

Package ‘stdbscan’

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Title Spatio-Temporal DBSCAN Clustering

Version 0.2.0

Description Implements the ST-DBSCAN (spatio-temporal density-based spatial clustering of applications with noise) clustering algorithm for detecting spatially and temporally dense regions in point data, with a fast C++ backend via 'Rcpp'. Birant and Kut (2007) <[doi:10.1016/j.datak.2006.01.013](https://doi.org/10.1016/j.datak.2006.01.013)>.

License GPL (>= 3)

Depends R (>= 3.5.0)

Encoding UTF-8

RoxygenNote 7.3.3

URL <https://github.com/MiboraMinima/stdbscan/>,
<https://miboraminima.github.io/stdbscan/>

BugReports <https://github.com/MiboraMinima/stdbscan/issues/>

LinkingTo Rcpp

Imports Rcpp, dbscan

Suggests knitr, rmarkdown, readr, testthat, ggplot2, plotly, covr,
MetBrewer

VignetteBuilder knitr

LazyData true

NeedsCompilation yes

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geolife_traj	<i>GPS pings from the GeoLife GPS Trajectories dataset</i>
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Description

Extraction of the GeoLife GPS Trajectories dataset. The selected trajectory id is 000-20081023025304.

Data manipulation applied to the raw data :

- Conversion to EPSG:4586
- Manual selection of the pings
- Selection of relevant variables

Usage

```
geolife_traj
```

Format

A data.frame with one row per ping and the following columns:

- date (chr): The date
- time (chr): The time
- x (dbl): Longitude (EPSG:4586)
- y (dbl): Latitude (EPSG:4586)

Source

<https://www.microsoft.com/en-us/download/details.aspx?id=52367>

Examples

```
data(geolife_traj)
head(geolife_traj)
```

predict.stdbscan	<i>Predict newdata</i>
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Description

Assigns each new observation to an existing cluster from a fitted `stdbscan` object, or marks it as noise if it falls outside any cluster.

Usage

```
## S3 method for class 'stdbscan'  
predict(object, data, newdata, ...)
```

Arguments

<code>object</code>	An object of class <code>stdbscan</code> .
<code>data</code>	matrix. The data set used to create the clustering object.
<code>newdata</code>	matrix. New data points for which the cluster membership should be predicted. The data must be in the same format as the input data.
<code>...</code>	Additional arguments are passed on to <code>dbscan::frNN()</code> .

Value

An integer vector of cluster labels, matching the labels of the input `stdbscan` object.

Examples

```
data(geolife_traj)  
  
geolife_traj$date_time <- as.POSIXct(  
  paste(geolife_traj$date, geolife_traj$time),  
  format = "%Y-%m-%d %H:%M:%S",  
  tz = "GMT"  
)  
geolife_traj$t <- as.numeric(  
  geolife_traj$date_time - min(geolife_traj$date_time)  
)  
data <- cbind(geolife_traj$x, geolife_traj$y, geolife_traj$t)  
  
res <- st_dbscan(  
  data = data,  
  eps_spatial = 3,  
  eps_temporal = 30,  
  min_pts = 5  
)  
  
newdata <- cbind(  
  c(440160, 440165, 440144, 440130, 440160),
```

```

    c(4428129, 4428135, 4428120, 4428123, 4428122),
    c(4617, 4620, 4629, 4635, 4640)
)
predict(res, data, newdata)

```

st_dbscan

Spatio-Temporal DBSCAN

Description

Perform **ST-DBSCAN** clustering on points with spatial and temporal coordinates. This algorithm identifies clusters of points that are close both in space and time.

Usage

```
st_dbscan(data, eps_spatial, eps_temporal, min_pts, ...)
```

Arguments

data	matrix. A matrix containing, in that order , x, y and t. x (longitude) and y (latitude) are the spatial coordinates and t is the cumulative time since a common origin (e.g. c(0, 6, 10)). t must be sorted.
eps_spatial	Numeric. The spatial radius threshold. Points closer than this in space may belong to the same cluster.
eps_temporal	Numeric. The temporal threshold. Points closer than this in time may belong to the same cluster.
min_pts	Integer. Minimum number of points required to form a core point.
...	Additional arguments are passed on to dbscan::frNN() and dbscan::dbscan().

Details

ST-DBSCAN extends classical DBSCAN by incorporating a temporal constraint. Two points are considered neighbors if they are within eps_spatial in space **and** within eps_temporal in time. Clusters are expanded from core points recursively following the DBSCAN algorithm.

ST-DBSCAN is implemented using the following approach:

1. Find the spatial neighbors using Fixed Radius Nearest Neighbors (dbscan::frNN())
2. Filter the spatial neighbors by the temporal constraint
3. Apply DBSCAN on the filtered neighbors using dbscan::dbscan()

Value

st_dbscan() returns an object of class stdbscan with the following components:

cluster	Integer vector with cluster assignments. Zero indicates noise points.
eps	Value of the eps_spatial parameter.
minPts	Value of the minPts parameter.
metric	Used distance metric.
borderPoints	Whether border points are considered as noise (FALSE) or not (TRUE).
eps_temporal	Value of the eps_temporal parameter.

This class is a simple extension of the dbscan class. For more details, see [dbscan](#) documentation.

References

Birant, D., & Kut, A. (2007). ST-DBSCAN: An algorithm for clustering spatial-temporal data. *Data & Knowledge Engineering*, 60(1), 208–221. <https://doi.org/10.1016/j.datak.2006.01.013>

Examples

```
data(geolife_traj)

geolife_traj$date_time <- as.POSIXct(
  paste(geolife_traj$date, geolife_traj$time),
  format = "%Y-%m-%d %H:%M:%S",
  tz = "GMT"
)
geolife_traj$t <- as.numeric(
  geolife_traj$date_time - min(geolife_traj$date_time)
)
data <- cbind(geolife_traj$x, geolife_traj$y, geolife_traj$t)

st_dbscan(
  data = data,
  eps_spatial = 3,
  eps_temporal = 30,
  min_pts = 3,
  # Extra arguments
  splitRule = "STD",
  search = "kdtree",
  approx = 1
)
```

st_dbscan_corepoint *Check if points are core points*

Description

Check if data points are core points. A core point is a point with more than `min_pts` points in its neighborhood.

Usage

```
st_dbscan_corepoint(data, eps_spatial, eps_temporal, min_pts, ...)
```

Arguments

<code>data</code>	matrix. A matrix containing, in that order , <code>x</code> , <code>y</code> and <code>t</code> . <code>x</code> (longitude) and <code>y</code> (latitude) are the spatial coordinates and <code>t</code> is the cumulative time since a common origin (e.g. <code>c(0, 6, 10)</code>).
<code>eps_spatial</code>	Numeric. The spatial radius threshold. Points closer than this in space may belong to the same cluster.
<code>eps_temporal</code>	Numeric. The temporal threshold. Points closer than this in time may belong to the same cluster.
<code>min_pts</code>	Integer. Minimum number of points required to form a core point.
<code>...</code>	Additional arguments are passed on to <code>dbscan::frNN()</code> .

Value

A boolean vector indicating if data points are core points.

Examples

```
data(geolife_traj)

geolife_traj$date_time <- as.POSIXct(
  paste(geolife_traj$date, geolife_traj$time),
  format = "%Y-%m-%d %H:%M:%S",
  tz = "GMT"
)
geolife_traj$t <- as.numeric(
  geolife_traj$date_time - min(geolife_traj$date_time)
)
data <- cbind(geolife_traj$x, geolife_traj$y, geolife_traj$t)

res <- st_dbscan_corepoint(
  data = data,
  eps_spatial = 3,
  eps_temporal = 30,
  min_pts = 3
)
```

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head(res)

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