this values must be "n" and "q", respectively.
- **time** time sequence for which output is wanted; the first value of times must be the initial time.
- **dd** string equal to b, d or bd to define if density-dependence act on birth rate, death rate or both, respectively.
SolveSI

- `im`: a number representing the total of immigrants per time unit.
- `s.range`: optional sequence (between 0 and 1) of the sterilization rates to be simulated.
- `...`: further arguments passed to `ode` function.

**Details**

The implemented model is described by Amaku, et. al., 2009 and the function is a wrapper around the defaults of `ode` function, whose help page must be consulted for details.

**Value**

- `list`. The first element, `name`, is a string with the name of the function, the second element, `model`, is the model function. The third, fourth and fifth elements are vectors (`pars`, `init`, `time`, respectively) containing the `pars`, `init` and `time` arguments of the function. The sixth element `results` is a `data.frame` with up to as many rows as elements in time. First column contains the time, second column the population size and third column the proportion of sterilized animals. If `s.range` is specified, fourth column contains its specific instances.

**Note**

Logistic growth models are not intended for scenarios in which population size is greater than carrying capacity and growth rate is negative.

**References**


http://oswaldosantos.github.io/capm

**See Also**

- `ode`

**Examples**

``` r
# Parameters and initial conditions.
pars.solve.si = c(b = 0.245, d = 0.101,
  k = 90000, s = 0.048)
init.solve.si = c(n = 89137, q = 0.198)

# Solve for a specific sterilization rate.
solve.si_pt = SolveSI(pars = pars.solve.si,
  init = init.solve.si,
  time = 0:15, dd = "b",
  im = 100, method = "rk4")

# Solve for a range of sterilization rates.
solve.si_rg = SolveSI(pars = pars.solve.si,
  init = init.solve.si,
```
SolveTC

Modelling of reversible contraception for companion animals

Description

System of ordinary differential equations to simulate the effect of reversible contraception in a population at equilibrium, where deaths are compensated by births and net immigration.

Usage

SolveTC(pars = NULL, init = NULL, time = NULL, f.range = NULL, s.range = NULL, z.range = NULL, ...)

Arguments

pars

a named vector of length 5. The values are point estimates of the death rate (d), the fertility recovery rate (f), the sterilization rate (s), the proportion of infertile immigrants (z) and the proportion of the death rate compensated by immigration (r). Abbreviations in parentheses indicate the names that must be given to the values.

init

a named vector of length 2, with the total number of fertile (n) and infertile (g) animals.

time

time sequence for which output is wanted; the first value of times must be the initial time.

f.range

optional sequence (between 0 and 1) with the fertility recovery rates to be simulated.

s.range

optional vector of length 2, with a range of sterilization rates to be assessed. If given, the rates evaluated are those specified by the argument plus the point estimate given in pars.

z.range

optional vector of length 2, with a range of the proportion of infertile immigrants. If given, the rates evaluated are those specified by the argument plus the point estimate given in pars.

...

further arguments passed to ode function.

Value

list. The first element, name, is a string with the name of the function, the second element, model, is the model function. The third, fourth and fifth elements are vectors (pars, init, time, respectively) containing the pars, init and time arguments of the function. The sixthth element results is a data.frame with up to as many rows as elements in time. The first fourth columns contain the time and the variables: n, g and u. When *.range arguments are given, additional columns contain the variables f, s and z.
References

http://oswaldosantos.github.io/capm


See Also

ode.

Examples

# Parameters and initial conditions.
pars_solvetc <- c(d = 1 / 6, f = 0.5, s = 0.2, 
                  z = 0.2, r = 0.8)

init_solvetc <- c(n = 950, g = 50)

# Solve for point estimates.
solve_tc_pt <- SolveTC(pars = pars_solvetc, 
                        init = init_solvetc, 
                        time = 0:10, method = "rk4")

# Solve for parameter ranges.
solve_tc_rg <- SolveTC(pars = pars_solvetc, 
                        init = init_solvetc, 
                        time = 0:15, 
                        f.range = seq(0, 1.01), 
                        s.range = c(0.05, 0.4), 
                        z.range = c(0.05, 0.4), 
                        method = "rk4")

SummarySurvey

Summary statistics for sample surveys

Description

Wraps functions for summary statistics from survey package.

Usage

SummarySurvey(design = NULL, variables = NULL, conf.level = 0.95, 
              rnd = 3)
SummarySurvey

Arguments

- **design**: an output form `DesignSurvey` function.
- **variables**: character vector with the type of estimate for each variable contained in `design` (see details).
- **conf.level**: the confidence level required.
- **rnd**: the number of decimal places (round) or significant digits (signif) to be used. If `NA`, scientific notation is used.

Details

The length of **variables** must be equal to the length of `names(design$variables)` (see examples).

Value

Matrix with survey summaries.

References

http://oswaldosantos.github.io/capm

Examples

```r
data("cluster_sample")
data("psu_ssu")

# Calibrated two-stage cluster design
cs <- cluster_sample[, c("interview_id", 
    "censustract_id", 
    "number_of_persons", 
    "number_of_dogs", 
    "number_of_cats")]

design <- DesignSurvey(na.omit(cs), 
    psu.ssu = psu_ssu, 
    psu.col = "censustract_id", 
    ssu.col = "interview_id", 
    cal.col = "number_of_persons", 
    cal.N = 129445)

SummarySurvey(design, c("total", "total", "total"))
```
Index

*Topic datasets
  cats, 11
  cluster_sample, 12
  dogs, 15
  psu_ssu, 30
*Topic package
  capm-package, 2
  as.character, 31, 33
  Calculate2StageSampleSize, 3
  CalculateGlobalSens, 4, 7, 20, 21, 33
  CalculateLocalSens, 6, 24
  CalculatePopChange, 7
  CalculateSimpleSampleSize, 8
  CalculateStratifiedSampleSize, 9
  capm-package, 2
  cats, 11
  character, 23, 27, 35, 41
  class, 19, 31, 33
  cluster_sample, 12
  data.frame, 3, 6, 10, 13, 16, 17, 22, 23, 28, 31, 32, 34, 36, 38, 39
  DesignSurvey, 13, 41
  dogs, 15
  element_text, 25
  FALSE, 4, 5
  FreqTab, 16
  geom_bar, 22
  GetDataIASA, 17
  labels, 29
  list, 4, 6, 7, 19, 36, 38, 39
  logical, 16, 22, 35
  Mapkm1PSU, 19
  matrix, 10
  numeric, 3, 9, 10, 13, 28, 31–33
  ode, 35, 36, 38–40
  plot.deSolve, 21, 27
  plot.sensFun, 25
  PlotGlobalSens, 20
  PlotHHxSpecies, 22
  PlotImmigrationFlow, 23
  PlotLocalSens, 24
  PlotModels, 7, 26
  PlotPopPyramid, 28
  psu_ssu, 30
  SamplePPS, 31, 33
  SampleSystematic, 31, 32
  sensFun, 6
  sensRange, 4–6, 33, 34
  SetRanges, 4, 33
  sf, 19
  SolveIASA, 4, 6, 7, 26, 27, 34, 34
  SolveSI, 4, 6, 7, 26, 34, 37
  SolveTC, 4, 6, 7, 26, 27, 39
  sort, 16
  SummarySurvey, 40
  svydesign, 13
  table, 16
  vector, 9, 10, 23, 27, 28, 35, 37, 39, 41
  write.table, 31, 32