Package ‘umap’

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**Title**  Uniform Manifold Approximation and Projection

**Version**  0.2.4.1

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**Description**  Uniform manifold approximation and projection is a technique for dimension reduction. The algorithm was described by McInnes and Healy (2018) in <arXiv:1802.03426>. This package provides an interface for two implementations. One is written from scratch, including components for nearest-neighbor search and for embedding. The second implementation is a wrapper for ‘python’ package ‘umap-learn’ (requires separate installation, see vignette for more details).

**Depends**  R (>= 3.1.2)

**Imports**  methods, openssl, reticulate, Rcpp (>= 0.12.6), RSpectra, stats

**License**  MIT + file LICENSE

**URL**  https://github.com/tkonopka/umap

**LinkingTo**  Rcpp

**LazyData**  true

**Suggests**  knitr, rmarkdown, testthat

**VignetteBuilder**  knitr

**Encoding**  UTF-8

**RoxygenNote**  7.0.2

**NeedsCompilation**  yes

**Repository**  CRAN

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predict.umap

Description

project data points onto an existing umap embedding

Usage

## S3 method for class 'umap'
predict(object, data, ...)

Arguments

object    trained object of class umap
data      matrix with data
...        additional arguments (not used)

Value

new matrix

Examples

# embedd iris dataset using default settings
iris.umap = umap(iris[,1:4])

# create a dataset with structure like iris, but with perturbation
iris.perturbed = iris[,1:4] + matrix(rnorm(nrow(iris)*4, 0, 0.1), ncol=4)

# project perturbed dataset
perturbed.embedding = predict(iris.umap, iris.perturbed)

# output is a matrix with embedding coordinates
head(perturbed.embedding)
**Description**

Computes a manifold approximation and projection

**Usage**

```r
umap(d, config = umap.defaults, method = c("naive", "umap-learn"), ...)
```

**Arguments**

- `d`: matrix, input data
- `config`: object of class `umap.config`
- `method`: character, implementation. Available methods are 'naive' (an implementation written in pure R) and 'umap-learn' (requires python package 'umap-learn')
- `...`: list of settings; overwrite default values from `config`

**Value**

object of class `umap`, containing at least a component with an embedding and a component with configuration settings

**Examples**

```r
# embedd iris dataset using default settings
iris.umap = umap(iris[,1:4])

# display object summary
iris.umap

# display embedding coordinates
head(iris.umap$layout)
```

**Description**

A list with parameters customizing a UMAP embedding. Each component of the list is an effective argument for `umap()`.
Usage

`umap.defaults`

Format

An object of class `umap.config` of length 21.

Details

- **n_neighbors**: integer; number of nearest neighbors
- **n_components**: integer; dimension of target (output) space
- **metric**: character or function; determines how distances between data points are computed. When using a string, available metrics are: euclidean, manhattan. Other available generalized metrics are: cosine, pearson, pearson2. Note the triangle inequality may not be satisfied by some generalized metrics, hence knn search may not be optimal. When using metric.function as a function, the signature must be function(matrix, origin, target) and should compute a distance between the origin column and the target columns
- **n_epochs**: integer; number of iterations performed during layout optimization
- **input**: character, use either "data" or "dist"; determines whether the primary input argument to `umap()` is treated as a data matrix or as a distance matrix
- **init**: character or matrix. The default string "spectral" computes an initial embedding using eigenvectors of the connectivity graph matrix. An alternative is the string "random", which creates an initial layout based on random coordinates. This setting can also be set to a matrix, in which case layout optimization begins from the provided coordinates.
- **min_dist**: numeric; determines how close points appear in the final layout
- **set_op_ratio_mix_ratio**: numeric in range [0,1]; determines who the knn-graph is used to create a fuzzy simplicial graph
- **local_connectivity**: numeric; used during construction of fuzzy simplicial set
- **bandwidth**: numeric; used during construction of fuzzy simplicial set
- **alpha**: numeric; initial value of "learning rate" of layout optimization
- **gamma**: numeric; determines, together with alpha, the learning rate of layout optimization
- **negative_sample_rate**: integer; determines how many non-neighbor points are used per point and per iteration during layout optimization
- **a**: numeric; contributes to gradient calculations during layout optimization. When left at NA, a suitable value will be estimated automatically.
- **b**: numeric; contributes to gradient calculations during layout optimization.
- **spread**: numeric; used during automatic estimation of a/b parameters.
- **random_state**: integer; seed for random number generation used during umap()
- **transform_state**: integer; seed for random number generation used during predict()
- **knn.repeat**: number of times to restart knn search
- **verbose**: logical or integer; determines whether to show progress messages
- **umap_learn_args**: vector of arguments to python package umap-learn
Examples

# display all default settings
umap.defaults

# create a new settings object with n_neighbors set to 5
custom.settings = umap.defaults
custom.settings$n_neighbors = 5
custom.settings
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