

Package ‘ldaPrototype’

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Title Prototype of Multiple Latent Dirichlet Allocation Runs

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Description Determine a Prototype from a number of runs of Latent Dirichlet Allocation (LDA) measuring its similarities with S-CLOP: A procedure to select the LDA run with highest mean pairwise similarity, which is measured by S-CLOP (Similarity of multiple sets by Clustering with Local Pruning), to all other runs. LDA runs are specified by its assignments leading to estimators for distribution parameters. Repeated runs lead to different results, which we encounter by choosing the most representative LDA run as prototype.

URL <https://github.com/JonasRieger/ldaPrototype>,
<https://doi.org/10.5281/zenodo.3597978>

BugReports <https://github.com/JonasRieger/ldaPrototype/issues>

License GPL (>= 3)

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Author Jonas Rieger [aut, cre] (<<https://orcid.org/0000-0002-0007-4478>>)

Maintainer Jonas Rieger <jonas.rieger@tu-dortmund.de>

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R topics documented:

IdaPrototype-package	2
as.LDABatch	4
as.LDARep	5
dendTopics	7
getJob	8
getPrototype	9
getSCLOP	13
getSimilarity	14
getTopics	15
jaccardTopics	16
LDA	18
LDABatch	20
LDAPrototype	22
LDARep	24
mergeBatchTopics	26
mergeRepTopics	27
mergeTopics	28
pruneSCLOP	29
reuters	30
SCLOP	31

Index	33
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IdaPrototype-package *IdaPrototype: Prototype of Multiple Latent Dirichlet Allocation Runs*

Description

Determine a Prototype from a number of runs of Latent Dirichlet Allocation (LDA) measuring its similarities with S-CLOP: A procedure to select the LDA run with highest mean pairwise similarity, which is measured by S-CLOP (Similarity of multiple sets by Clustering with Local Pruning), to all other runs. LDA runs are specified by its assignments leading to estimators for distribution parameters. Repeated runs lead to different results, which we encounter by choosing the most representative LDA run as prototype.

For bug reports and feature requests please use the issue tracker: <https://github.com/JonasRieger/IdaPrototype/issues>.

Data

[reuters](#) Example Dataset (91 articles from Reuters) for testing.

Constructor

[LDA](#) LDA objects used in this package.
[as.LDARep](#) LDARep objects.
[as.LDABatch](#) LDABatch objects.

Getter

[getTopics](#) Getter for LDA objects.
[getJob](#) Getter for LDARep and LDABatch objects.
[getSimilarity](#) Getter for TopicSimilarity objects.
[getSCLOP](#) Getter for PrototypeLDA objects.
[getPrototype](#) Determine the Prototype LDA.

Performing multiple LDAs

[LDARep](#) Performing multiple LDAs locally (using parallelization).
[LDABatch](#) Performing multiple LDAs on Batch Systems.

Calculation Steps (Workflow) to determine the Prototype LDA

[mergeTopics](#) Merge topic matrices from multiple LDAs.
[jaccardTopics](#) Calculate topic similarities.
[dendTopics](#) Create a dendrogram from topic similarities.
[SCLOP](#) Determine various S-CLOP values.
[pruneSCLOP](#) Prune TopicDendrogram objects.

Shortcuts

[getPrototype](#) Shortcut which includes all calculation steps.
[LDAPrototype](#) Shortcut which performs multiple LDAs and determines their Prototype.

Author(s)

Maintainer: Jonas Rieger <jonas.rieger@tu-dortmund.de> ([ORCID](#))

References

Rieger, Jonas (2020). ldaPrototype: A method in R to get a Prototype of multiple Latent Dirichlet Allocations. *Journal of Open Source Software*, **5**(51), 2181, DOI 10.21105/joss.02181, URL <https://doi.org/10.21105/joss.02181>.

Rieger, Jonas, Jörg Rahnenführer and Carsten Jentsch (2020). "Improving Latent Dirichlet Allocation: On Reliability of the Novel Method LDAPrototype." In: *Natural Language Processing and Information Systems, NLDB 2020*. LNCS 12089, pp. 118–125, DOI 10.1007/978-3-030-51310-8_11, URL https://doi.org/10.1007/978-3-030-51310-8_11.

Rieger, Jonas, Lars Koppers, Carsten Jentsch and Jörg Rahnenführer (2020). "Improving Reliability of Latent Dirichlet Allocation by Assessing Its Stability using Clustering Techniques on Replicated Runs." arXiv 2003.04980, URL <https://arxiv.org/abs/2003.04980>.

See Also

Useful links:

- <https://github.com/JonasRieger/ldaPrototype>
- <https://doi.org/10.5281/zenodo.3597978>
- Report bugs at <https://github.com/JonasRieger/ldaPrototype/issues>

as.LDABatch

*LDABatch Constructor***Description**

Constructs a [LDABatch](#) object for given elements reg, job and id.

Usage

```
as.LDABatch(reg, job, id)
```

```
is.LDABatch(obj, verbose = FALSE)
```

Arguments

reg	[Registry] Registry. See findDone .
job	[data.frame or integer] A data.frame or data.table with a column named "job.id" or a vector of integerish job ids. See reduceResultsList .
id	[character(1)] A name for the registry. If not passed, the folder's name is extracted from reg.
obj	[R object] Object to test.
verbose	[logical(1)] Should test information be given in the console?

Details

Given a [Registry](#) the function returns a [LDABatch](#) object, which can be handled using the getter functions at [getJob](#).

Value

named list with entries id for the registry's folder name, jobs for the submitted jobs' ids and its parameter settings and reg for the registry itself.

See Also

Other constructor functions: [LDA\(\)](#), [as.LDAREp\(\)](#)

Other batch functions: [LDABatch\(\)](#), [getJob\(\)](#), [mergeBatchTopics\(\)](#)

Examples

```
## Not run:
batch = LDABatch(docs = reuters_docs, vocab = reuters_vocab, K = 15, chunk.size = 20)
batch

batch2 = as.LDABatch(reg = getRegistry(batch))
batch2
head(getJob(batch2))

batch3 = as.LDABatch()
batch3

### one way of loading an existing registry ###
batchtools::loadRegistry("LDABatch")
batch = as.LDABatch()

## End(Not run)
```

as.LDARep

*LDABatch Constructor***Description**

Constructs a [LDABatch](#) object for given elements lda, job and id.

Usage

```
as.LDARep(...)

## Default S3 method:
as.LDARep(lda, job, id, ...)

## S3 method for class 'LDABatch'
as.LDARep(x, ...)

is.LDARep(obj, verbose = FALSE)
```

Arguments

...	additional arguments
lda	[named list] List of LDA objects, named by the corresponding "job.id" (integerish). If list is unnamed, names are set.
job	[data.frame or named vector] A data.frame or data.table with named columns (at least) "job.id" (integerish), "K", "alpha", "eta" and "num.iterations" or a named vector with entries (at least) "K", "alpha", "eta" and "num.iterations". If not passed, it is interpreted from param of each LDA.

id	[character(1)] A name for the computation. If not passed, it is set to "LDARep".
x	[named list] LDABatch or LDARep object.
obj	[R object] Object to test.
verbose	[logical(1)] Should test information be given in the console?

Details

Given a list of [LDA](#) objects the function returns a [LDARep](#) object, which can be handled using the getter functions at [getJob](#).

Value

named list with entries `id` for computation's name, `jobs` for the parameter settings and `lda` for the results themselves.

See Also

Other constructor functions: [LDA\(\)](#), [as.LDABatch\(\)](#)

Other replication functions: [LDAPrototype\(\)](#), [LDARep\(\)](#), [getJob\(\)](#), [mergeRepTopics\(\)](#)

Examples

```
res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 7, num.iterations = 20)
lda = getLDA(res)
```

```
res2 = as.LDARep(lda, id = "newName")
res2
getJob(res2)
getJob(res)
```

```
## Not run:
batch = LDABatch(docs = reuters_docs, vocab = reuters_vocab, n = 4, id = "TEMP", K = 30)
res3 = as.LDARep(batch)
res3
getJob(res3)
```

```
## End(Not run)
```

dendTopics	<i>Topic Dendrogram</i>
------------	-------------------------

Description

Builds a dendrogram for topics based on their pairwise similarities using the cluster algorithm [hclust](#).

Usage

```
dendTopics(sims, ind, method = "complete")
```

```
## S3 method for class 'TopicDendrogram'
plot(x, pruning, pruning.par, ...)
```

Arguments

sims	TopicSimilarity object or lower triangular named matrix] TopicSimilarity object or pairwise jaccard similarities of underlying topics as the sims element from TopicSimilarity objects. The topic names should be formatted as <i><Run X>.<Topic Y></i> , so that the name before the first dot identifies the LDA run.
ind	[integer or character] An integerish vector for specifying the topics taken into account. Alternatively a character vector can be passed. Then, all topics are taken for which the name contain at least one of the phrases in ind (see grepl). By default all topics are considered.
method	[character(1)] The agglomeration method. See hclust .
x	an R object.
pruning	[list of dendrograms] PruningSCLOP object specifying the best possible local pruning state.
pruning.par	[list] List of parameters to mark the pruning. See section "Details" at dendTopics for default parameters. Types for marking the pruning state are "abline", "color" and "both".
...	additional arguments.

Details

The label's colors are determined based on their Run belonging using [rainbow_hcl](#) by default. Colors can be manipulated using [labels_colors](#). Analogously, the labels themselves can be manipulated using [labels](#). For both the function [order.dendrogram](#) is useful.

The resulting [dendrogram](#) can be plotted. In addition, it is possible to mark a pruning state in the plot, either by color or by separator lines (or both) setting `pruning.par`. For the default values of `pruning.par` call the corresponding function on any [PruningSCLOP](#) object.

Value

`dendrogram` `TopicDendrogram` object (and `dendrogram` object) of all considered topics.

See Also

Other plot functions: `pruneSCLOP()`

Other `TopicSimilarity` functions: `getSimilarity()`, `jaccardTopics()`

Other workflow functions: `LDARep()`, `SCLOP()`, `getPrototype()`, `jaccardTopics()`, `mergeTopics()`

Examples

```
res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 10, num.iterations = 30)
topics = mergeTopics(res, vocab = reuters_vocab)
jacc = jaccardTopics(topics, atLeast = 2)
sim = getSimilarity(jacc)
```

```
dend = dendTopics(jacc)
dend2 = dendTopics(sim)
```

```
plot(dend)
plot(dendTopics(jacc, ind = c("Rep2", "Rep3")))
```

```
pruned = pruneSCLOP(dend)
```

```
plot(dend, pruning = pruned)
plot(dend, pruning = pruned, pruning.par = list(type = "color"))
plot(dend, pruning = pruned, pruning.par = list(type = "both", lty = 1, lwd = 2, col = "red"))
```

```
dend2 = dendTopics(jacc, ind = c("Rep2", "Rep3"))
plot(dend2, pruning = pruneSCLOP(dend2), pruning.par = list(lwd = 2, col = "darkgrey"))
```

getJob

Getter and Setter for LDARep and LDABatch

Description

Returns the job ids and its parameter set (`getJob`) or the (registry's) id (`getID`) for a `LDABatch` or `LDARep` object. `getRegistry` returns the registry itself for a `LDABatch` object. `getLDA` returns the list of `LDA` objects for a `LDABatch` or `LDARep` object. In addition, you can specify one or more LDAs by their id(s).

`setFilDir` sets the registry's file directory for a `LDABatch` object. This is useful if you move the registry's folder, e.g. if you do your calculations on a batch system, but want to do your evaluation on your desktop computer.

Usage

```

getJob(x)

getID(x)

getRegistry(x)

getLDA(x, job, reduce, all)

setFileDir(x, file.dir)

```

Arguments

x	[named list] LDABatch or LDARep object.
job	[data.frame or integer] A data.frame or data.table with a column named "job.id" or a vector of integerish job ids.
reduce	[logical(1)] If the list of LDAs contains only one element, should the list be reduced and the single (unnamed) element be returned? Default is TRUE.
all	not implemented for LDABatch and LDARep object. See getLDA
file.dir	[Vector to be coerced to a fs_path object.] New file directory to overwrite the registry's old one. This can be useful if the registry is transferred from a batch system.

See Also

Other getter functions: [getSCLOP\(\)](#), [getSimilarity\(\)](#), [getTopics\(\)](#)

Other replication functions: [LDAPrototype\(\)](#), [LDARep\(\)](#), [as.LDARep\(\)](#), [mergeRepTopics\(\)](#)

Other batch functions: [LDABatch\(\)](#), [as.LDABatch\(\)](#), [mergeBatchTopics\(\)](#)

getPrototype

Determine the Prototype LDA

Description

Returns the Prototype LDA of a set of LDAs. This set is given as [LDABatch](#) object, [LDARep](#) object, or as list of LDAs. If the matrix of S-CLOP scores `sclop` is passed, no calculation is needed/done.

Usage

```
getPrototype(...)  
  
## S3 method for class 'LDABatch'  
getPrototype(  
  x,  
  vocab,  
  limit.rel,  
  limit.abs,  
  atLeast,  
  progress = TRUE,  
  pm.backend,  
  ncpus,  
  keepTopics = FALSE,  
  keepSims = FALSE,  
  keepLDAs = FALSE,  
  sclop,  
  ...  
)  
  
## S3 method for class 'LDAREp'  
getPrototype(  
  x,  
  vocab,  
  limit.rel,  
  limit.abs,  
  atLeast,  
  progress = TRUE,  
  pm.backend,  
  ncpus,  
  keepTopics = FALSE,  
  keepSims = FALSE,  
  keepLDAs = FALSE,  
  sclop,  
  ...  
)  
  
## Default S3 method:  
getPrototype(  
  lda,  
  vocab,  
  id,  
  limit.rel,  
  limit.abs,  
  atLeast,  
  progress = TRUE,  
  pm.backend,  
  ncpus,
```

```

    keepTopics = FALSE,
    keepSims = FALSE,
    keepLDAs = FALSE,
    sclop,
    ...
)

```

Arguments

...	additional arguments
x	[named list] LDABatch or LDAREp object.
vocab	[character] Vocabularies taken into consideration for merging topic matrices. Not considered, if <code>sclop</code> is passed. Default is the vocabulary of the first LDA.
limit.rel	[0,1] See jaccardTopics . Default is 1/500. Not considered for calculation, if <code>sclop</code> is passed. But should be passed determining the correct value for the resulting object.
limit.abs	[integer(1)] See jaccardTopics . Default is 10. Not considered for calculation, if <code>sclop</code> is passed. But should be passed determining the correct value for the resulting object.
atLeast	[integer(1)] See jaccardTopics . Default is 0. Not considered for calculation, if <code>sclop</code> is passed. But should be passed determining the correct value for the resulting object.
progress	[logical(1)] Should a nice progress bar be shown for the steps of mergeTopics and jaccardTopics ? Turning it off, could lead to significantly faster calculation. Default ist TRUE. Not considered, if <code>sclop</code> is passed.
pm.backend	[character(1)] One of "multicore", "socket" or "mpi". If <code>pm.backend</code> is set, parallelStart is called before computation is started and parallelStop is called after. Not considered, if <code>sclop</code> is passed.
ncpus	[integer(1)] Number of (physical) CPUs to use. If <code>pm.backend</code> is passed, default is determined by availableCores . Not considered, if <code>sclop</code> is passed.
keepTopics	[logical(1)] Should the merged topic matrix from mergeTopics be kept? Not considered, if <code>sclop</code> is passed.
keepSims	[logical(1)] Should the calculated topic similarities matrix from jaccardTopics be kept? Not considered, if <code>sclop</code> is passed.
keepLDAs	[logical(1)] Should the considered LDAs be kept?

sclop	[symmetrical named matrix] (optional) All pairwise S-CLOP scores of the given LDA runs determined by SCLOP.pairwise . Matching of names is not implemented yet, so order matters.
lda	[named list] List of LDA objects, named by the corresponding "job.id".
id	[character(1)] A name for the computation. If not passed, it is set to "LDARep". Not considered for LDABatch or LDARep objects.

Details

While [LDAPrototype](#) marks the overall shortcut for performing multiple LDA runs and choosing the Prototype of them, [getPrototype](#) just hooks up at determining the Prototype. The generation of multiple LDAs has to be done before use of this function. The function is flexible enough to use it at at least two steps/parts of the analysis: After generating the LDAs (no matter whether as [LDABatch](#) or [LDARep](#) object) or after determining the pairwise SCLOP values.

To save memory a lot of interim calculations are discarded by default.

If you use parallel computation, no progress bar is shown.

For details see the details sections of the workflow functions.

Value

named list with entries

lda List of [LDA](#) objects of the determined Prototype LDA and - if `keepLDAs` is TRUE - all considered LDAs.

protoid [character(1)] Name (ID) of the determined Prototype LDA.

id [character(1)] See above.

param [named list] with parameter specifications for `limit.rel` [0,1], `limit.abs` [integer(1)] and `atLeast` [integer(1)] See above for explanation.

topics [named matrix] with the count of vocabularies (row wise) in topics (column wise).

sims [lower triangular named matrix] with all pairwise jaccard similarities of the given topics.

wordslimit [integer] with counts of words determined as relevant based on `limit.rel` and `limit.abs`.

wordsconsidered [integer] with counts of considered words for similarity calculation. Could differ from `wordslimit`, if `atLeast` is greater than zero.

sclop [symmetrical named matrix] with all pairwise S-CLOP scores of the given LDA runs.

See Also

Other shortcut functions: [LDAPrototype\(\)](#)

Other PrototypeLDA functions: [LDAPrototype\(\)](#), [getSCLOP\(\)](#)

Other workflow functions: [LDARep\(\)](#), [SCLOP\(\)](#), [dendTopics\(\)](#), [jaccardTopics\(\)](#), [mergeTopics\(\)](#)

Examples

```

res = LDARep(docs = reuters_docs, vocab = reuters_vocab,
             n = 4, K = 10, num.iterations = 30)
topics = mergeTopics(res, vocab = reuters_vocab)
jacc = jaccardTopics(topics, atLeast = 2)
dend = dendTopics(jacc)
sclop = SCLOP.pairwise(jacc)

getPrototype(lda = getLDA(res), sclop = sclop)

proto = getPrototype(res, vocab = reuters_vocab, keepSims = TRUE,
                    limit.abs = 20, atLeast = 10)
proto
getPrototype(proto) # = getLDA(proto)
getConsideredWords(proto)
# > 10 if there is more than one word which is the 10-th often word (ties)
getRelevantWords(proto)
getSCLOP(proto)

```

getSCLOP

Getter for PrototypeLDA

Description

Returns the corresponding element of a [PrototypeLDA](#) object.

Usage

```

getSCLOP(x)

## S3 method for class 'PrototypeLDA'
getSimilarity(x)

## S3 method for class 'PrototypeLDA'
getRelevantWords(x)

## S3 method for class 'PrototypeLDA'
getConsideredWords(x)

getMergedTopics(x)

getPrototypeID(x)

## S3 method for class 'PrototypeLDA'
getLDA(x, job, reduce = TRUE, all = FALSE)

## S3 method for class 'PrototypeLDA'
getID(x)

```

```
## S3 method for class 'PrototypeLDA'
getParam(x)
```

Arguments

x	[named list] PrototypeLDA object.
job	[data.frame or integer] A data.frame or data.table with a column named "job.id" or a vector of integerish job ids. Default is the (integerish) ID of the Prototype LDA.
reduce	[logical(1)] If the list of LDAs contains only one element, should the list be reduced and the single (unnamed) element be returned? Default is TRUE. Not considered, if all is TRUE.
all	[logical(1)] Shortcut for job: Should all stored LDAs be returned?

See Also

Other getter functions: [getJob\(\)](#), [getSimilarity\(\)](#), [getTopics\(\)](#)

Other PrototypeLDA functions: [LDAPrototype\(\)](#), [getPrototype\(\)](#)

getSimilarity	<i>Getter for TopicSimilarity</i>
---------------	-----------------------------------

Description

Returns the corresponding element of a [TopicSimilarity](#) object.

Usage

```
getSimilarity(x)
getRelevantWords(x)
getConsideredWords(x)

## S3 method for class 'TopicSimilarity'
getParam(x)
```

Arguments

x	[named list] TopicSimilarity object.
---	---

See Also

Other getter functions: [getJob\(\)](#), [getSCLOP\(\)](#), [getTopics\(\)](#)

Other TopicSimilarity functions: [dendTopics\(\)](#), [jaccardTopics\(\)](#)

 getTopics

Getter for LDA

Description

Returns the corresponding element of a [LDA](#) object. `getEstimators` computes the estimators for phi and theta.

Usage

```
getTopics(x)
```

```
getAssignments(x)
```

```
getDocument_sums(x)
```

```
getDocument_expects(x)
```

```
getLog.likelihoods(x)
```

```
getParam(x)
```

```
getK(x)
```

```
getAlpha(x)
```

```
getEta(x)
```

```
getNum.iterations(x)
```

```
getEstimators(x)
```

Arguments

x [named list]
 [LDA](#) object.

Details

The estimators for phi and theta in

$$w_n^{(m)} \mid T_n^{(m)}, \phi_k \sim \text{Discrete}(\phi_k),$$

$$\begin{aligned}\phi_k &\sim \text{Dirichlet}(\eta), \\ T_n^{(m)} \mid \theta_m &\sim \text{Discrete}(\theta_m), \\ \theta_m &\sim \text{Dirichlet}(\alpha)\end{aligned}$$

are calculated referring to Griffiths and Steyvers (2004) by

$$\begin{aligned}\hat{\phi}_{k,v} &= \frac{n_k^{(v)} + \eta}{n_k + V\eta}, \\ \hat{\theta}_{m,k} &= \frac{n_k^{(m)} + \alpha}{N^{(m)} + K\alpha}\end{aligned}$$

with V is the vocabulary size, K is the number of modeled topics; $n_k^{(v)}$ is the count of assignments of the v -th word to the k -th topic. Analogously, $n_k^{(m)}$ is the count of assignments of the m -th text to the k -th topic. $N^{(m)}$ is the total number of assigned tokens in text m and n_k the total number of assigned tokens to topic k .

References

Griffiths, Thomas L. and Mark Steyvers (2004). "Finding scientific topics". In: *Proceedings of the National Academy of Sciences* **101** (suppl 1), pp.5228–5235, DOI 10.1073/pnas.0307752101, URL <https://doi.org/10.1073/pnas.0307752101>.

See Also

Other getter functions: [getJob\(\)](#), [getSCLOP\(\)](#), [getSimilarity\(\)](#)

Other LDA functions: [LDABatch\(\)](#), [LDAREP\(\)](#), [LDA\(\)](#)

jaccardTopics

Pairwise Jaccard Coefficients

Description

Calculates the similarity of all pairwise topic combinations using a modified Jaccard Coefficient.

Usage

```
jaccardTopics(
  topics,
  limit.rel,
  limit.abs,
  atLeast,
  progress = TRUE,
  pm.backend,
  ncpus
)
```


Arguments

topics	[named matrix] The counts of vocabularies/words (row wise) in topics (column wise).
limit.rel	[0,1] A relative lower bound limit for which words are taken into account. Those words are taken as relevant for a topic that have a count higher than <code>limit.rel</code> multiplied by the total count of the given topic. Default is 1/500.
limit.abs	[integer(1)] An absolute lower bound limit for which words are taken into account. All words are taken as relevant for a topic that have a count higher than <code>limit.abs</code> . Default is 10.
atLeast	[integer(1)] An absolute count of how many words are at least considered as relevant for a topic. Default is 0.
progress	[logical(1)] Should a nice progress bar be shown? Turning it off, could lead to significantly faster calculation. Default is TRUE. If <code>pm.backend</code> is set, parallelization is done and no progress bar will be shown.
pm.backend	[character(1)] One of "multicore", "socket" or "mpi". If <code>pm.backend</code> is set, <code>parallelStart</code> is called before computation is started and <code>parallelStop</code> is called after.
ncpus	[integer(1)] Number of (physical) CPUs to use. If <code>pm.backend</code> is passed, default is determined by <code>availableCores</code> .

Details

The modified Jaccard Coefficient J_m is calculated by

$$J_m(\mathbf{z}_i, \mathbf{z}_j | \mathbf{c}) = \frac{\sum_{v=1}^V \mathbb{1}_{\{n_i^{(v)} > c_i \wedge n_j^{(v)} > c_j\}} \left(n_i^{(v)}, n_j^{(v)} \right)}{\sum_{v=1}^V \mathbb{1}_{\{n_i^{(v)} > c_i \vee n_j^{(v)} > c_j\}} \left(n_i^{(v)}, n_j^{(v)} \right)}$$

with V is the vocabulary size, and $n_k^{(v)}$ is the count of assignments of the v -th word to the k -th topic. The threshold vector \mathbf{c} is determined by the maximum threshold of the user given lower bounds `limit.rel` and `limit.abs`. In addition, at least `atLeast` words per topic are considered for calculation. According to this, if there are less than `atLeast` words considered as relevant after applying `limit.rel` and `limit.abs` the `atLeast` most common words per topic are taken to determine topic similarities.

The procedure of determining relevant words is executed for each topic individually. The values `wordslimit` and `wordsconsidered` describes the number of relevant words per topic.

Value

named list with entries

sims [lower triangular named matrix] with all pairwise jaccard similarities of the given topics.

wordslimit [integer] with counts of words determined as relevant based on `limit.rel` and `limit.abs`.

wordsc considered [integer] with counts of considered words for similarity calculation. Could differ from `wordslimit`, if `atLeast` is greater than zero.

param [named list] with parameter specifications for `limit.rel` [0,1], `limit.abs` [integer(1)] and `atLeast` [integer(1)] See above for explanation.

See Also

Other TopicSimilarity functions: [dendTopics\(\)](#), [getSimilarity\(\)](#)

Other workflow functions: [LDARep\(\)](#), [SCLOP\(\)](#), [dendTopics\(\)](#), [getPrototype\(\)](#), [mergeTopics\(\)](#)

Examples

```
res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 10, num.iterations = 30)
topics = mergeTopics(res, vocab = reuters_vocab)
jacc = jaccardTopics(topics, atLeast = 2)
jacc

n1 = getConsideredWords(jacc)
n2 = getRelevantWords(jacc)
(n1 - n2)[n1 - n2 != 0]

sim = getSimilarity(jacc)
dim(sim)
```

LDA

LDA Object

Description

Constructor for LDA objects used in this package.

Usage

```
LDA(
  x,
  param,
  assignments,
  topics,
  document_sums,
  document_expects,
  log.likelihoods
)
```

```

as.LDA(
  x,
  param,
  assignments,
  topics,
  document_sums,
  document_expects,
  log.likelihoods
)

is.LDA(obj, verbose = FALSE)

```

Arguments

x	[named list] Output from <code>lda.collapsed.gibbs.sampler</code> . Alternatively each element can be passed for individual results. Individually set elements overwrite elements from x.
param	[named list] Parameters of the function call <code>lda.collapsed.gibbs.sampler</code> . List always should contain names "K", "alpha", "eta" and "num.iterations".
assignments	Individual element for LDA object.
topics	Individual element for LDA object.
document_sums	Individual element for LDA object.
document_expects	Individual element for LDA object.
log.likelihoods	Individual element for LDA object.
obj	[R object] Object to test.
verbose	[logical(1)] Should test information be given in the console?

Details

The functions `LDA` and `as.LDA` do exactly the same. If you call `LDA` on an object `x` which already is of the structure of an LDA object (in particular a LDA object itself), the additional arguments `param`, `assignments`, ... may be used to override the specific elements.

Value

named list LDA object.

See Also

Other constructor functions: `as.LDABatch()`, `as.LDARep()`
 Other LDA functions: `LDABatch()`, `LDARep()`, `getTopics()`

Examples

```

res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 1, K = 10)
lda = getLDA(res)

LDA(lda)
# does not change anything

LDA(lda, assignments = NULL)
# creates a new LDA object without the assignments element

LDA(param = getParam(lda), topics = getTopics(lda))
# creates a new LDA object with elements param and topics

```

LDABatch

LDA Replications on a Batch System

Description

Performs multiple runs of Latent Dirichlet Allocation on a batch system using the [batchtools-package](#).

Usage

```

LDABatch(
  docs,
  vocab,
  n = 100,
  seeds,
  id = "LDABatch",
  load = FALSE,
  chunk.size = 1,
  resources,
  ...
)

```

Arguments

docs	[list] Documents as received from LDAprep .
vocab	[character] Vocabularies passed to lda.collapsed.gibbs.sampler .
n	[integer(1)] Number of Replications.
seeds	[integer(n)] Random Seeds for each Replication.
id	[character(1)] Name for the registry's folder.

load	[logical(1)] If a folder with name <code>id</code> exists: should the existing registry be loaded?
chunk.size	[integer(1)] Requested chunk size for each single chunk. See chunk .
resources	[named list] Computational resources for the jobs to submit. See submitJobs .
...	additional arguments passed to lda.collapsed.gibbs.sampler . Arguments will be coerced to a vector of length <code>n</code> . Default parameters are <code>alpha = eta = 1/K</code> and <code>num.iterations = 200</code> . There is no default for <code>K</code> .

Details

The function generates multiple LDA runs with the possibility of using a batch system. The integration is done by the [batchtools-package](#). After all jobs of the corresponding registry are terminated, the whole registry can be ported to your local computer for further analysis.

The function returns a `LDABatch` object. You can receive results and all other elements of this object with getter functions (see [getJob](#)).

Value

named list with entries `id` for the registry's folder name, `jobs` for the submitted jobs' ids and its parameter settings and `reg` for the registry itself.

See Also

Other batch functions: [as.LDABatch\(\)](#), [getJob\(\)](#), [mergeBatchTopics\(\)](#)

Other LDA functions: [LDAREp\(\)](#), [LDA\(\)](#), [getTopics\(\)](#)

Examples

```
## Not run:
batch = LDABatch(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 15)
batch
getRegistry(batch)
getJob(batch)
getLDA(batch, 2)

batch2 = LDABatch(docs = reuters_docs, vocab = reuters_vocab, K = 15, chunk.size = 20)
batch2
head(getJob(batch2))

## End(Not run)
```

LDAPrototype

*Determine the Prototype LDA***Description**

Performs multiple runs of LDA and returns the Prototype LDA of this set of LDAs.

Usage

```
LDAPrototype(
  docs,
  vocabLDA,
  vocabMerge = vocabLDA,
  n = 100,
  seeds,
  id = "LDARep",
  pm.backend,
  ncpus,
  limit.rel,
  limit.abs,
  atLeast,
  progress = TRUE,
  keepTopics = FALSE,
  keepSims = FALSE,
  keepLDAs = FALSE,
  ...
)
```

Arguments

docs	[list] Documents as received from LDAprep .
vocabLDA	[character] Vocabularies passed to lda.collapsed.gibbs.sampler .
vocabMerge	[character] Vocabularies taken into consideration for merging topic matrices.
n	[integer(1)] Number of Replications.
seeds	[integer(n)] Random Seeds for each Replication.
id	[character(1)] Name for the computation.
pm.backend	[character(1)] One of "multicore", "socket" or "mpi". If pm.backend is set, parallelStart is called before computation is started and parallelStop is called after.

<code>ncpus</code>	[integer(1)] Number of (physical) CPUs to use. If <code>pm.backend</code> is passed, default is determined by <code>availableCores</code> .
<code>limit.rel</code>	[0,1] See <code>jaccardTopics</code> . Default is 1/500.
<code>limit.abs</code>	[integer(1)] See <code>jaccardTopics</code> . Default is 10.
<code>atLeast</code>	[integer(1)] See <code>jaccardTopics</code> . Default is 0.
<code>progress</code>	[logical(1)] Should a nice progress bar be shown for the steps of <code>mergeTopics</code> and <code>jaccardTopics</code> ? Turning it off, could lead to significantly faster calculation. Default is TRUE.
<code>keepTopics</code>	[logical(1)] Should the merged topic matrix from <code>mergeTopics</code> be kept?
<code>keepSims</code>	[logical(1)] Should the calculated topic similarities matrix from <code>jaccardTopics</code> be kept?
<code>keepLDAs</code>	[logical(1)] Should the considered LDAs be kept?
<code>...</code>	additional arguments passed to <code>lda.collapsed.gibbs.sampler</code> . Arguments will be coerced to a vector of length <code>n</code> . Default parameters are <code>alpha = eta = 1/K</code> and <code>num.iterations = 200</code> . There is no default for <code>K</code> .

Details

While `LDAPrototype` marks the overall shortcut for performing multiple LDA runs and choosing the Prototype of them, `getPrototype` just hooks up at determining the Prototype. The generation of multiple LDAs has to be done before use of `getPrototype`.

To save memory a lot of interim calculations are discarded by default.

If you use parallel computation, no progress bar is shown.

For details see the details sections of the workflow functions at `getPrototype`.

Value

named list with entries

`lda` List of `LDA` objects of the determined Prototype LDA and - if `keepLDAs` is TRUE - all considered LDAs.

`protoid` [character(1)] Name (ID) of the determined Prototype LDA.

`id` [character(1)] See above.

`param` [named list] with parameter specifications for `limit.rel` [0,1], `limit.abs` [integer(1)] and `atLeast` [integer(1)] See above for explanation.

`topics` [named matrix] with the count of vocabularies (row wise) in topics (column wise).

`sims` [lower triangular named matrix] with all pairwise jaccard similarities of the given topics.

wordslimit [integer] with counts of words determined as relevant based on `limit.rel` and `limit.abs`.

wordscorered [integer] with counts of considered words for similarity calculation. Could differ from `wordslimit`, if `atLeast` is greater than zero.

sclop [symmetrical named matrix] with all pairwise S-CLOP scores of the given LDA runs.

See Also

Other shortcut functions: [getPrototype\(\)](#)

Other PrototypeLDA functions: [getPrototype\(\)](#), [getSCLOP\(\)](#)

Other replication functions: [LDARep\(\)](#), [as.LDARep\(\)](#), [getJob\(\)](#), [mergeRepTopics\(\)](#)

Examples

```
res = LDAPrototype(docs = reuters_docs, vocabLDA = reuters_vocab,
  n = 4, K = 10, num.iterations = 30)
res
getPrototype(res) # = getLDA(res)
getSCLOP(res)
```

```
res = LDAPrototype(docs = reuters_docs, vocabLDA = reuters_vocab,
  n = 4, K = 10, num.iterations = 30, keepLDAs = TRUE)
res
getLDA(res, all = TRUE)
getPrototypeID(res)
getParam(res)
```

LDARep

LDA Replications

Description

Performs multiple runs of Latent Dirichlet Allocation.

Usage

```
LDARep(docs, vocab, n = 100, seeds, id = "LDARep", pm.backend, ncpus, ...)
```

Arguments

docs	[list] Documents as received from LDAPrep .
vocab	[character] Vocabularies passed to lda.collapsed.gibbs.sampler .
n	[integer(1)] Number of Replications.

seeds	[integer(n)] Random Seeds for each Replication.
id	[character(1)] Name for the computation.
pm.backend	[character(1)] One of "multicore", "socket" or "mpi". If pm.backend is set, parallelStart is called before computation is started and parallelStop is called after.
ncpus	[integer(1)] Number of (physical) CPUs to use. If pm.backend is passed, default is determined by availableCores .
...	additional arguments passed to lda.collapsed.gibbs.sampler . Arguments will be coerced to a vector of length n. Default parameters are alpha = eta = 1/K and num.iterations = 200. There is no default for K.

Details

The function generates multiple LDA runs with the possibility of using parallelization. The integration is done by the [parallelMap-package](#).

The function returns a LDARep object. You can receive results and all other elements of this object with getter functions (see [getJob](#)).

Value

named list with entries id for computation's name, jobs for the parameter settings and lda for the results itself.

See Also

Other replication functions: [LDAPrototype\(\)](#), [as.LDARep\(\)](#), [getJob\(\)](#), [mergeRepTopics\(\)](#)

Other LDA functions: [LDABatch\(\)](#), [LDA\(\)](#), [getTopics\(\)](#)

Other workflow functions: [SCLOP\(\)](#), [dendTopics\(\)](#), [getPrototype\(\)](#), [jaccardTopics\(\)](#), [mergeTopics\(\)](#)

Examples

```
res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 4, seeds = 1:4,
  id = "myComputation", K = 7:10, alpha = 1, eta = 0.01, num.iterations = 20)
res
getJob(res)
getID(res)
getLDA(res, 4)
```

```
LDARep(docs = reuters_docs, vocab = reuters_vocab,
  K = 10, num.iterations = 100, pm.backend = "socket")
```

```
mergeBatchTopics      Merge LDA Topic Matrices
```

Description

Collects LDA results from a given registry and merges their topic matrices for a given set of vocabularies.

Usage

```
mergeBatchTopics(...)

## S3 method for class 'LDABatch'
mergeBatchTopics(x, vocab, progress = TRUE, ...)

## Default S3 method:
mergeBatchTopics(vocab, reg, job, id, progress = TRUE, ...)
```

Arguments

...	additional arguments
x	[named list] LDABatch object. Alternatively job, reg and id can be passed or their defaults are taken.
vocab	[character] Vocabularies taken into consideration for merging topic matrices. Default is the vocabulary of the first LDA.
progress	[logical(1)] Should a nice progress bar be shown? Turning it off, could lead to significantly faster calculation. Default ist TRUE.
reg	[Registry] Registry. See reduceResultsList .
job	[data.frame or integer] A data.frame or data.table with a column named "job.id" or a vector of integerish job ids. See reduceResultsList .
id	[character(1)] A name for the registry. If not passed, the folder's name is extracted from reg.

Details

For details and examples see [mergeTopics](#).

Value

named matrix with the count of vocabularies (row wise) in topics (column wise).

See Also

Other merge functions: [mergeRepTopics\(\)](#), [mergeTopics\(\)](#)

Other batch functions: [LDABatch\(\)](#), [as.LDABatch\(\)](#), [getJob\(\)](#)

 mergeRepTopics

Merge LDA Topic Matrices

Description

Collects LDA results from a list of replicated runs and merges their topic matrices for a given set of vocabularies.

Usage

```
mergeRepTopics(...)

## S3 method for class 'LDARep'
mergeRepTopics(x, vocab, progress = TRUE, ...)

## Default S3 method:
mergeRepTopics(lda, vocab, id, progress = TRUE, ...)
```

Arguments

...	additional arguments
x	[named list] LDARep object. Alternatively lda and id can be passed.
vocab	[character] Vocabularies taken into consideration for merging topic matrices. Default is the vocabulary of the first LDA.
progress	[logical(1)] Should a nice progress bar be shown? Turning it off, could lead to significantly faster calculation. Default ist TRUE.
lda	[named list] List of LDA objects, named by the corresponding "job.id".
id	[character(1)] Name for the computation. Default is "LDARep".

Details

For details and examples see [mergeTopics](#).

Value

named matrix with the count of vocabularies (row wise) in topics (column wise).

See Also

Other merge functions: [mergeBatchTopics\(\)](#), [mergeTopics\(\)](#)

Other replication functions: [LDAPrototype\(\)](#), [LDAREp\(\)](#), [as.LDAREp\(\)](#), [getJob\(\)](#)

 mergeTopics

Merge LDA Topic Matrices

Description

Generic function, which collects LDA results and merges their topic matrices for a given set of vocabularies.

Usage

```
mergeTopics(x, vocab, progress = TRUE)
```

Arguments

x	[named list] LDAREp or LDABatch object.
vocab	[character] Vocabularies taken into consideration for merging topic matrices.
progress	[logical(1)] Should a nice progress bar be shown? Turning it off, could lead to significantly faster calculation. Default ist TRUE.

Details

This function uses the function [mergeRepTopics](#) or [mergeBatchTopics](#). The topic matrices are transposed and cbinded, so that the resulting matrix contains the counts of vocabularies/words (row wise) in topics (column wise).

Value

named matrix with the count of vocabularies (row wise) in topics (column wise).

See Also

Other merge functions: [mergeBatchTopics\(\)](#), [mergeRepTopics\(\)](#)

Other workflow functions: [LDAREp\(\)](#), [SCLOP\(\)](#), [dendTopics\(\)](#), [getPrototype\(\)](#), [jaccardTopics\(\)](#)

Examples

```

res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 10, num.iterations = 30)
topics = mergeTopics(res, vocab = reuters_vocab)
dim(topics)
length(reuters_vocab)

## Not run:
res = LDABatch(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 10, num.iterations = 30)
topics = mergeTopics(res, vocab = reuters_vocab)
dim(topics)
length(reuters_vocab)

## End(Not run)

```

pruneSCLOP

Local Pruning State of Topic Dendrograms

Description

The function `SCLOP` calculates the S-CLOP value for the best possible local pruning state of a dendrogram from `dendTopics`. The function `pruneSCLOP` supplies the corresponding pruning state itself.

Usage

```

pruneSCLOP(dend)

## S3 method for class 'PruningSCLOP'
plot(x, dend, pruning.par, ...)

pruning.par(pruning)

```

Arguments

<code>dend</code>	[dendrogram] TopicDendrogram (and dendrogram) object of all considered topics as the output from <code>dendTopics</code> .
<code>x</code>	an R object.
<code>pruning.par</code>	[list] List of parameters to mark the pruning. See section "Details" at <code>dendTopics</code> for default parameters. Types for marking the pruning state are "abline", "color" and "both".
<code>...</code>	additional arguments.
<code>pruning</code>	[list of dendrograms] PruningSCLOP object specifying the best possible local pruning state.

Details

For details of computing the S-CLOP values see [SCLOP](#).

For details and examples of plotting the pruning state see [dendTopics](#).

Value

list of [dendrograms](#) [PruningSCLOP](#) object specifying the best possible local pruning state.

See Also

Other plot functions: [dendTopics\(\)](#)

Other SCLOP functions: [SCLOP\(\)](#)

reuters

A Snippet of the Reuters Dataset

Description

Example Dataset from Reuters consisting of 91 articles. It can be used to familiarize with the bunch of functions offered by this package.

Usage

```
data(reuters_docs)
```

```
data(reuters_vocab)
```

Format

reuters_docs is a list of documents of length 91 prepared by [LDAPrep](#).

reuters_vocab is

An object of class character of length 2141.

Source

<http://ronaldo.cs.tcd.ie/esslli07/data/reuters21578-xml/>

References

Lewis, David (1997). *Reuters-21578 Text Categorization Collection Distribution 1.0*. <http://kdd.ics.uci.edu/databases/reuters21578/reuters21578.html>

Luz, Saturnino. *XML-encoded version of Reuters-21578*. <http://ronaldo.cs.tcd.ie/esslli07/data/reuters21578-xml/>

SCLOP *Similarity/Stability of multiple sets of Objects using Clustering with Local Pruning*

Description

The function SCLOP calculates the S-CLOP value for the best possible local pruning state of a dendrogram from `dendTopics`. The function `pruneSCLOP` supplies the corresponding pruning state itself.

To get all pairwise S-CLOP scores of two LDA runs, the function `SCLOP.pairwise` can be used. It returns a matrix of the pairwise S-CLOP scores.

All three functions use the function `disparitySum` to calculate the least possible sum of disparities (on the best possible local pruning state) on a given dendrogram.

Usage

`SCLOP(dend)`

`disparitySum(dend)`

`SCLOP.pairwise(sims)`

Arguments

<code>dend</code>	[<code>dendrogram</code>] Output from <code>dendTopics</code> .
<code>sims</code>	[<code>TopicSimilarity</code> object or lower triangular named matrix] <code>TopicSimilarity</code> object or pairwise jaccard similarities of underlying topics as the <code>sims</code> element from <code>TopicSimilarity</code> objects. The topic names should be formatted as <code><Run X>.<Topic Y></code> , so that the name before the first dot identifies the LDA run.

Details

For one specific cluster g and R LDA Runs the disparity is calculated by

$$U(g) := \frac{1}{R} \sum_{r=1}^R |t_r^{(g)} - 1| \cdot \sum_{r=1}^R t_r^{(g)},$$

while $\mathbf{t}^{(g)} = (t_1^{(g)}, \dots, t_R^{(g)})^T$ contains the number of topics that belong to the different LDA runs and that occur in cluster g .

The function `disparitySum` returns the least possible sum of disparities $U_{\Sigma}(G^*)$ for the best possible pruning state G^* with $U_{\Sigma}(G) = \sum_{g \in G} U(g) \rightarrow \min$. The highest possible value for $U_{\Sigma}(G^*)$ is limited by

$$U_{\Sigma, \max} := \sum_{g \in \bar{G}} U(g) = N \cdot \frac{R-1}{R},$$

with \tilde{G} denotes the corresponding worst case pruning state. This worst case scenario is useful for normalizing the SCLOP scores.

The function SCLOP then calculates the value

$$\text{S-CLOP}(G^*) := 1 - \frac{1}{U_{\Sigma, \max}} \cdot \sum_{g \in G^*} U(g) \in [0, 1],$$

where $\sum_{g \in G^*} U(g) = U_{\Sigma}(G^*)$.

Value

SCLOP [0,1] value specifying the S-CLOP for the best possible local pruning state of the given dendrogram.

disparitySum [numeric(1)] value specifying the least possible sum of disparities on the given dendrogram.

SCLOP.pairwise [symmetrical named matrix] with all pairwise S-CLOP scores of the given LDA runs.

See Also

Other SCLOP functions: [pruneSCLOP\(\)](#)

Other workflow functions: [LDARep\(\)](#), [dendTopics\(\)](#), [getPrototype\(\)](#), [jaccardTopics\(\)](#), [mergeTopics\(\)](#)

Examples

```
res = LDARep(docs = reuters_docs, vocab = reuters_vocab, n = 4, K = 10, num.iterations = 30)
topics = mergeTopics(res, vocab = reuters_vocab)
jacc = jaccardTopics(topics, atLeast = 2)
dend = dendTopics(jacc)
```

```
SCLOP(dend)
disparitySum(dend)
```

```
SCLOP.pairwise(jacc)
SCLOP.pairwise(getSimilarity(jacc))
```


Index

- * **LDA functions**
 - getTopics, 15
 - LDA, 18
 - LDABatch, 20
 - LDAREp, 24
 - * **PrototypeLDA functions**
 - getPrototype, 9
 - getSCLOP, 13
 - LDAPrototype, 22
 - * **SCLOP functions**
 - pruneSCLOP, 29
 - SCLOP, 31
 - * **TopicSimilarity functions**
 - dendTopics, 7
 - getSimilarity, 14
 - jaccardTopics, 16
 - * **batch functions**
 - as.LDABatch, 4
 - getJob, 8
 - LDABatch, 20
 - mergeBatchTopics, 26
 - * **constructor functions**
 - as.LDABatch, 4
 - as.LDAREp, 5
 - LDA, 18
 - * **datasets**
 - reuters, 30
 - * **getter functions**
 - getJob, 8
 - getSCLOP, 13
 - getSimilarity, 14
 - getTopics, 15
 - * **merge functions**
 - mergeBatchTopics, 26
 - mergeRepTopics, 27
 - mergeTopics, 28
 - * **plot functions**
 - dendTopics, 7
 - pruneSCLOP, 29
 - * **replication functions**
 - as.LDAREp, 5
 - getJob, 8
 - LDAPrototype, 22
 - LDAREp, 24
 - mergeRepTopics, 27
 - * **shortcut functions**
 - getPrototype, 9
 - LDAPrototype, 22
 - * **workflow functions**
 - dendTopics, 7
 - getPrototype, 9
 - jaccardTopics, 16
 - LDAREp, 24
 - mergeTopics, 28
 - SCLOP, 31
- as.LDA (LDA), 18
- as.LDABatch, 2, 4, 6, 9, 19, 21, 27
- as.LDAREp, 2, 4, 5, 9, 19, 24, 25, 28
- availableCores, 11, 17, 23, 25
- chunk, 21
- data.frame, 4, 5, 9, 14, 26
- dendrogram, 7, 8, 29–31
- dendTopics, 3, 7, 7, 12, 15, 18, 25, 28–32
- disparitySum (SCLOP), 31
- docs (reuters), 30
- findDone, 4
- fs_path, 9
- getAlpha (getTopics), 15
- getAssignments (getTopics), 15
- getConsideredWords (getSimilarity), 14
- getConsideredWords.PrototypeLDA (getSCLOP), 13
- getDocument_expects (getTopics), 15
- getDocument_sums (getTopics), 15
- getEstimators (getTopics), 15

- getEta (getTopics), 15
- getID (getJob), 8
- getID.PrototypeLDA (getSCLOP), 13
- getJob, 3, 4, 6, 8, 14–16, 21, 24, 25, 27, 28
- getK (getTopics), 15
- getLDA, 9
- getLDA (getJob), 8
- getLDA.PrototypeLDA (getSCLOP), 13
- getLog.likelihoods (getTopics), 15
- getMergedTopics (getSCLOP), 13
- getNum.iterations (getTopics), 15
- getParam (getTopics), 15
- getParam.PrototypeLDA (getSCLOP), 13
- getParam.TopicSimilarity (getSimilarity), 14
- getPrototype, 3, 8, 9, 14, 18, 23–25, 28, 32
- getPrototypeID (getSCLOP), 13
- getRegistry (getJob), 8
- getRelevantWords (getSimilarity), 14
- getRelevantWords.PrototypeLDA (getSCLOP), 13
- getSCLOP, 3, 9, 12, 13, 15, 16, 24
- getSimilarity, 3, 8, 9, 14, 14, 16, 18
- getSimilarity.PrototypeLDA (getSCLOP), 13
- getTopics, 3, 9, 14, 15, 15, 19, 21, 25
- grepl, 7
- hclust, 7
- is.LDA (LDA), 18
- is.LDABatch (as.LDABatch), 4
- is.LDAREp (as.LDAREp), 5
- jaccardTopics, 3, 8, 11, 12, 15, 16, 23, 25, 28, 32
- labels, 7
- labels_colors, 7
- LDA, 2–6, 8, 12, 15, 16, 18, 21, 23, 25, 27
- lda.collapsed.gibbs.sampler, 19–25
- LDABatch, 3, 4, 6, 8, 9, 11, 12, 16, 19, 20, 25–28
- LDAPrep, 20, 22, 24, 30
- LDAPrototype, 3, 6, 9, 12, 14, 22, 25, 28
- ldaPrototype (ldaPrototype-package), 2
- ldaPrototype-package, 2
- LDAREp, 3, 5, 6, 8, 9, 11, 12, 16, 18, 19, 21, 24, 24, 27, 28, 32
- mergeBatchTopics, 4, 9, 21, 26, 28
- mergeRepTopics, 6, 9, 24, 25, 27, 27, 28
- mergeTopics, 3, 8, 11, 12, 18, 23, 25–28, 28, 32
- order.dendrogram, 7
- parallelStart, 11, 17, 22, 25
- parallelStop, 11, 17, 22, 25
- plot.PruningSCLOP (pruneSCLOP), 29
- plot.TopicDendrogram (dendTopics), 7
- PrototypeLDA, 3, 13, 14
- pruneSCLOP, 3, 8, 29, 31, 32
- pruning.par (pruneSCLOP), 29
- PruningSCLOP, 7, 29, 30
- rainbow_hcl, 7
- reduceResultsList, 4, 26
- Registry, 4, 26
- reuters, 2, 30
- reuters_docs (reuters), 30
- reuters_vocab (reuters), 30
- SCLOP, 3, 8, 12, 18, 25, 28–30, 31
- SCLOP.pairwise, 12
- setFileDir (getJob), 8
- submitJobs, 21
- TopicDendrogram, 3, 8, 29
- TopicSimilarity, 3, 7, 14, 31
- vocab (reuters), 30