

# Package ‘distances’

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**Type** Package

**Title** Tools for Distance Metrics

**Version** 0.1.12

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**Description** Provides tools for constructing, manipulating and using distance metrics.

**Depends** R (>= 3.4.0)

**Imports** stats

**Suggests** testthat

**NeedsCompilation** yes

**License** GPL (>= 3)

**LicenseNote** The distances packages includes the ANN library  
(distributed under the LGPLv2.1 license).

**URL** <https://github.com/fsavje/distances>

**BugReports** <https://github.com/fsavje/distances/issues>

**Encoding** UTF-8

**RoxygenNote** 7.3.2

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distances

*Constructor for distance metric objects***Description**

`distances` constructs a distance metric for a set of points. Currently, it only creates Euclidean distances. It can, however, create distances in any linear projection of Euclidean space. In other words, Mahalanobis distances or normalized Euclidean distances are both possible. It is also possible to give each dimension of the space different weights.

**Usage**

```
distances(
  data,
  id_variable = NULL,
  dist_variables = NULL,
  normalize = NULL,
  weights = NULL
)
```

**Arguments**

<code>data</code>	a matrix or data frame containing the data points between distances should be derived.
<code>id_variable</code>	optional IDs of the data points. If <code>id_variable</code> is a single string and <code>data</code> is a data frame, the corresponding column in <code>data</code> will be taken as IDs. That column will be excluded from <code>data</code> when constructing distances (unless it is listed in <code>dist_variables</code> ). If <code>id_variable</code> is <code>NULL</code> , the IDs are set to <code>1:nrow(data)</code> . Otherwise, <code>id_variable</code> must be of length <code>nrow(data)</code> and will be used directly as IDs.
<code>dist_variables</code>	optional names of the columns in <code>data</code> that should be used when constructing distances. If <code>dist_variables</code> is <code>NULL</code> , all columns will be used (net of eventual column specified by <code>id_variable</code> ). If <code>data</code> is a matrix, <code>dist_variables</code> must be <code>NULL</code> .
<code>normalize</code>	optional normalization of the data prior to distance construction. If <code>normalize</code> is <code>NULL</code> or <code>"none"</code> , no normalization will be done (effectively setting <code>normalize</code> to the identity matrix). If <code>normalize</code> is <code>"mahalanobize"</code> , normalization will be done with <code>var(data)</code> (i.e., resulting in Mahalanobis distances). If <code>normalize</code> is <code>"studentize"</code> , normalization is done with the diagonal of <code>var(data)</code> . If <code>normalize</code> is a matrix, it will be used in the normalization. If <code>normalize</code> is a vector, a diagonal matrix with the supplied vector as its diagonal will be used. The matrix used for normalization must be positive-semidefinite.
<code>weights</code>	optional weighting of the data prior to distance construction. If <code>normalize</code> is <code>NULL</code> no weighting will be done (effectively setting <code>weights</code> to the identity matrix). If <code>weights</code> is a matrix, that will be used in the weighting. If <code>normalize</code> is a vector, a diagonal matrix with the supplied vector as its diagonal will be used. The matrix used for weighting must be positive-semidefinite.



```

my_distances7 <- distances(my_data_points_withID,
                           id_variable = "my_ids")

# Compare to standard R functions

all.equal(as.matrix(my_distances1), as.matrix(dist(my_data_points)))
# > TRUE

all.equal(as.matrix(my_distances2), as.matrix(dist(my_data_points[, "x"])))
# > TRUE

tmp_distances <- sqrt(mahalanobis(as.matrix(my_data_points),
                                unlist(my_data_points[1, ]),
                                var(my_data_points)))

names(tmp_distances) <- 1:10
all.equal(as.matrix(my_distances3)[1, ], tmp_distances)
# > TRUE

tmp_data_points <- as.matrix(my_data_points)
tmp_data_points[, 1] <- sqrt(2) * tmp_data_points[, 1]
all.equal(as.matrix(my_distances5), as.matrix(dist(tmp_data_points)))
# > TRUE

tmp_data_points <- as.matrix(my_data_points)
tmp_cov_mat <- var(tmp_data_points)
tmp_data_points[, 1] <- sqrt(2) * tmp_data_points[, 1]
tmp_distances <- sqrt(mahalanobis(tmp_data_points,
                                tmp_data_points[1, ],
                                tmp_cov_mat))

names(tmp_distances) <- 1:10
all.equal(as.matrix(my_distances6)[1, ], tmp_distances)
# > TRUE

tmp_distances <- as.matrix(dist(my_data_points))
colnames(tmp_distances) <- rownames(tmp_distances) <- letters[1:10]
all.equal(as.matrix(my_distances7), tmp_distances)
# > TRUE

```

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distance\_columns

*Distance matrix columns*


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## Description

distance\_columns extracts columns from the distance matrix.

## Usage

```
distance_columns(distances, column_indices, row_indices = NULL)
```

**Arguments**

- `distances` A [distances](#) object.
- `column_indices` An integer vector with point indices indicating which columns to be extracted.
- `row_indices` If NULL, complete rows will be extracted. If integer vector with point indices, only the indicated rows will be extracted.

**Details**

If the complete distance matrix is desired, [distance\\_matrix](#) is faster than `distance_columns`.

**Value**

Returns a matrix with the requested columns.

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<code>distance_matrix</code>	<i>Distance matrix</i>
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**Description**

`distance_matrix` makes distance matrices (complete and partial) from [distances](#) objects.

**Usage**

```
distance_matrix(distances, indices = NULL)
```

**Arguments**

- `distances` A [distances](#) object.
- `indices` If NULL, the complete distance matrix is made. If integer vector with point indices, a partial matrix including only the indicated data points is made.

**Value**

Returns a distance matrix of class [dist](#).

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is.distances	<i>Check distances object</i>
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**Description**

is.distances checks whether the provided object is a valid instance of the [distances](#) class.

**Usage**

```
is.distances(x)
```

**Arguments**

x                      object to check.

**Value**

Returns TRUE if x is a valid distances object, otherwise FALSE.

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max_distance_search	<i>Max distance search</i>
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**Description**

max\_distance\_search searches for the data point furthest from a set of query points.

**Usage**

```
max_distance_search(distances, query_indices = NULL, search_indices = NULL)
```

**Arguments**

- distances            A [distances](#) object.
- query\_indices        An integer vector with point indices to query. If NULL, all data points in distances are queried.
- search\_indices       An integer vector with point indices to search among. If NULL, all data points in distances are searched over.

**Value**

An integer vector with point indices for the data point furthest from each query.

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`nearest_neighbor_search`*Nearest neighbor search*

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**Description**

`nearest_neighbor_search` searches for the `k` nearest neighbors of a set of query points.

**Usage**

```
nearest_neighbor_search(  
  distances,  
  k,  
  query_indices = NULL,  
  search_indices = NULL,  
  radius = NULL  
)
```

**Arguments**

<code>distances</code>	A <a href="#">distances</a> object.
<code>k</code>	The number of neighbors to search for.
<code>query_indices</code>	An integer vector with point indices to query. If <code>NULL</code> , all data points in <code>distances</code> are queried.
<code>search_indices</code>	An integer vector with point indices to search among. If <code>NULL</code> , all data points in <code>distances</code> are searched over.
<code>radius</code>	Restrict the search to a fixed radius around each query. If fewer than <code>k</code> search points exist within this radius, no neighbors are reported (indicated by NA).

**Value**

A matrix with point indices for the nearest neighbors. Columns in this matrix indicate queries, and rows are ordered by distances from the query.

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