Package ‘InSilicoVA’

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Type Package

Title Probabilistic Verbal Autopsy Coding with 'InSilicoVA' Algorithm

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Depends R (>= 3.5.0), rJava, coda, ggplot2, InterVA5

Imports methods, grDevices

SystemRequirements Java (>= 7)

Description Computes individual causes of death and population cause-specific mortality fractions using the 'InSilicoVA' algorithm from McCormick et al. (2016) <DOI:10.1080/01621459.2016.1152191>. It uses data derived from verbal autopsy (VA) interviews, in a format similar to the input of the widely used 'InterVA' method. This package provides general model fitting and customization for 'InSilicoVA' algorithm and basic graphical visualization of the output.

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URL https://github.com/verbal-autopsy-software/InSilicoVA

BugReports https://github.com/verbal-autopsy-software/InSilicoVA/issues

RoxygenNote 7.2.1

Suggests testthat

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R topics documented:

causetext .................................................. 2
condprob .................................................. 3
condprobnum ............................................. 3
Translation list of COD codes

Description

This is the translation of COD abbreviation codes into their corresponding full names.

Format

A data frame with the translation of COD codes to their names on 68 CODs (both the version of COD only and COD with group code).

Examples

```r
data(causetext)
```
condprob

Conditional probability table used by InterVA-4

Description

This is a conditional probability matrix used by InterVA-4.2. There are 60 causes and 245 symptoms. The orders of the rows and columns must not be changed.

Format

A data frame with 245 observations on 60 variables. Each observation is the conditional probability.

Examples

data(condprob)

condprobum

Conditional probability values used by InterVA-4

Description

This is a conditional probability matrix used by InterVA-4.2. There are 60 causes and 245 symptoms.

Format

A data frame with 245 observations on 60 variables. Each observation is the conditional probability.

Examples

data(condprobum)
Description

Produce convergence test for CSMFs from fitted "insilico" objects.

Usage

```r
csmf.diag(
  csmf,
  conv.csmf = 0.02,
  test = c("gelman", "heidel")[2],
  verbose = TRUE,
  autoburnin = FALSE,
  which.sub = NULL,
  ...
)
```

Arguments

- `csmf` It could be either fitted "insilico" object, a list of fitted "insilico" object from different chains of the same length but different starting values, i.e., different seed. Or it could be the matrix of CSMF obtained by insilico, or the list of matrices of CSMF. All CSMF could contain more than one subpopulations, but should be in the same format and order. And notice if the raw CSMF is used instead of the "insilico" object, external causes might need to be removed manually by user is external.sep is TRUE when fitting the model.
- `conv.csmf` The minimum mean CSMF to be checked. Default to be 0.02, which means any causes with mean CSMF lower than 0.02 will not be tested.
- `test` Type of test. Currently supporting Gelman and Rubin’s test (test = "gelman") for multi-chain test, and Heidelberger and Welch’s test (test = "heidel") for single-chain test.
- `verbose` Logical indicator to return the test detail instead of one logical outcome for Heidelberger and Welch’s test. Default to be TRUE.
- `autoburnin` Logical indicator of whether to omit the first half of the chain as burn in. Default to be FALSE since insilico return only the iterations after burnin by default.
- `which.sub` the name of the sub-population to test when there are multiple in the fitted object.
- `...` Arguments to be passed to heidel.diag or gelman.diag

Details

The tests are performed using heidel.diag and gelman.diag functions in coda package. The function takes either one or a list of output from insilico function, or only the iteration by CSMF matrix. Usually in practice, many causes with very tiny CSMF are hard to converge based on standard tests,
thus it is suggested to check convergence for only causes with mean CSMF over certain threshold by setting proper conv.csmf.

Note for Gelman and Rubin’s test, all chains should have the same length. If the chains are sampled with automatically length determination, they might not be comparable by this test.

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References


See Also

insilico, summary.insilico

Examples

# load sample data together with sub-population list
data(RandomVA2)

## Not run:
# extract InterVA style input data
data <- RandomVA2
# extract sub-population information.
subpop <- RandomVA2$sex

# run without sub-population
fit1a<- insilico( data, subpop = NULL,
                   Nsim = 400, burnin = 200, thin = 10 , seed = 1,
                   auto.length = FALSE)
fit1b<- insilico( data, subpop = NULL,
                   Nsim = 400, burnin = 200, thin = 10 , seed = 2,
                   auto.length = FALSE)
fit1c<- insilico( data, subpop = NULL,
extract.prob

Obtain conditional probabilities from training data

Description

This is the function internally used in insilico.train function.

Usage

extract.prob(
  train,
  gs,
  gstable,
  thre = 0.95,
  type = c("quantile", "fixed", "empirical")[1],
  isNumeric = FALSE,
  impute = TRUE
)

Arguments

train  
Training data, it should be in the same format as the testing data and contains one additional column (see cause below) specifying known cause of death. The first column is also assumed to be death ID.

gs  
the name of the column in train that contains cause of death.

gstable  
The list of causes of death used in training data.

thre  
a numerical value between 0 to 1. It specifies the maximum rate of missing for any symptoms to be considered in the model. Default value is set to 0.95, meaning if a symptom has more than 95% missing in the training data, it will be removed.

type  
Three types of learning conditional probabilities are provided: “quantile” or “fixed”. Since InSilicoVA works with ranked conditional probabilities $P(S|C)$, “quantile” means the rankings of the $P(S|C)$ are obtained by matching the same quantile distributions in the default InterVA $P(S|C)$, and “fixed” means $P(S|C)$ are matched to the closest values in the default InterVA $P(S|C)$ table. Empirically both types of rankings produce similar results. The third option “empirical” means no rankings are calculated, only the raw $P(S|C)$ values are returned.

isNumeric  
Indicator if the input is already in numeric form. If the input is coded numerically such that 1 for “present”, 0 for “absent”, and -1 for “missing”, this indicator could be set to True to avoid conversion to standard InterVA format.

impute  
Indicator for whether to impute 1. $P(S|C)$ with $P(S)$ if symptom $S$ does not exist more than the threshold of fractions within death due to $C$; and 2. values of exact 0 or 1.

Value

cond.prob  
raw $P(S|C)$ matrix

cond.prob.alpha  
ranked $P(S|C)$ matrix

table.alpha  
list of ranks used

table.num  
list of median numerical values for each rank

symps.train  
training data after removing symptoms with too high missing rate.

get.indiv

Get individual COD probabilities from InSilicoVA Model Fits

Description

This function calculates individual probabilities for each death and provide posterior credible intervals for each estimates. The default set up is to calculate the 95
Usage

```r
get.indiv(
  object,
  data = NULL,
  CI = 0.95,
  is.aggregate = FALSE,
  by = NULL,
  is.sample = FALSE,
  java_option = "-Xmx1g",
  ...
)
```

Arguments

- **object**: Fitted "insilico" object.
- **data**: data for the fitted "insilico" object. The first column of the data should be the ID that matches the "insilico" fitted model.
- **CI**: Credible interval for posterior estimates.
- **is.aggregate**: logical indicator for constructing aggregated distribution rather than individual distributions.
- **by**: list of column names to group by.
- **is.sample**: logical indicator for returning the posterior samples of individual probabilities instead of posterior summaries.
- **java_option**: Option to initialize java JVM. Default to "-Xmx1g", which sets the maximum heap size to be 1GB.
- **...**: Not used.

Value

- **mean**: individual mean COD distribution matrix.
- **median**: individual median COD distribution matrix.
- **lower**: individual lower bound for each COD probability.
- **upper**: individual upper bound for each COD probability.

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References

indivplot

See Also

insilico, updateIndiv, plot.insilico

Examples

## Not run:
data(RandomVA1)
fit1 <- insilico(RandomVA1, subpop = NULL,
Nsim = 1000, burnin = 500, thin = 10, seed = 1,
auto.length = FALSE)
summary(fit1, id = "d199")

# Calculate aggregated COD distributions
agg.csmf <- get.indiv(data = RandomVA1, fit1, CI = 0.95,
is.aggregate = TRUE, by = NULL)
head(agg.csmf)

agg.by.sex.age <- get.indiv(data = RandomVA1, fit1, CI = 0.95,
is.aggregate = TRUE, by = list("sex", "age"))
head(agg.by.sex.age$mean)

# Obtain individual level P(Y|X) posterior draws (N by C by Nitr array)
prob <- get.indiv(data = RandomVA1, fit1, is.sample = TRUE)
dim(prob)

## End(Not run)

indivplot

plot aggregated COD distribution

Description

Produce a bar plot of the aggregated COD distribution as approximate CSMFs for a fitted "insilico" object.

Usage

indivplot(
  x,
  type = c("errorbar", "bar")[1],
  top = 10,
  causelist = NULL,
  which.plot = NULL,
  xlab = "Causes",
  ylab = "COD distribution",
  title = "COD distributions for the top causes",
  horiz = TRUE,
  angle = 60,
)
fill = "lightblue",
err_width = 0.4,
err_size = 0.6,
point_size = 2,
border = "black",
bw = FALSE,
...
)

Arguments

x object from get.indiv function.
type An indicator of the type of chart to plot. "errorbar" for line plots of only the error bars on single population; "bar" for bar chart with error bars on single population.
top The number of top causes to plot. If multiple sub-populations are to be plotted, it will plot the union of the top causes in all sub-populations.
causelist The list of causes to plot. It could be a numeric vector indicating the position of the causes in the InterVA cause list (see causetext), or a vector of character string of the cause names. The argument supports partial matching of the cause names. e.g., "HIV/AIDS related death" could be abbreviated into "HIV"; "Other and unspecified infect dis" could be abbreviated into "Other and unspecified infect".
which.plot Specification of which group to plot if there are multiple.
xlab Labels for the causes.
ylab Labels for the CSMF values.
title Title of the plot.
horiz Logical indicator indicating if the bars are plotted horizontally.
angle Angle of rotation for the texts on x axis when horiz is set to FALSE
fill The color to fill the bars when type is set to "bar".
err_width Size of the error bars.
err_size Thickness of the error bar lines.
point_size Size of the points.
border The color to color the borders of bars when type is set to "bar".
bw Logical indicator for setting the theme of the plots to be black and white.
...

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References


See Also

`insilico`, `summary.insilico`

Examples

```R
## Not run:
# Toy example with 1000 VA deaths
data(RandomVA1)
fit1 <- insilico(RandomVA1, subpop = NULL,
                 Nsim = 1000, burnin = 500, thin = 10 , seed = 1,
                 auto.length = FALSE)
summary(fit1, id = "d199")

# update credible interval for individual probabilities to 90%
indiv.new <- get.indiv(fit1, CI = 0.9)
fit1$indiv.prob.lower <- indiv.new$lower
fit1$indiv.prob.upper <- indiv.new$upper
fit1$indiv.CI    <- 0.9
summary(fit1, id = "d199")

# get empirical aggregated COD distribution
agg.csmf <- get.indiv(data = RandomVA2, fit1, CI = 0.95,
                        is.aggregate = TRUE, by = NULL)
head(agg.csmf)

# aggregate individual COD distribution by sex and age
# note the model was fitted assuming the same CSMF for all deaths
# this aggregation provides an approximate CSMF for each sub-groups
agg.by.sex.age <- get.indiv(data = RandomVA2, fit1, CI = 0.95,
                             is.aggregate = TRUE, by = list("sex", "age"))
head(agg.by.sex.age$mean)

# plot of aggregated individual COD distribution
# 0. plot for all data
indivplot(agg.csmf, top = 10)
# 1. plot for specific one group
indivplot(agg.by.sex.age, which.plot = "Men 60-", top = 10)
# 2. comparing multiple groups
indivplot(agg.by.sex.age, which.plot = list("Men 60+", "Men 60-"),
          top = 5)
# 3. comparing multiple groups on selected causes
indivplot(agg.by.sex.age, which.plot = list("Men 60-", "Women 60-"),
          top = 0, causelist = c("HIV/AIDS related death",
                                 "..."))
```
### insilico

**Implement InSilicoVA methods**

#### Description

This function implements InSilicoVA model. The InSilicoVA model is fitted with MCMC implemented in Java. For more detail, see the paper on [https://arxiv.org/abs/1411.3042](https://arxiv.org/abs/1411.3042).

#### Usage

```r
insilico(
  data,
  data.type = c("WHO2012", "WHO2016")[[1]],
  sci = NULL,
  isNumeric = FALSE,
  updateCondProb = TRUE,
  keepProbbase.level = TRUE,
  CondProb = NULL,
  CondProbNum = NULL,
  datacheck = TRUE,
  datacheck.missing = TRUE,
  warning.write = FALSE,
  directory = NULL,
  external.sep = TRUE,
  Nsim = 4000,
  thin = 10,
  burnin = 2000,
  auto.length = TRUE,
  conv.csmf = 0.02,
  jump.scale = 0.1,
  levels.prior = NULL,
  levels.strength = 1,
  trunc.min = 1e-04,
  trunc.max = 0.9999,
  subpop = NULL,
  java_option = "-Xmx1g",
  seed = 1,
  phy.code = NULL,
  phy.cat = NULL,
  phy.unknown = NULL,
  phy.external = NULL,
)```

Arguments

**data**
The original data to be used. It is suggested to use similar input as InterVA4, with the first column being death IDs and 245 symptoms. The only difference in input is InsilicoVA takes three levels: “present”, “absent”, and “missing (no data)”. Similar to InterVA software, “present” symptoms takes value “Y”; “absent” symptoms take take value “NA” or “”. For missing symptoms, e.g., questions not asked or answered in the original interview, corrupted data, etc., the input should be coded by “” to distinguish from “absent” category. The order of the columns does not matter as long as the column names are correct. It can also include more unused columns than the standard InterVA4 input. But the first column should be the death ID. For example input data format, see RandomVA1 and RandomVA2.

**data.type**
Type of questionnaire. “WHO2012” corresponds to the standard input of InterVA4, and “WHO2016” corresponds to the standard input of InterVA5.

**sci**
A data frame that contains the symptom-cause-information (aka Probbase) that InterVA uses to assign a cause of death.

**isNumeric**
Indicator if the input is already in numeric form. If the input is coded numerically such that 1 for “present”, 0 for “absent”, and -1 for “missing”, this indicator could be set to True to avoid conversion to standard InterVA format.

**updateCondProb**
Logical indicator. If FALSE, then fit InsilicoVA model without re-estimating conditional probabilities.

**keepProbbase.level**
Logical indicator when updateCondProb is FALSE. If TRUE, then only estimate the InterVA’s conditional probability interpretation table; if FALSE, estimate the whole conditional probability matrix. Default to TRUE.

**CondProb**
Customized conditional probability matrix to use. It should be strict the same configuration as InterVA-4 software. That is, it should be a matrix of 245 rows of symptoms and 60 columns of causes, arranged in the same order as in InterVA-4 specification. The elements in the matrix should be the conditional probability of corresponding symptom given the corresponding cause, represented in alphabetic form indicating levels. For example input, see condprob

**CondProbNum**
Customized conditional probability matrix to use if specified fully by numerical values between 0 and 1. If it is specified, re-estimation of conditional probabilities will not be performed, i.e., updateCondProb will be set to FALSE.

**datacheck**
Logical indicator for whether to check the data satisfying InterVA rules. Default set to be TRUE. If warning.write is set to true, the inconsistent input
will be logged in file `warning_insilico.txt` and `errorlog_insilico.txt`. It's strongly suggested to be set to TRUE.

datacheck.missing
Logical indicator for whether to perform data check before deleting complete missing symptoms. Default to TRUE.

warning.write
Logical indicator for whether to save the changes made to data input by datacheck. If set to TRUE, the changes will be logged in file `warning_insilico.txt` and `errorlog_insilico.txt` in current working directory.

directory
The directory to store the output from. It should be an valid existing directory or a folder to be created.

external.sep
Logical indicator for whether to separate out external causes first. Default set to be TRUE. If set to TRUE, the algorithm will estimate external causes, e.g., traffic accident, accidental fall, suicide, etc., by checking the corresponding indicator only without considering other medical symptoms. It is strongly suggested to set to be TRUE.

Nsim
Number of iterations to run. Default to be 4000.

thin
Proportion of thinning for storing parameters. For example, if thin = k, the output parameters will only be saved every k iterations. Default to be 10

burnin
Number of iterations as burn-in period. Parameters sampled in burn-in period will not be saved.

auto.length
Logical indicator of whether to automatically increase chain length if convergence not reached.

conv.csmf
Minimum CSMF value to check for convergence if auto.length is set to TRUE. For example, under the default value 0.02, all causes with mean CSMF at least 0.02 will be checked for convergence.

jump.scale
The scale of Metropolis proposal in the Normal model. Default to be 0.1.

levels.prior
Vector of prior expectation of conditional probability levels. They do not have to be scaled. The algorithm internally calibrate the scale to the working scale through `levels.strength`. If NULL the algorithm will use InterVA table as prior.

levels.strength
Scaling factor for the strength of prior beliefs in the conditional probability levels. Larger value constrain the posterior estimates to be closer to prior expectation. Default value 1 scales `levels.prior` to a suggested scale that works empirically.

trunc.min
Minimum possible value for estimated conditional probability table. Default to be 0.0001

trunc.max
Maximum possible value for estimated conditional probability table. Default to be 0.9999

subpop
This could be the column name of the variable in data that is to be used as sub-population indicator, or a list of column names if more than one variable are to be used. Or it could be a vector of sub-population assignments of the same length of death records. It could be numerical indicators or character vectors of names.
java_option Option to initialize java JVM. Default to “-Xmx1g”, which sets the maximum heap size to be 1GB. If R produces “java.lang.OutOfMemoryError: Java heap space” error message, consider increasing heap size using this option, or one of the following: (1) decreasing Nsim, (2) increasing thin, or (3) disabling auto.length.

seed Seed used for initializing sampler. The algorithm will produce the same outcome with the same seed in each machine.

phy.code A matrix of physician assigned cause distribution. The physician assigned causes need not be the same as the list of causes used in InSilicoVA and InterVA-4. The cause list used could be a higher level aggregation of the InSilicoVA causes. See phy.cat for more detail. The first column of phy.code should be death ID that could be matched to the symptom dataset, the following columns are the probabilities of each cause category used by physicians.

phy.cat A two column matrix describing the correspondence between InSilicoVA causes and the physician assigned causes. Note each InSilicoVA cause (see causetext) could only correspond to one physician assigned cause. See SampleCategory for an example. 'Unknown' category should not be included in this matrix.

phy.unknown The name of the physician assigned cause that correspond to unknown COD.

phy.external The name of the physician assigned cause that correspond to external causes. This will only be used if external.sep is set to TRUE. In that case, all external causes should be grouped together, as they are assigned deterministically by the corresponding symptoms.

phy.debias Fitted object from physician coding debias function (see physician_debias) that overwrites phy.code.

exclude.impossible.cause option to exclude impossible causes at the individual level. The following rules are implemented: subset: Causes with 0 probability given the age group and gender of the observation, according to the InterVA conditional probabilities, are removed; subset2: In addition to the same rules as subset, also remove Prematurity for baby born during at least 37 weeks of pregnancy, remove Birth asphyxia for baby not born during at least 37 weeks of pregnancy, and remove pregnancy-related deaths for deaths without pregnancy; all: Causes with 0 probability given any symptom of the observation, according to the InterVA conditional probabilities, are removed; interVA: Causes with 0 probability given any positive indicators according to the InterVA conditional probabilities, are removed; and none: no causes are removed. subset2 is the default.

impossible.combination matrix indicating additional impossible symptom-cause combinations in addition to the ones specified by exclude.impossible.cause. It should be a matrix of three columns, where each row is one rule of impossible combination. In each row, the first column specify the name of the symptom (as in the input data column names, e.g., “i079o”), the second column specify the name of the cause (as in the probbase column name, i.e., “b_0101”), and the third column specifying either 0 or 1, indicating the cause is impossible when the symptom takes the specified value.

no.is.missing logical indicator to treat all absence of symptoms as missing. Default to FALSE. If set to TRUE, InSilicoVA will perform calculations similar to InterVA-4 w.r.t
treating absent symptoms. It is highly recommended to set this argument to FALSE.

**indiv.CI**
credible interval for individual probabilities. If set to NULL, individual COD distributions will not be calculated to accelerate model fitting time. See `get.indiv` for details of updating the C.I. later after fitting the model.

**groupcode**
logical indicator of including the group code in the output causes

... not used

## Details

For Windows user, this function will produce a popup window showing the progress. For Mac and Unix user, this function will print progress messages on the console. Special notice for users using default R GUI for mac, the output will not be printed on console while the function is running, and will only be printed out after it is completed. Thus if you use a Mac, we suggest using either RStudio for mac, or running R from terminal.

The chains could be set to run automatically longer. If set `auto.length` to be TRUE, the chain will assess convergence after finishing the length K chain input by user using Heidelberger and Welch’s convergence diagnostic. If convergence is not reached, the chain will run another K iterations and use the first K iterations as burn-in. If the chain is still not converged after 2K iterations, it will proceed to another 2K iterations and again use the first 2K iterations as burn-in. If convergence is still not reached by the end, it will not double the length again to avoid heavy memory use. A warning will be given in that case. The extended chains will be thinned in the same way.

For more detail of model specification, see the paper on https://arxiv.org/abs/1411.3042.

## Value

**id**
A vector of death ID. Note the order of the ID is in general different from the input file. See report for organizing the report.

**data**
Cleaned numerical data.

**indiv.prob**
Matrix of individual mean cause of death distribution. Each row corresponds to one death with the corresponding ID.

**csmf**
Matrix of CSMF vector at each iterations after burn-in and thinning. Each column corresponds to one cause.

**conditional.probs**
If the model is estimated with `keepProbbase.level` = TRUE, this value gives a matrix of each conditional probability at each level at each iterations. Each column corresponds to one level of probability. If `keepProbbase.level` = FALSE, this value gives a three-dimensional array. If `updateCondProb` = FALSE, the value will be set to NULL. See report for more analysis.

**missing.symptoms**
Vector of symptoms missing from all input data.

**external**
Logical indicator of whether the model is fitted with external causes separated calculated.

**impossible.causes**
Impossible cause-symptom pairs, if any.
The posterior credible interval to compute for individual COD probability distributions. If set to NULL, only the posterior mean of the individual COD probabilities will be produced. Default to be 0.95.

median probability of each cause of death for each individual death.

lower CI bound for the probability of each cause of death for each individual death.

upper CI bound for the probability of each cause of death for each individual death.

Logs of deleted observations and reasons of deletion.

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plot.insilico, summary.insilico, physician_debias

## Not run:
data(RandomVA1)
fit0<- insilico(RandomVA1, subpop = NULL, 
  Nsim = 20, burnin = 10, thin = 1, seed = 1, 
  auto.length = FALSE)
summary(fit0)
summary(fit0, id = "d199")

##
## Scenario 1: standard input without sub-population specification
##
## fit1<- insilico(RandomVA1, subpop = NULL, 
##  Nsim = 1000, burnin = 500, thin = 10, seed = 1, 
##  auto.length = FALSE)
## summary(fit1)
## plot(fit1)

##
## Scenario 2: standard input with sub-population specification
## Scenario 5: skipping re-estimation of conditional probabilities

# Though in practice the need for this situation is very unlikely, # use only the default conditional probabilities without re-estimation
fit5<- insilico(RandomVA1, subpop = NULL,  
  Nsim = 1000, burnin = 500, thin = 10 , seed = 1,  
  updateCondProb = FALSE,  
  auto.length = FALSE)  
summary(fit5)

## Scenario 6: modify default conditional probability matrix

# Load the default conditional probability matrix
data(condprob)  
# The conditional probabilities are given in levels such as I, A+, A, A-, etc.
condprob[1:5, 1:5]  
# To modify certain cells
new_cond_prob <- condprob  
new_cond_prob["elder", "HIV/AIDS related death"] <- "C"
# or equivalently
ew_cond_prob[1, 3] <- "C"

fit6<- insilico(RandomVA1, subpop = NULL,
Nsim = 1000, burnin = 500, thin = 10 , seed = 1,
CondProb = new_cond_prob,
auto.length = FALSE)
# note: compare this with fit1 above to see the change induced
# by changing Pr(elder | HIV) from "C+" to "C".
summary(fit6)

## Scenario 7: modify default numerical values in conditional probabilities directly
##
# Load the default conditional probability matrix
data(condprobnum)
# The conditional probabilities are given in numerical values in this dataset
condprobnum[1:5, 1:5]
# To modify certain cells, into any numerical values you want
new_cond_prob_num <- condprobnum
new_cond_prob_num["elder", "HIV/AIDS related death"] <- 0.004
# or equivalently
new_cond_prob_num[1, 3] <- 0.005

fit7<- insilico(RandomVA1, subpop = NULL,
Nsim = 1000, burnin = 500, thin = 10 , seed = 1,
CondProbNum = new_cond_prob_num,
auto.length = FALSE)
# note: compare this with fit1, fit5, and fit6
summary(fit7)

## Scenario 8: physician coding
## see also the examples in physician_debias() function section
##
# Load sample input for physicians
data(RandomPhysician)
# The symptom section looks the same as standard input
head(RandomPhysician[, 1:5])
# At the end of file, including a few more columns of physician id and coded cause
head(RandomPhysician[, 245:250])

# Load Cause Grouping (if physician-coded causes are in larger categories)
data(SampleCategory)
head(SampleCategory)

# existing doctor codes in the sample dataset
doctors <- paste0(”doc", c(1:15))
causelist <- c("Communicable", "TB/AIDS", "Maternal",
"NCD", "External", "Unknown")
phydebias <- physician_debias(RandomPhysician,
phy.id = c("rev1", "rev2"), phy.code = c("code1", "code2"),
phylist = doctors, causelist = causelist,
insilico.fit

Implement InSilicoVA methods with more flexible customization

Description

This function implements InSilicoVA model. This is the lower level core function of InSilicoVA with more flexibility in customized input. For more detail of model specification, see the paper on https://arxiv.org/abs/1411.3042 and the default function insilico.

Usage

insilico.fit(
  data,
  data.type = c("WHO2012", "WHO2016") [1],
  sci = NULL,
  isNumeric = FALSE,
  tol = 0.0001, max.itr = 100)

fit8 <- insilico(RandomVA1, subpop = NULL,
  Nsim = 1000, burnin = 500, thin = 10, seed = 1,
  phy.debias = phydebias,
  phy.cat = SampleCategory,
  phy.external = "External", phy.unknown = "Unknown",
  auto.length = FALSE)

summary(fit8)

# example to fit WHO2016 data
data(RandomVA5)
fit1a <- insilico(RandomVA5, data.type="WHO2016", subpop = NULL,
  Nsim = 1000, burnin = 500, thin = 10, seed = 1,
  auto.length = FALSE)

summary(fit1a)
plot(fit1)

# example to change directory for error files
fit1b <- insilico(RandomVA5[1:50, ], data.type="WHO2016",
  Nsim = 1000, burnin = 500, thin = 10,
  seed = 1, auto.length=F)
fit1c <- insilico(RandomVA5[1:50, ], data.type="WHO2016",
  Nsim = 1000, burnin = 500, thin = 10,
  seed = 1, auto.length=F)

# similarly for WHO 2012 version
fit1 <- insilico(RandomVA1, subpop = NULL,
  Nsim = 1000, burnin = 500, thin = 10, seed = 1,
  auto.length = FALSE)

## End(Not run)
updateCondProb = TRUE,
keepProbbase.level = TRUE,
CondProb = NULL,
CondProbNum = NULL,
datacheck = TRUE,
datacheck.missing = TRUE,
warning.write = FALSE,
directory = NULL,
external.sep = TRUE,
Nsim = 4000,
thin = 10,
burnin = 2000,
auto.length = TRUE,
conv.csdf = 0.02,
jump.scale = 0.1,
levels.prior = NULL,
levels.strength = 1,
trunc.min = 1e-04,
trunc.max = 0.9999,
subpop = NULL,
java_option = "-Xmx1g",
seed = 1,
phy.code = NULL,
phy.cat = NULL,
phy.unknown = NULL,
phy.external = NULL,
phy.debias = NULL,
exclude.impossible.cause = c("subset2", "subset", "all", "InterVA", "none")[1],
impossible.combination = NULL,
n.no.is.missing = FALSE,
customization.dev = FALSE,
Probbase_by_symp.dev = FALSE,
probbase.dev = NULL,
table.dev = NULL,
table.num.dev = NULL,
gstable.dev = NULL,
nlevel.dev = NULL,
indiv.CI = NULL,
groupcode = FALSE,
...)

Arguments

data see `insilico`
data.type see `insilico`
sci see `insilico`
isNumeric see `insilico`
updateCondProb see insilico
keepProbbase.level see insilico
CondProb see insilico
CondProbNum see insilico
datacheck see insilico
datacheck.missing see insilico
warning.write see insilico
directory see insilico
external.sep see insilico
Nsim see insilico
thin see insilico
burnin see insilico
auto.length see insilico
conv.csmf see insilico
jump.scale see insilico
levels.prior see insilico
levels.strength see insilico
trunc.min see insilico
trunc.max see insilico
subpop see insilico
java_option see insilico
seed see insilico
phy.code see insilico
phy.cat see insilico
phy.unknown see insilico
phy.external see insilico
phy.debias see insilico
exclude.impossible.cause see insilico
impossible.combination see insilico.train
no.is.missing see insilico
customization.dev
  Logical indicator for customized variables
Probbase_by_symptom.dev
  Not tested yet.
The customized conditional probabilities of symptoms given causes, which could be in a different format than InterVA default, but it should consist of `nlevel.dev` levels rather than numerical values.

The table of level names in `probbase.dev`. Default to be NULL

The corresponding prior numerical values for each level in `probbase.dev`, in the same order as `table.dev`. Default to be NULL

Table of gold standard causes for each death. Default to be NULL

number of levels in `probbase.dev`. Default to be NULL

credible interval for individual probabilities

logical indicator of including the group code in the output causes

a `insilico` fit object, see see `insilico` for more detail.

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See Also

plot.insilico, summary.insilico

This function implements InSilicoVA model with non-InterVA4 input data.
Usage

\texttt{insilico.train(}
\begin{verbatim}
data, train, cause, causes.table = NULL, thre = 0.95, type = c("quantile", "fixed", "empirical")[1], isNumeric = FALSE, updateCondProb = TRUE, keepProbbase.level = TRUE, CondProb = NULL, CondProbNum = NULL, datacheck = TRUE, datacheck.missing = TRUE, warning.write = FALSE, external.sep = TRUE, Nsim = 4000, thin = 10, burnin = 2000, auto.length = TRUE, conv.csmf = 0.02, jump.scale = 0.1, levels.prior = NULL, levels.strength = NULL, trunc.min = 1e-04, trunc.max = 0.9999, subpop = NULL, java_option = "-Xmx1g", seed = 1, phy.code = NULL, phy.cat = NULL, phy.unknown = NULL, phy.external = NULL, phy.debias = NULL, exclude.impossible.cause = TRUE, impossible.combination = NULL, indiv.CI = NULL, CondProbTable = NULL, ...
\end{verbatim}
\texttt{)}

Arguments

data\hspace{1cm}The original data to be used. It is suggested to use similar input as InterVA4, with the first column being death IDs and 245 symptoms. The only difference in input is InsilicoVA takes three levels: “present”, “absent”, and “missing (no data)”. Similar to InterVA software, “present” symptoms takes value “Y”; “ab-
sent” symptoms take value “NA” or “”. For missing symptoms, e.g., questions not asked or answered in the original interview, corrupted data, etc., the input should be coded by “.” to distinguish from “absent” category. The order of the columns does not matter as long as the column names are correct. It can also include more unused columns than the standard InterVA4 input. But the first column should be the death ID. For example input data format, see RandomVA1 and RandomVA2.

**train**

Training data, it should be in the same format as the testing data and contains one additional column (see cause below) specifying known cause of death. The first column is also assumed to be death ID.

**cause**

the name of the column in train that contains cause of death.

**causes.table**

The list of causes of death used in training data.

**thre**

a numerical value between 0 to 1. It specifies the maximum rate of missing for any symptoms to be considered in the model. Default value is set to 0.95, meaning if a symptom has more than 95% missing in the training data, it will be removed.

**type**

Three types of learning conditional probabilities are provided: “empirical”, “quantile” or “fixed”. Since InSilicoVA works with ranked conditional probabilities $P(S|C)$, “quantile” means the rankings of the $P(S|C)$ are obtained by matching the same quantile distributions in the default InterVA $P(S|C)$, and “fixed” means $P(S|C)$ are matched to the closest values in the default InterVA $P(S|C)$ table. Empirically both types of rankings produce similar results. “empirical”, on the other hand, means no ranking is calculated, but use the empirical conditional probabilities directly. If “empirical”, updateCondProb will be forced to be FALSE.

**isNumeric**

Indicator if the input is already in numeric form. If the input is coded numerically such that 1 for “present”, 0 for “absent”, and -1 for “missing”, this indicator could be set to True to avoid conversion to standard InterVA format.

**updateCondProb**

Logical indicator. If FALSE, then fit InSilicoVA model without re-estimating conditional probabilities.

**keepProbbase.level**

see insilico for more detail.

**CondProb**

see insilico for more detail.

**CondProbNum**

see insilico for more detail.

**datacheck**

Not Implemented.

**datacheck.missing**

Not Implemented.

**warning.write**

Not Implemented.

**external.sep**

Not Implemented.

**Nsim**

see insilico for more detail.

**thin**

see insilico for more detail.

**burnin**

see insilico for more detail.

**auto.length**

see insilico for more detail.

**conv.csmf**

see insilico for more detail.
jump.scale  see `insilico` for more detail.
levels.prior  see `insilico` for more detail.
levels.strength
trunc.min     see `insilico` for more detail.
trunc.max     see `insilico` for more detail.
subpop        see `insilico` for more detail.
java_option   see `insilico` for more detail.
seed          see `insilico` for more detail.
phy.code      see `insilico` for more detail.
phy.cat       see `insilico` for more detail.
phy.unknown   see `insilico` for more detail.
phy.external  see `insilico` for more detail.
phy.debias    see `insilico` for more detail.
exclude.impossible.cause
impossible.combination
   a matrix of two columns, first is the name of symptoms, and the second is the
   name of causes. Each row corresponds to a combination of impossible symptom
   (that exists) and cause.
indiv.CI      see `insilico` for more detail.
CondProbTable a data frame of two columns: one alphabetic level of the CondProb argument
   and one numerical value corresponding to the numerical value of each level.
   Only used when only conditional probabilities are provided instead of training
data.
...            not used

Details

Please see `insilico` for more details about choosing chain length and OS system differences. This
function implements InSilico with customized input format and training data.

For more detail of model specification, see the paper on `https://arxiv.org/abs/1411.3042`.

Value

`insilico` object
**mapICD**  
*Map ICD-10 codes into the WHO 2016 cause list*

**Description**
Map ICD-10 codes into the WHO 2016 cause list

**Usage**
mapICD(x)

**Arguments**
x  
a character object or a vector of ICD-10 codes

**Examples**
mapICD("A90")
mapICD(c("A90", "C30"))

**physician_debias**  
*Implement physician debias algorithm*

**Description**
This function implements physician debias algorithm proposed in Salter-Townshend and Murphy (2013).

**Usage**
physician_debias(
  data,
  phy.id,
  phy.code,
  phylist,
  causelist,
  tol = 1e-04,
  max.itr = 5000,
  verbose = FALSE
)
Arguments

data
  The original data to be used. It is suggested to use similar input as InterVA4, with the first column being death IDs. The only difference in input is InsilicoVA takes three levels: “present”, “absent”, and “missing (no data)”. Similar to InterVA software, “present” symptoms takes value “Y”; “absent” symptoms take value “NA” or “”. For missing symptoms, e.g., questions not asked or answered in the original interview, corrupted data, etc., the input should be coded by “.” to distinguish from “absent” category. The order of the columns does not matter as long as the column names are correct. Currently it cannot other non-symptom columns such as subpopulation. And the first column should be the death ID. Everything other than the death ID, physician ID, and physician codes should be symptoms.

phy.id
  vector of column names for physician ID

phy.code
  vector of column names for physician code

phylist
  vector of physician ID used in physician ID columns

causelist
  vector of causes used in physician code columns

tol
  tolerance of the EM algorithm

max.itr
  maximum iteration to run

verbose
  logical indicator for printing out likelihood change

Value

code.debias
  Individual cause likelihood distribution

csmf
  Cause specific distribution in the sample

phy.bias
  Bias matrix for each physician

cond.prob
  Conditional probability of symptoms given causes

References


Examples

data(RandomPhysician)
head(RandomPhysician[, 1:10])
## Not run:
phydebias <- physician_debias(RandomPhysician, phy.id = c("rev1", "rev2"), phy.code = c("code1", "code2"), phylist = paste0("doc", c(1:15)), causelist = causelist, tol = 0.0001, max.itr = 5000)

# see the first physician's bias matrix
round(phydebias$phy.bias[[1]], 2)

## End(Not run)
plot.insilico  

plot CSMF from a "insilico" object

Description

Produce a bar plot of the CSMFs for a fitted "insilico" object.

Usage

## S3 method for class 'insilico'
plot(
x,  
type = c("errorbar", "bar", "compare")[1],  
top = 10,  
causelist = NULL,  
which.sub = NULL,  
xlab = "Causes",  
ylab = "CSMF",  
title = "Top CSMF Distribution",  
horiz = TRUE,  
angle = 60,  
fill = "lightblue",  
err_width = 0.4,  
err_size = 0.6,  
point_size = 2,  
border = "black",  
bw = TRUE,  
...  
)

Arguments

x          fitted "insilico" object

type       An indicator of the type of chart to plot. "errorbar" for line plots of only the 
          error bars on single population; "bar" for bar chart with error bars on single 
          population; "compare" for line charts on multiple sub-populations.

top        The number of top causes to plot. If multiple sub-populations are to be plotted, 
          it will plot the union of the top causes in all sub-populations.

causelist  The list of causes to plot. It could be a numeric vector indicating the position 
          of the causes in the InterVA cause list (see causetext), or a vector of character 
          string of the cause names. The argument supports partial matching of the cause 
          names. e.g., "HIV/AIDS related death" could be abbreviated into "HIV"; "Other 
          and unspecified infect dis" could be abbreviated into "Other and unspecified 
          infect".

which.sub  Specification of which sub-population to plot if there are multiple and type is 
          set to "bar".
plot.insilico

xlab Labels for the causes.
ylab Labels for the CSMF values.
title Title of the plot.
horiz Logical indicator indicating if the bars are plotted horizontally.
angle Angle of rotation for the texts on x axis when horiz is set to FALSE
fill The color to fill the bars when type is set to "bar".
err_width Size of the error bars.
err_size Thickness of the error bar lines.
point_size Size of the points.
border The color to color the borders of bars when type is set to "bar".
bw Logical indicator for setting the theme of the plots to be black and white.
... Not used.

Details

To-do

Author(s)

Zehang Li, Tyler McCormick, Sam Clark

Maintainer: Zehang Li <lizehang@uw.edu>

References


See Also

insilico, summary.insilico

Examples

```r
## Not run:
data(RandomVA1)
##
## Scenario 1: without sub-population specification
##
fit1<- insilico(RandomVA1, subpop = NULL,
                Nsim = 1000, burnin = 500, thin = 10 , seed = 1,
                auto.length = FALSE)

# basic line plot
plot(fit1)
# basic bar plot
plot(fit1, type = "bar")
```
# line plot with customized look
plot(fit1, top = 15, horiz = FALSE, fill = "gold",
     bw = TRUE, title = "Top 15 CSMFs", angle = 70,
     err_width = .2, err_size = .6, point_size = 2)
##
## Scenario 2: with sub-population specification
##
data(RandomVA2)
fit2<- insilico(RandomVA2, subpop = list("sex"),
                 Nsim = 1000, burnin = 500, thin = 10, seed = 1,
                 auto.length = FALSE)
summary(fit2)
# basic side-by-side line plot for all sub-populations
plot(fit2, type = "compare", main = "Top 5 causes comparison")
# basic line plot for specific sub-population
plot(fit2, which.sub = "Women", main = "Top 5 causes for women")
# customized plot with only specified causes
# the cause names need not be exact as InterVA cause list
# substrings in InterVA cause list is enough for specification
# e.g. the following two specifications are the same
some_causes_1 <- c("HIV/AIDS related death", "Pulmonary tuberculosis")
some_causes_2 <- c("HIV", "Pulmonary")
plot(fit2, type = "compare", horiz = FALSE, causelist = some_causes_1,
     title = "HIV and TB fractions in two sub-populations",
     angle = 20)
## End(Not run)

print.insilico

### Print method for summarizing InSilicoVA Model Fits

**Description**

This function is the print method for class insilico.

**Usage**

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

**Arguments**

- `x` insilico object.
- `...` not used
Author(s)

Zehang Li, Tyler McCormick, Sam Clark
Maintainer: Zehang Li <lizehang@uw.edu>

References


See Also

`summary.insilico`

Examples

```r
## Not run:
# load sample data together with sub-population list
data(RandomVA1)
# extract InterVA style input data
data <- RandomVA1$data
# extract sub-population information.
# The groups are "HIV Positive", "HIV Negative" and "HIV status unknown".
subpop <- RandomVA1$subpop

# run without subpopulation
fit1 <- insilico(data, subpop = NULL, 
                 Nsim = 400, burnin = 200, thin = 10 , seed = 1, 
                 external.sep = TRUE, keepProbbase.level = TRUE)
fit1

## End(Not run)
```
Arguments

x        insilico_summary object.
...
not used

Author(s)

Zehang Li, Tyler McCormick, Sam Clark
Maintainer: Zehang Li <lizehang@uw.edu>

References


See Also

summary.insilico

Examples

## Not run:
# load sample data together with sub-population list
data(RandomVA1)
# extract InterVA style input data
data <- RandomVA1$data
# extract sub-population information.
# The groups are "HIV Positive", "HIV Negative" and "HIV status unknown".
subpop <- RandomVA1$subpop

# run without subpopulation
fit1 <- insilico( data, subpop = NULL,
                  Nsim = 400, burnin = 200, thin = 10, seed = 1,
                  external.sep = TRUE, keepProbase.level = TRUE)
summary(fit1)
summary(fit1, top = 10)

# save individual COD distributions to files
summary(fit1, file = "results.csv")

## End(Not run)

---

**probbase**

*Conditional probability of InterVA4*

**Description**

This is the table of conditional probabilities of symptoms given CODs, together with the data check rules. The values are from InterVA-4.2.
Format

A data frame with 246 observations on 81 variables.

Examples

```r
data(probbase)
```

<table>
<thead>
<tr>
<th>probbase3</th>
<th>Conditional probability of InterVA4.03</th>
</tr>
</thead>
</table>

Description

This is the table of conditional probabilities of symptoms given CODs. The values are from InterVA-4.03.

Format

A data frame with 246 observations on 81 variables. Each observation is the conditional probability.

Examples

```r
data(probbase)
```

<table>
<thead>
<tr>
<th>RandomPhysician</th>
<th>100 records of Sample Input together with two simulated physician codes</th>
</tr>
</thead>
</table>

Description

This is the same dataset as in RandomVA2 with additional columns specifying physician ID and codes.

Format

100 arbitrary input records.

Examples

```r
data(RandomPhysician)
head(RandomPhysician[, 1:10])
```
**RandomVA1**

**Description**

This is a dataset consisting of 1000 arbitrary sample input deaths in the default format of InSilicoVA, i.e., the same input format as in InterVA-4 software and R package.

**Format**

1000 arbitrary input records.

**Examples**

```r
data(RandomVA1)
dim(RandomVA1)
head(RandomVA1)
```

---

**RandomVA2**

**Description**

This is a dataset consisting of 1000 arbitrary sample input deaths in the default format of InSilicoVA with additional columns specifying age and sex, which could be served as characteristics in sub-population estimation.

**Format**

100 arbitrary input records.

**Examples**

```r
data(RandomVA2)
dim(RandomVA2)
head(RandomVA2)
```
### SampleCategory

**Correspondence between InterVA causes and the physician coded cause categories**

#### Description

This is the matrix explaining the correspondence between InterVA causes and the physician coded cause categories.

#### Format

Matrix of 2 columns

#### Examples

```r
data(SampleCategory)
head(SampleCategory)
```

### SamplePhysician

**100 records of Sample debiased physician codes**

#### Description

This is in the same format of the output running `physician_debias`. It is a data frame of 100 rows, and column represents ID and probability of the cause in each category.

#### Format

100 arbitrary input records.

#### Examples

```r
data(SamplePhysician)
head(SamplePhysician)
```
Description

Produce bar plot of the CSMFs for a fitted "insilico" object in broader groups.

Usage

stackplot(
  x, 
  grouping = NULL, 
  type = c("stack", "dodge")[1], 
  order.group = NULL, 
  order.sub = NULL, 
  err = TRUE, 
  CI = 0.95, 
  sample.size.print = FALSE, 
  xlab = "Group", 
  ylab = "CSMF", 
  ylim = NULL, 
  title = "CSMF by broader cause categories", 
  horiz = FALSE, 
  angle = 60, 
  err_width = 0.4, 
  err_size = 0.6, 
  point_size = 2, 
  border = "black", 
  bw = FALSE, 
  ...
)

Arguments

- x: fitted "insilico" object
- grouping: C by 2 matrix of grouping rule. If set to NULL, make it default.
- type: type of the plot to make
- order.group: list of grouped categories. If set to NULL, make it default.
- order.sub: Specification of the order of sub-populations to plot
- err: indicator of inclusion of error bars
- CI: confidence interval for error bars
- sample.size.print: Logical indicator for printing also the sample size for each sub-population labels.
- xlab: Labels for the causes.
ylab       Labels for the CSMF values.
ylim       Range of y-axis.
title      Title of the plot.
horiz      Logical indicator indicating if the bars are plotted horizontally.
angle      Angle of rotation for the texts on x axis when horiz is set to FALSE
err_width  Size of the error bars.
err_size   Thickness of the error bar lines.
point_size Size of the points.
border     The color for the border of the bars.
bw         Logical indicator for setting the theme of the plots to be black and white.
...

Author(s)

Zehang Li, Tyler McCormick, Sam Clark
Maintainer: Zehang Li <lizehang@uw.edu>

References


See Also

insilico, summary.insilico

Examples

```r
## Not run:
data(RandomVA1)
##
## Scenario 1: without sub-population specification
##
## fit1 <- insilico(RandomVA1, subpop = NULL,
##   Nsim = 1000, burnin = 500, thin = 10, seed = 1,
##   auto.length = FALSE)
# stack bar plot for grouped causes
# the default grouping could be seen from
data(SampleCategory)
stackplot(fit1, type = "dodge", xlab = "")

##
## Scenario 2: with sub-population specification
##
data(RandomVA2)
fit2 <- insilico(RandomVA2, subpop = list("sex"),
```
summary.insilico

Summarizing InSilicoVA Model Fits

Description

This function is the summary method for class insilico.

Usage

## S3 method for class 'insilico'
summary(
  object,
  CI.csmf = 0.95,
  CI.cond = 0.95,
  file = NULL,
  top = 10,
  id = NULL,
  ...
)

Arguments

object Fitted "insilico" object.
CI.csmf Confidence interval for CSMF estimates.
summary.insilico

CI.cond        Confidence interval for conditional probability estimates
file           Optional .csv file to write to. If it is specified, individual cause of death distribution will be saved to the file.
top            Number of top causes to display on screen.
id             ID of specific death to display on screen.
...             Not used.

Details

summary.insilico formats some basic information about the InSilicoVA fitted object on screen and show the several top CSMFs of user’s choice. See below for more detail.

Value

id.all         all IDs of the deaths.
indiv          individual Cause of Death distribution matrix.
csmf           CSMF distribution and confidence interval for each cause.
csmf.ordered   CSMF distribution and confidence interval for each cause, ordered by mean.
condprob       Conditional probability matrix and confidence intervals.
updateCondProb Component of "insilico" object.
keepProbase.level Component of "insilico" object.
datacheck      Component of "insilico" object.
Nsim           Component of "insilico" object.
thin           Component of "insilico" object.
burnin         Component of "insilico" object.
jump.scale     Component of "insilico" object.
levels.prior   Component of "insilico" object.
levels.strength Component of "insilico" object.
trunc.min      Component of "insilico" object.
trunc.max      Component of "insilico" object.
subpop_counts  Component of "insilico" object.
showTop        Component of "insilico" object.

Author(s)

Zehang Li, Tyler McCormick, Sam Clark
Maintainer: Zehang Li <lizehang@uw.edu>

References

updateIndiv

See Also

insilico, plot.insilico

Examples

## Not run:
# load sample data together with sub-population list
data(RandomVA1)
# extract InterVA style input data
data <- RandomVA1$data
# extract sub-population information.
# The groups are "HIV Positive", "HIV Negative" and "HIV status unknown".
subpop <- RandomVA1$subpop

# run without subpopulation
fit1 <- insilico(data, subpop = NULL,
Nsim = 400, burnin = 200, thin = 10, seed = 1,
external.sep = TRUE, keepProbbase.level = TRUE)
summary(fit1)
summary(fit1, top = 10)

# save individual COD distributions to files
summary(fit1, file = "results.csv")
## End(Not run)

Update individual COD probabilities from InSilicoVA Model Fits

Description

This function updates individual probabilities for each death and provide posterior credible intervals for each estimates.

Usage

updateIndiv(object, CI = 0.95, java_option = "-Xmx1g", ...)

Arguments

object Fitted "insilico" object.
CI Credible interval for posterior estimates.
java_option Option to initialize java JVM. Default to “-Xmx1g”, which sets the maximum heap size to be 1GB.
... Not used.

Value

object Updated "insilico" object.
Author(s)
Zehang Li, Tyler McCormick, Sam Clark
Maintainer: Zehang Li <lizehang@uw.edu>

References

See Also
insilico, get.indiv

Examples

```
## Not run:
data(RandomVA1)
fit1a<- insilico(RandomVA1, subpop = NULL, Nsim = 1000, burnin = 500, thin = 10, seed = 1, auto.length = FALSE)
summary(fit1a, id = "d199")

# The following script updates credible interval for individual
fit1b <- updateIndiv(fit1a, CI = 0.95)
summary(fit1b, id = "d199")
```

## End(Not run)
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