

Package ‘LSAfun’

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Type Package

Title Applied Latent Semantic Analysis (LSA) functions

Description This package provides functions that allow for convenient working with Latent Semantic Analysis. For actually building an LSA space, use the package 'lsa'.

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LSAfun-package *Computations based on Latent Semantic Analysis*

Description

LSAfun (short for Latent Semantic Analysis functions) is a package working with Latent Semantic Analysis. Latent Semantic Analysis is an algorithm working on a corpus of text documents. It achieves a high-dimensional vector representation for word (and document) meanings. The exact algorithm is described in Martin & Berry (2007).

Such a representation allows for the computation of word (and document) similarities, for example by computing cosine values of angles between two vectors.

The focus of this package

This package is not designed to create LSA semantic spaces; this is the focus of the R-package [lsa](#). Instead, it provides functions to be applied on existing LSA semantic spaces, such as

1. Similarity Computations
2. neighborhood Computations
3. Applied Functions
4. Composition Methods

How to get an LSA space

LSAfun comes with one example LSA space, the [wonderland](#) space.

This package can also directly use LSA semantic spaces created with the [lsa](#)-package. Thus, it allows the user to use own LSA spaces. (Note that the function [lsa](#) gives a list of three matrices. Of those, the term matrix U should be used.)

Another possibility is to use one of the LSA spaces provided at <http://www.lingexp.uni-tuebingen.de/z2/LSAspaces>. These are stored in the `.rda` format. To load one of these spaces into the R workspace, save them into a directory, set the working directory to that directory, and load the space using `load()`.

Author(s)

Fritz Günther

`breakdown`*Clean up special characters*

Description

Replaces special characters in character vectors

Usage`breakdown(x)`**Arguments**`x` a character vector**Details**

Applies the following functions to a character vector

- sets all letters to lower case
- replaces umlauts (for example ä replaced by ae)
- removes accents from letters (for example é replaced by e)
- replaces ß by ss

Also removes other special characters, like punctuation signs, numbers and breaks

Value

A character vector

Author(s)

Fritz Günther

See Also[gsub](#)**Examples**`breakdown("Märchen")``breakdown("I was visiting Orléans last week.
It was nice, though!")`

 choose.target

Random Target Selection

Description

Randomly samples words within a given similarity range to the input

Usage

```
choose.target(x, lower, upper, n, tvecs=tvecs, breakdown=TRUE)
```

Arguments

x	a character vector of length(x) = 1 specifying a word or a sentence/document
lower	the lower bound of the similarity range; a numeric
upper	the upper bound of the similarity range; a numeric
n	an integer giving the number of target words to be sampled
tvecs	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

Computes cosine values between the input x and all the word vectors in tvecs. Then only selects words with a cosine similarity between lower and upper to the input, and randomly samples n of these words.

This function is designed for randomly selecting target words with a predefined similarity towards a given prime word (or sentence/document).

Value

A named numeric vector. The names of the vector give the target words, the entries their respective cosine similarity to the input.

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, 104, 211-240.

See Also

[cosine](#), [Cosine](#), [neighbors](#)

Examples

```
data(wonderland)

choose.target("mad hatter", lower=.2, upper=.3,
             n=20, tvectors=wonderland)
```

coherence	<i>Coherence of a text</i>
-----------	----------------------------

Description

Computes coherence of a given paragraph/document

Usage

```
coherence(x, split=c(".", "!", "?"), tvectors=tvectors, breakdown=TRUE)
```

Arguments

<code>x</code>	a character vector of length(<code>x</code>) = 1 containing the document
<code>split</code>	a vector of expressions that determine where to split sentences
<code>tvectors</code>	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
<code>breakdown</code>	if TRUE, the function breakdown is applied to the input

Details

This function applies the method described in Landauer & Dumais (1997): The *local coherence* is the cosine between two adjacent sentences. The *global coherence* is then computed as the mean value of these local coherences.

The format of `x` (or `y`) should be of the kind `x <- "sentence1. sentence2. sentence3"` Every sentence can also just consist of one single word.

To import a document `Document.txt` to from a directory for coherence computation, set your working directory to this directory using `setwd()`. Then use the following command lines:

```
fileName1 <- "Alice_in_Wonderland.txt"
x <- readChar(fileName1, file.info(fileName1)$size)
```

Value

A list of two elements; the first element (`$local`) contains the local coherences as a numeric vector, the second element (`$global`) contains the global coherence as a numeric.

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, 104, 211-240.

See Also

[cosine](#), [Cosine](#), [costring](#)

Examples

```
data(wonderland)
```

```
coherence ("There was certainly too much of it in the air. Even the Duchess
sneezed occasionally; and as for the baby, it was sneezing and howling
alternately without a moment's pause. The only things in the kitchen
that did not sneeze, were the cook, and a large cat which was sitting on
the hearth and grinning from ear to ear.",
tvectors=wonderland)
```

compose

Two-Word Composition

Description

Computes the vector of a complex expression *p* consisting of two single words *u* and *v*, following the methods examined in Mitchell & Lapata (2008) (see *Details*).

Usage

```
## Default
compose(x,y,method="Add", a=1,b=1,c=1,m,k,tvectors=tvectors,
breakdown=TRUE, norm="none")
```

Arguments

<i>x</i>	a single word (character vector with <code>length(x) = 1</code>)
<i>y</i>	a single word (character vector with <code>length(y) = 1</code>)
<i>a, b, c</i>	weighting parameters, see <i>Details</i>
<i>m</i>	number of nearest words to the Predicate that are initially activated (see Predication)
<i>k</i>	size of the <i>k</i> -neighborhood; $k \leq m$ (see Predication)

method	the composition method to be used (see <i>Details</i>)
norm	whether to normalize the single word vectors before applying a composition function. Setting norm = "none" will not perform any normalizations, setting norm = "all" will normalize every involved word vector. Setting norm = "block" is only valid for the Predication method
tectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

Let p be the vector with entries p_i for the two-word phrase consisting of u with entries u_i and v with entries v_i . The different composition methods as described by Mitchell & Lapata (2008) are as follows:

- Additive Model (method = "Add")

$$p_i = u_i + v_i$$

- Weighted Additive Model (method = "WeightAdd")

$$p_i = a * u_i + b * v_i$$

- Multiplicative Model (method = "Multiply")

$$p_i = u_i * v_i$$

- Combined Model (method = "Combined")

$$p_i = a * u_i + b * v_i + c * u_i * v_i$$

- Predication (method = "Predication")
(see [Predication](#))

If method="Predication" is used, x will be taken as Predicate and y will be taken as Argument of the phrase (see *Examples*)

Value

The phrase vector as numeric

Author(s)

Fritz Günther

References

- Kintsch, W. (2001). Predication. *Cognitive science*, 25, 173-202.
- Mitchell, J. & Lapata, M. (2008). Vector-based Models of Semantic Composition. In *Proceedings of ACL-08: HLT* (pp. 236-244). Columbus, Ohio.

See Also

[Predication](#)

Examples

```
data(wonderland)
```

```
compose(x="mad",y="hatter",method="Add",tectors=wonderland)
```

```
compose(x="mad",y="hatter",method="Combined",a=1,b=2,c=3,  
tectors=wonderland)
```

```
compose(x="mad",y="hatter",method="Predication",m=20,k=3,  
tectors=wonderland)
```

Cosine

Compute LSA cosine

Description

Computes the cosine for two single words

Usage

```
Cosine(x,y,tectors=tectors,breakdown=TRUE)
```

Arguments

x	A single word, given as a character of length(x) = 1
y	A single word, given as a character of length(y) = 1
tectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

Instead of using numeric vectors, as the `cosine()` function from the *lsa* package does, this function allows for the direct computation of the cosine between two single words (i.e. Characters). which are automatically searched for in the LSA space given in as `tectors`.

Value

The cosine as a numeric

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, *104*, 211-240.

Dennis, S. (2007). How to use the LSA Web Site. In T. K. Landauer, D. S. McNamara, S. Dennis, & W. Kintsch (Eds.), *Handbook of Latent Semantic Analysis* (pp. 35-56). Mahwah, NJ: Erlbaum.

<http://lsa.colorado.edu/>

See Also

[cosine](#)

Examples

```
data(wonderland)
```

```
Cosine("alice","rabbit",tvectors=wonderland)
```

costring	<i>Sentence Comparison</i>
----------	----------------------------

Description

Computes cosine values between sentences and/or documents

Usage

```
costring(x,y,tvectors=tvectors,breakdown=TRUE)
```

Arguments

x	a character vector
y	a character vector
tvectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

In the traditional LSA approach, the vector D for a document (or a sentence) consisting of the words (t_1, \dots, t_n) is computed as

$$D = \sum_{i=1}^n t_i$$

This function computes the cosine between two documents (or sentences) or the cosine between a single word and a document (or sentence).

The format of x (or y) can be of the kind `x <- "word1 word2 word3"`, but also of the kind `x <- c("word1", "word2", "word3")`. This allows for simple copy&paste-inserting of text, but also for using character vectors, e.g. the output of `neighbors()`.

To import a document *Document.txt* to from a directory for comparisons, set your working directory to this directory using `setwd()`. Then use the following command lines:

```
fileName1 <- "Alice_in_Wonderland.txt"
x <- readChar(fileName1, file.info(fileName1)$size)
```

Value

A numeric giving the cosine between the input sentences/documents

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, *104*, 211-240.

Dennis, S. (2007). How to use the LSA Web Site. In T. K. Landauer, D. S. McNamara, S. Dennis, & W. Kintsch (Eds.), *Handbook of Latent Semantic Analysis* (pp. 35-56). Mahwah, NJ: Erlbaum.

<http://lsa.colorado.edu/>

See Also

[cosine](#), [Cosine](#), [multicos](#), [multicostring](#)

Examples

```
data(wonderland)
costring("Alice was beginning to get very tired.",
        "A white rabbit with a clock ran close to her.",
        tvectors=wonderland)
```

genericSummary	<i>Summarize a text</i>
----------------	-------------------------

Description

Selects sentences from a text that best describe its topic

Usage

```
genericSummary(text,k,split=c(".", "!", "?"),min=5,breakdown=TRUE,...)
```

Arguments

text	A character vector of length(text) = 1 specifying the text to be summarized
k	The number of sentences to be used in the summary
split	A character vector specifying which symbols determine the end of a sentence in the document
min	The minimum amount of words a sentence must have to be included in the computations
breakdown	If TRUE, the function breakdown is applied to the input
...	Further arguments to be passed on to textmatrix

Details

Applies the method of Gong & Liu (2001) for generic text summarization of text document D via Latent Semantic Analysis:

1. Decompose the document D into individual sentences, and use these sentences to form the candidate sentence set S , and set $k = 1$.
2. Construct the terms by sentences matrix A for the document D .
3. Perform the SVD on A to obtain the singular value matrix Σ , and the right singular vector matrix V^t . In the singular vector space, each sentence i is represented by the column vector $\psi_i = [v_{i1}, v_{i2}, \dots, v_{ir}]^t$ of V^t .
4. Select the k 'th right singular vector from matrix V^t .
5. Select the sentence which has the largest index value with the k 'th right singular vector, and include it in the summary.
6. If k reaches the predefined number, terminate the operation; otherwise, increment k by one, and go to Step 4.

(Cited directly from Gong & Liu, 2001, p. 21)

Value

A character vector of the length k

Author(s)

Fritz Günther

See Also[textmatrix](#), [lsa](#), [svd](#)**Examples**

```
D <- "This is just a test document. It is set up just to throw some random
sentences in this example. So do not expect it to make much sense. Probably, even
the summary won't be very meaningful. But this is mainly due to the document not being
meaningful at all. For test purposes, I will also include a sentence in this
example that is not at all related to the rest of the document. Lions are larger than cats."
```

```
genericSummary(D,k=1)
```

 multicos

Vector x Vector Comparison

Description

Computes a cosine matrix from given word vectors

Usage

```
multicos(x,y=x,tvectors=tvectors,breakdown=TRUE)
```

Arguments

x	a character vector or numeric of length=ncol(tvectors) (vector with same dimensionality as LSA space)
y	a character vector; y = x by default
tvectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

Submit a character vector consisting of n words to get a $n \times n$ cosine matrix of all their pairwise cosines.

Alternatively, submit two different character vectors to get their pairwise cosines. Single words are also possible arguments.

Also allows for computation of cosines between a given numeric vector with the same dimensionality as the LSA space and a vector consisting of n words.

Value

A matrix containing the pairwise cosines of x and y

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, *104*, 211-240.

Dennis, S. (2007). How to use the LSA Web Site. In T. K. Landauer, D. S. McNamara, S. Dennis, & W. Kintsch (Eds.), *Handbook of Latent Semantic Analysis* (pp. 35-56). Mahwah, NJ: Erlbaum.

<http://lsa.colorado.edu/>

See Also

[cosine](#), [Cosine](#), [costring](#), [multicostring](#)

Examples

```
data(wonderland)
multicos("mouse rabbit cat", "king queen",
         tvectors=wonderland)
```

multicostring	<i>Sentence x Vector Comparison</i>
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Description

Computes cosines between a sentence/ document and multiple words

Usage

```
multicostring(x,y,tvectors=tvectors,breakdown=TRUE)
```

Arguments

x	a character vector specifying a sentence/ document (or also a single word)
y	a character vector specifying multiple single words
tvectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

The format of `x` (or `y`) can be of the kind `x <- "word1 word2 word3"`, but also of the kind `x <- c("word1", "word2", "word3")`. This allows for simple copy&paste-inserting of text, but also for using character vectors, e.g. the output of [neighbors](#).

Both `x` and `y` can also just consist of one single word. For computing the vector for the document/sentence specified in `x`, the simple Addition model is used (see [costring](#)).

Value

A numeric giving the cosine between the input sentences/documents

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, 104, 211-240.

Dennis, S. (2007). How to use the LSA Web Site. In T. K. Landauer, D. S. McNamara, S. Dennis, & W. Kintsch (Eds.), *Handbook of Latent Semantic Analysis* (pp. 35-56). Mahwah, NJ: Erlbaum.

<http://lsa.colorado.edu/>

See Also

[cosine](#), [Cosine](#), [multicos](#), [multicostring](#)

Examples

```
data(wonderland)

multicostring("Alice was beginning to get very tired.",
              "A white rabbit with a clock ran close to her.",
              tvectors=wonderland)

multicostring("Suddenly, a cat appeared in the woods",
              names(neighbors("cheshire",n=20,tvectors=wonderland)),
              tvectors=wonderland)
```

MultipleChoice

Answers Multiple Choice Questions

Description

Selects the nearest word to an input out of a set of options

Usage

```
MultipleChoice(x,y,tvectors=tvectors,breakdown=TRUE)
```

Arguments

x	a character vector of length(x) = 1 specifying a sentence/ document (or also a single word)
y	a character vector specifying multiple answer options
tvectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input

Details

Computes all the cosines between a given sentence/document or word and multiple answer options. Then selects the nearest option to the input (the option with the highest cosine). This function relies entirely on the [costring](#) function.

A warning message will be displayed if all words of one answer alternative are not found in the semantic space.

Value

The nearest option to x as a character

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, 104, 211-240.

See Also

[cosine](#), [Cosine](#), [costring](#)

Examples

```
data(wonderland)

LSAfun::MultipleChoice("Who does the march hare celebrate his unbrithday with?",
  c("Mad Hatter", "Red Queen", "Caterpillar", "Cheshire Cat"),
  tectors=wonderland)
```

 neighbors

Find nearest neighbors

Description

Returns the *n* nearest words to a given word or sentence/document

Usage

```
neighbors(x,n,tectors=tectors,breakdown=TRUE)
```

Arguments

<i>x</i>	a character vector of length(<i>x</i>) = 1 or a numeric of length=ncol(<i>tectors</i>) vector with same dimensionality as LSA space
<i>n</i>	the number of neighbors to be computed
<i>tectors</i>	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
<i>breakdown</i>	if TRUE, the function breakdown is applied to the input

Details

The format of *x* should be of the kind `x <- "word1 word2 word3"` instead of `x <- c("word1", "word2", "word3")` if sentences/documents are used as input. This allows for simple copy&paste-inserting of text.

To import a document *Document.txt* to from a directory for comparisons, set your working directory to this directory using `setwd()`. Then use the following command lines:

```
fileName1 <- "Alice_in_Wonderland.txt"
x <- readChar(fileName1, file.info(fileName1)$size).
```

Since *x* can also be chosen to be any vector of the active LSA Space, this function can be combined with `compose()` to compute neighbors of complex expressions (see examples)

Value

A named numeric vector. The neighbors are given as names of the vector, and their respective cosines to the input as vector entries.

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, *104*, 211-240.

Dennis, S. (2007). How to use the LSA Web Site. In T. K. Landauer, D. S. McNamara, S. Dennis, & W. Kintsch (Eds.), *Handbook of Latent Semantic Analysis* (pp. 35-56). Mahwah, NJ: Erlbaum.

<http://lsa.colorado.edu/>

See Also

[cosine](#), [plot_neighbors](#), [compose](#)

Examples

```
data(wonderland)

neighbors("cheshire",n=20,tvectors=wonderland)

neighbors(compose("mad","hatter",method="Add",tvectors=wonderland),
n=20,tvectors=wonderland)
```

normalize

Normalize a vector

Description

Normalizes a character vector to a unit vector

Usage

```
normalize(x)
```

Arguments

x a numeric or integer vector

Details

The (euclidean) norm of a vector x is defined as

$$\|x\| = \sqrt{\sum(x^2)}$$

To normalize a vector to a unit vector u with $\|u\| = 1$, the following equation is applied:

$$x' = x/\|x\|$$

Value

The normalized vector as a numeric

Author(s)

Fritz Günther

Examples

```
normalize(1:2)

## check vector norms:

x <- 1:2

sqrt(sum(x^2))          ## vector norm
sqrt(sum(normalize(x)^2)) ## norm = 1
```

oldbooks

A collection of five classic books

Description

This object is a list containing five classical books:

- *Around the World in Eighty Days* by Jules Verne
- *The Three Musketeers* by Alexandre Dumas
- *Frankenstein* by Mary Shelley
- *Dracula* by Bram Stoker
- *The Strange Case of Dr Jekyll and Mr Hyde* by Robert Stevenson

as single-element character vectors. All five books were taken from the [Project Gutenberg home-page](#) and contain formatting symbols, such as `\n` for breaks.

Usage

```
data(oldbooks)
```

Format

A named list containing five character vectors as elements

Source

[Project Gutenberg](#)

References

Dumas, A. (1844). *The Three Musketeers*. Retrieved from <http://www.gutenberg.org/ebooks/1257>

Shelley, M. W. (1818). *Frankenstein; Or, The Modern Prometheus*. Retrieved from <http://www.gutenberg.org/ebooks/84>

Stevenson, R. L. (1886). *The Strange Case of Dr. Jekyll and Mr. Hyde*. Retrieved from <http://www.gutenberg.org/ebooks/42>

Stoker, B. (1897). *Dracula*. Retrieved from <http://www.gutenberg.org/ebooks/345>

Verne, J.(1873). *Around the World in Eighty Days*. Retrieved from <http://www.gutenberg.org/ebooks/103>

plot_neighbors	<i>2D- or 3D-Plot of neighbors</i>
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Description

2D- or 3D-Approximation of the neighborhood of a given word/sentence

Usage

```
plot_neighbors(x,n,connect.lines=0,start.lines=T,
  method="PCA",dims=3,axes=F,box=F,cex=1,alpha=0.5,
  col="black",tectors=tectors,breakdown=TRUE,...)
```

Arguments

x	a character vector of length(x) = 1 or a numeric of length=ncol(tectors) vector with same dimensionality as LSA space
n	the number of neighbors to be computed
dims	the dimensionality of the plot; set either dims = 2 or dims = 3
method	the method to be applied; either a Principal Component Analysis (method="PCA") or a Multidimensional Scaling (method="MDS")
connect.lines	(3d plot only) the number of closest associate words each word is connected with via line. Setting connect.lines="all" will draw all connecting lines and will automatically apply alpha="shade"; it will furthermore override the start.lines argument

<code>start.lines</code>	(3d plot only) whether lines shall be drawn between <code>x</code> and all the neighbors
<code>axes</code>	(3d plot only) whether axes shall be included in the plot
<code>box</code>	(3d plot only) whether a box shall be drawn around the plot
<code>cex</code>	(2d Plot only) A numerical value giving the amount by which plotting text should be magnified relative to the default.
<code>t.vectors</code>	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
<code>breakdown</code>	if TRUE, the function <code>breakdown</code> is applied to the input
<code>alpha</code>	(3d plot only) a vector of one or two numerics between 0 and 1 specifying the luminance of <code>start.lines</code> (first entry) and <code>connect.lines</code> (second entry). Specifying only one numeric will pass this value to both kinds of lines. With setting <code>alpha="shade"</code> , the luminance of every line will be adjusted to the cosine between the two words it connects.
<code>col</code>	(3d plot only) a vector of one or two characters specifying the color of <code>start.lines</code> (first entry) and <code>connect.lines</code> (second entry). Specifying only one colour will pass this colour to both kinds of lines. With setting <code>col="rainbow"</code> , the colour of every line will be adjusted to the cosine between the two words it connects. Setting <code>col="rainbow"</code> will also apply <code>alpha="shade"</code>
<code>...</code>	additional arguments which will be passed to <code>plot3d</code> (in a three-dimensional plot only)

Details

Attempts to create an image of the semantic neighborhood (based on cosine similarity) to a given word, sentence/ document, or vector. An attempt is made to depict this subpart of the LSA space in a two- or three-dimensional plot.

To achieve this, either a Principal Component Analysis (PCA) or a Multidimensional Scaling (MDS) is computed to preserve the interconnections between all the words in this neighborhood as good as possible. Therefore, it is important to note that the image created from this function is only the best two- or three-dimensional approximation to the true LSA space subpart.

For creating pretty plots showing the similarity structure within this neighborhood best, set `connect.lines="all"` and `col="rainbow"`

Value

For three-dimensional plots: see `plot3d`: this function is called for the side effect of drawing the plot; a vector of object IDs is returned

`plot_neighbors` also gives the coordinate vectors of the words in the plot as a data frame

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, *104*, 211-240.

Mardia, K.V., Kent, J.T., & Bibby, J.M. (1979). *Multivariate Analysis*, London: Academic Press.

See Also

[cosine](#), [neighbors](#), [multicos](#), [plot_wordlist](#), [plot3d](#), [princomp](#)

Examples

```
data(wonderland)

## Standard Plot
plot_neighbors("cheshire", n=20, tvectors=wonderland)

## Pretty Plot
plot_neighbors("cheshire", n=20, tvectors=wonderland,
               connect.lines="all", col="rainbow")

plot_neighbors(compose("mad", "hatter", tvectors=wonderland),
               n=20, connect.lines=2, tvectors=wonderland)
```

plot_wordlist	<i>2D- or 3D-Plot of a list of words</i>
---------------	--

Description

2D or 3D-Plot of mutual word similarities to a given list of words

Usage

```
plot_wordlist(x, connect.lines=0, method="PCA", dims=3,
              axes=F, box=F, cex=1, alpha=0.5, col="black",
              tvectors=tvectors, breakdown=TRUE, ...)
```

Arguments

x	a character vector of length(x) > 1 that contains multiple words
dims	the dimensionality of the plot; set either dims = 2 or dims = 3
method	the method to be applied; either a Principal Component Analysis (method="PCA") or a Multidimensional Scaling (method="MDS")

<code>connect.lines</code>	(3d plot only) the number of closest associate words each word is connected with via line. Setting <code>connect.lines="all"</code> will draw all connecting lines and will automatically apply <code>alpha="shade"</code> ; it will furthermore override the <code>start.lines</code> argument
<code>axes</code>	(3d plot only) whether axes shall be included in the plot
<code>box</code>	(3d plot only) whether a box shall be drawn around the plot
<code>cex</code>	(2d Plot only) A numerical value giving the amount by which plotting text should be magnified relative to the default.
<code>tvectors</code>	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
<code>breakdown</code>	if TRUE, the function <code>breakdown</code> is applied to the input
<code>alpha</code>	(3d plot only) a vector of one or two numerics between 0 and 1 specifying the luminance of <code>start.lines</code> (first entry) and <code>connect.lines</code> (second entry). Specifying only one numeric will pass this value to both kinds of lines. With setting <code>alpha="shade"</code> , the luminance of every line will be adjusted to the cosine between the two words it connects.
<code>col</code>	(3d plot only) a vector of one or two characters specifying the color of <code>start.lines</code> (first entry) and <code>connect.lines</code> (second entry). Specifying only one colour will pass this colour to both kinds of lines. With setting <code>col="rainbow"</code> , the colour of every line will be adjusted to the cosine between the two words it connects. Setting <code>col="rainbow"</code> will also apply <code>alpha="shade"</code>
<code>...</code>	additional arguments which will be passed to <code>plot3d</code> (in a three-dimensional plot only)

Details

Computes all pairwise similarities within a given list of words. On this similarity matrix, a Principal Component Analysis (PCA) or a Multidimensional Scaling (MDS) is applied to get a two- or three-dimensional solution that best captures the similarity structure. This solution is then plotted. For creating pretty plots showing the similarity structure within this list of words best, set `connect.lines="all"` and `col="rainbow"`

Value

see `plot3d`: this function is called for the side effect of drawing the plot; a vector of object IDs is returned.
`plot_neighbors` also gives the coordinate vectors of the words in the plot as a data frame

Author(s)

Fritz Günther

References

Landauer, T.K., & Dumais, S.T. (1997). A solution to Plato's problem: The Latent Semantic Analysis theory of acquisition, induction and representation of knowledge. *Psychological Review*, 104, 211-240.

Mardia, K.V., Kent, J.T., & Bibby, J.M. (1979). *Multivariate Analysis*, London: Academic Press.

See Also

[cosine](#), [neighbors](#), [multicos](#), [plot_neighbors](#), [plot3d](#), [princomp](#)

Examples

```
data(wonderland)

## Standard Plot

words <- c("alice","hatter","queen","knight","hare","cheshire")

plot_wordlist(words,tvectors=wonderland,method="MDS",dims=2)
```

Predication

Compute Vector for Predicate-Argument-Expressions

Description

Computes vectors for complex expressions of type PREDICATE[ARGUMENT] by applying the method of Kintsch (2001) (see *Details*).

Usage

```
Predication(P,A,m,k,tvectors=tvectors,breakdown=TRUE,norm="none")
```

Arguments

P	Predicate of the expression, a single word (character vector)
A	Argument of the expression, a single word (character vector)
m	number of nearest words to the Predicate that are initially activated
k	size of the k-neighborhood; $k \leq m$
tvectors	the semantic space in which the computation is to be done (a numeric matrix where every row is a word vector)
breakdown	if TRUE, the function breakdown is applied to the input
norm	whether to normalize the single word vectors before applying a composition function. Setting norm = "none" will not perform any normalizations, setting norm = "all" will normalize every involved word vector (Predicate, Argument, and every single activated neighbor). Setting norm = "block" will normalize the Argument vector and will normalize the [Predicate + neighbors] vector, to weight the Argument and the "Predicate in context" equally.

Details

The vector for the expression is computed following the Predication Process by Kintsch (2001): The m nearest neighbors to the Predicate are computed. Of those, the k nearest neighbors to the Argument are selected. The vector for the expression is then computed as the sum of Predicate vector, Argument vector, and the vectors of those k neighbors (the k -neighborhood).

Value

An object of class Pred: This object is a list consisting of:

\$PA	The vector for the complex expression as described above
\$P.Pred	The vector for Predicate plus the k -neighborhoodvectors without the Argument vector
\$neighbors	The words in the k -neighborhood.
\$P	The Predicate given as input
\$A	The Argument given as input

Author(s)

Fritz Günther

References

Kintsch, W. (2001). Predication. *Cognitive science*, 25, 173-202.

See Also

[cosine](#), [neighbors](#), [multicos](#), [compose](#)

Examples

```
data(wonderland)
```

```
Predication(P="mad", A="hatter", m=20, k=3, t=vectors=wonderland)
```


Description

A data frame containing simulated data for a Semantic Priming Experiment. This data contains 514 prime-target pairs, which are taken from the Hutchison, Balota, Cortese and Watson (2008) study. These pairs are generated by pairing each of 257 target words with one semantically related and one semantically unrelated prime.

The data frame contains four columns:

- First column: Prime Words
- Second column: Target Words
- Third column: **Simulated** Reaction Times
- Fourth column: Specifies whether a prime-target pair is considered semantically related or unrelated

Usage

```
data(priming)
```

Format

A data frame with 514 rows and 4 columns

References

Hutchison, K. A., Balota, D. A., Cortese, M. & Watson, J. M. (2008). Predicting semantic priming at the item level. *Quarterly Journal of Experimental Psychology*, 61, 1036-1066.

syntest

A multiple choice test for synonyms and antonyms

Description

This object multiple choice test for synonyms and antonyms, consisting of seven columns.

1. The first column defines the question, i.e. the word a synonym or an antonym has to be found for.
2. The second up to the fifth column show the possible answer alternatives.
3. The sixth column defines the correct answer.
4. The seventh column indicates whether a synonym or an antonym has to be found for the word in question.

The test consists of twenty questions, which are given in the twenty rows of the data frame.

Usage

```
data(syntest)
```

Format

A data frame with 20 rows and 7 columns

wonderland

LSA Space: Alice's Adventures in Wonderland

Description

This data set is a 50-dimensional LSA space derived from Lewis Carroll's book "Alice's Adventures in Wonderland". The book was split into 791 paragraphs which served as documents for the LSA algorithm (Landauer, Foltz & Laham, 1998). Only words that appeared in at least two documents were used for building the LSA space.

This LSA space contains 1123 different terms, all in lower case letters, and was created using the [lsa](#)-package. It can be used as `tvector`s for all the functions in the `LSAfun`-package.

Usage

```
data(wonderland)
```

Format

A 1123x50 matrix with terms as rownames.

Source

[Alice in Wonderland from Project Gutenberg](#)

References

Landauer, T., Foltz, P., and Laham, D. (1998) *Introduction to Latent Semantic Analysis*. In: *Discourse Processes* 25, pp. 259-284.

Carroll, L. (1865). *Alice's Adventures in Wonderland*. New York: MacMillan.

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