Package 'LACE'

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Title Longitudinal Analysis of Cancer Evolution (LACE)

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Depends R (>= 3.6.0)

Imports parallel, Rfast

Suggests BiocGenerics, BiocStyle, testthat, knitr

Name LACE: an R package for the inference of longitudinal cancer evolution models

Description LACE is an algorithmic framework that processes single-cell somatic mutation profiles from cancer samples collected at different time points and in distinct experimental settings, to produce longitudinal models of cancer evolution. The approach solves a Boolean Matrix Factorization problem with phylogenetic constraints, by maximizing a weighed likelihood function computed on multiple time points.

Encoding UTF-8

LazyData TRUE

License file LICENSE

URL https://github.com/BIMIB-DISCo/LACE

BugReports https://github.com/BIMIB-DISCo/LACE

biocViews BiomedicalInformatics

RoxygenNote 7.0.2

VignetteBuilder knitr

NeedsCompilation no

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R topics documented:

`data_HN120Metastasis` *mutation data for cell line HN120 Metastasis from Sharma, A. et al. (2018).*

Description

mutation data for cell line HN120 Metastasis from Sharma, A. et al. (2018).

Usage

```
data(data_HN120Metastasis)
```

Format

list of mutation data for 3 time points

Value

list of mutational data for cell line HN120 Metastasis

Source

Sharma, A. et al. Longitudinal single-cell RNA sequencing of patient-derived primary cells reveals drug-induced infidelity in stem cell hierarchy. Nature communications 9, 4931 (2018).

`data_HN120Primary` *mutation data for cell line HN120 Primary from Sharma, A. et al. (2018).*

Description

mutation data for cell line HN120 Primary from Sharma, A. et al. (2018).

Usage

```
data(data_HN120Primary)
```

Format

list of mutation data for 3 time points

Value

list of mutational data for cell line HN120 Primary

Source

Sharma, A. et al. Longitudinal single-cell RNA sequencing of patient-derived primary cells reveals drug-induced infidelity in stem cell hierarchy. Nature communications 9, 4931 (2018).

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inference_HN120Metastasis

results obtained with the function LACE on input data data_HN120Metastasis from Sharma, A. et al. (2018).

Description

results obtained with the function LACE on input data data_HN120Metastasis from Sharma, A. et al. (2018).

Usage

```
data(inference_HN120Metastasis)
```

Format

results obtained with the function LACE on input data data_HN120Metastasis

Value

results obtained with the function LACE on input data data_HN120Metastasis

---

inference_HN120Primary

results obtained with the function LACE on input data data_HN120Primary from Sharma, A. et al. (2018).

Description

results obtained with the function LACE on input data data_HN120Primary from Sharma, A. et al. (2018).

Usage

```
data(inference_HN120Primary)
```

Format

results obtained with the function LACE on input data data_HN120Primary

Value

results obtained with the function LACE on input data data_HN120Primary

LACE *LACE*

Description

Perform inference of the maximum likelihood clonal tree from longitudinal data.

Usage

```
LACE(
  D,
  lik_w = NULL,
  alpha = NULL,
  beta = NULL,
  initialization = NULL,
  num_rs = 50,
  num_iter = 10000,
  n_try_bs = 500,
  learning_rate = 1,
  marginalize = FALSE,
  num_processes = Inf,
  seed = NULL,
  verbose = TRUE,
  log_file = ""
)
```

Arguments

D	Mutation data from multiple experiments for a list of driver genes.
lik_w	Weight for each data point. If not provided, weights to correct for sample sizes are used.
alpha	False positive error rate provided as list of elements; if a vector of alpha (and beta) is provided, the inference is performed for multiple values and the solution at maximum-likelihood is returned.
beta	False negative error rate provided as list of elements; if a vector of beta (and alpha) is provided, the inference is performed for multiple values and the solution at maximum-likelihood is returned.
initialization	Starting point of the mcmc; if not provided, a random starting point is used.
num_rs	Number of restarts during mcmc inference.
num_iter	Maximum number of mcmc steps to be performed during the inference.
n_try_bs	Number of steps without change in likelihood of best solution after which to stop the mcmc.
learning_rate	Parameter to tune the probability of accepting solutions at lower values during mcmc. Value of learning_rate = 1 (default), set a probability proportional to the difference in likelihood; values of learning_rate greater than 1 inclease the chance of accepting solutions at lower likelihood during mcmc while values lower than 1 decrease such probability.
marginalize	Boolean. Shall I marginalize C when computing likelihood?

num_processes	Number of processes to be used during parallel execution. To execute in single process mode, this parameter needs to be set to either NA or NULL.
seed	Seed for reproducibility.
verbose	Boolean. Shall I print to screen information messages during the execution?
log_file	log file where to print outputs when using parallel. If parallel execution is disabled, this parameter is ignored.

Value

A list of 7 elements: B, C, clones_prevalence, relative_likelihoods, joint_likelihood, clones_summary and error_rates. Here, B returns the maximum likelihood longitudinal clonal tree, C the attachment of cells to clones and clones_prevalence clones' prevalence; relative_likelihoods and joint_likelihood are respectively the likelihood of the solutions at each individual time points and the joint likelihood; clones_summary provide a summary of association of mutations to clones. Finally error_rates provides the best values of alpha and beta among the considered ones.

Examples

```
data(data_HN120Primary)
inference = LACE(D = data_HN120Primary,
                 lik_w = c(0.338,0.329,0.333),
                 alpha = list(c(0.01,0.01,0.02)),
                 beta = list(c(0.01,0.01,0.02)),
                 num_rs = 5,
                 num_iter = 10,
                 n_try_bs = 5,
                 num_processes = NA,
                 seed = 12345,
                 verbose = FALSE)
```

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