Package ‘sfdct’

January 9, 2024

Title  Constrained Triangulation for Simple Features

Version  0.3.0

Description  Build a constrained high quality Delaunay triangulation from simple features objects, applying constraints based on input line segments, and triangle properties including maximum area, minimum internal angle. The triangulation code in ‘RTriangle’ uses the method of Cheng, Dey and Shewchuk (2012, ISBN:9781584887300). For a low-dependency alternative with low-quality path-based constrained triangulation see <https://CRAN.R-project.org/package=decido> and for high-quality configurable triangulation see <https://github.com/hypertidy/anglr>. Also consider comparison with the ‘GEOS’ lib which since version 3.10.0 includes a low quality polygon triangulation method that starts with ear clipping and refines to Delaunay.

Depends  R (>= 3.3.0)

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License_restricts_use  yes

Encoding  UTF-8

LazyData  true

Imports  dplyr, methods, RTriangle, sf, sp, tibble

RoxygenNote  7.2.3

Suggests  testthat, covr, knitr, maps, rmarkdown, viridisLite

VignetteBuilder  knitr

URL  https://github.com/hypertidy/sfdct

BugReports  https://github.com/hypertidy/sfdct/issues

NeedsCompilation  no

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antarctica  

Description

Antarctica, and not Antarctica.

Examples

library(sf)
plot(antarctica, col = rainbow(nrow(antarctica), alpha = 0.4))

c_triangulate  

Constrained Delaunay Triangulation

Description

Triangulate simple features including the input edges as constraints, rather than being bounded to the convex hull.

Usage

c_triangulate(x, ...)

## S3 method for class 'POINT'
c_triangulate(x, trim = TRUE, ...)

## S3 method for class 'MULTIPOINT'
c_triangulate(x, trim = TRUE, ...)

## S3 method for class 'GEOMETRYCOLLECTION'
c_triangulate(x, trim = TRUE, ...)

## S3 method for class 'sfg'
c_triangulate(x, trim = TRUE, ...)

## S3 method for class 'sfc'
c_triangulate(x, ...)

## S3 method for class 'sf'
ct_triangulate(x, trim = TRUE, ...)

### Arguments

- **x**: simple feature geometry or data frame
- **...**: arguments for `triangulate`, see details
- **trim**: drop triangles that fall "outside" i.e. "holes" and non-convex regions, TRUE by default

### Details

This is not a Delaunay Triangulation by default, but is "mostly-Delaunay". Use the `D = TRUE` option, passed to the underlying function in RTriangle to ensure the criterion is met, as well as edge constraints.

All POLYGON, LINESTRING, MULTIPOLYGON, and MULTILINESTRING inputs (including those in GEOMETRYCOLLECTION) are broken down into line segments that are included in the mesh. Holes are removed by default, but can be retained with the `trim` argument.

The triangles are collected as POLYGONs within a GEOMETRYCOLLECTION, and in the case of an sf object it's returned within the original input data frame.

There's no way in this package to retain the set of shared vertices, or the segment or the triangle indices. It is a fundamental feature of the standard, that this information is not represented.

Further arguments may be passed down to the underlying triangulation function `triangulate`. Note that planar coordinates are assumed, no matter what projection the input is in. There's no sensible meaning to a value for `a` in units m^2 for a layer that is in longitude/latitude, for those use "area in square degrees", the straightforward meaning in planar coordinates. These arguments are, from the documentation of that function:

- **a**: a Maximum triangle area. If specified, triangles cannot be larger than this area.
- **q**: Minimum triangle angle in degrees.
- **Y**: If TRUE prohibits the insertion of Steiner points on the mesh boundary.
- **j**: If TRUE jettisons vertices that are not part of the final triangulation from the output.
- **D**: If TRUE produce a conforming Delaunay triangulation. This ensures that all the triangles in the mesh are truly Delaunay, and not merely constrained Delaunay. This option invokes Ruppert's original algorithm, which splits every subsegment whose diametral circle is encroached. It usually increases the number of vertices and triangles.
- **S**: Specifies the maximum number of added Steiner points.
- **V**: Verbosity level. Specify higher values for more detailed information about what the Triangle library is doing.
- **Q**: If TRUE suppresses all explanation of what the Triangle library is doing, unless an error occurs.

### Value

- simple feature column `st_sfc` or data frame `st_sfc`
**Note**

GEOMETRYCOLLECTION as input is not yet supported.

**Examples**

```r
library(sf)
nc <- read_sf(system.file("shape/nc.shp", package="sf"), quiet = TRUE)
nc_triangles <- ct_triangulate(nc[, c("NAME", "geometry")])
plot(nc[, "NAME"])
plot(nc_triangles, add = TRUE, col = NA, lty = "dotted")
idx <- c(4, 5, 6, 7, 8, 20, 21)
op <- par(mfrow = c(2, 1))
if (packageVersion("sf") <= '0.2.8'){
  nc <- st_transform(nc, "+proj=eqc +ellps=WGS84")
}
plot(st_triangulate(nc[idx, c("NAME", "geometry")]), col = "grey")
## Warning: ct_triangulate does correctly triangulate longitude/latitude data
plot(ct_triangulate(nc[idx, c("NAME", "geometry")]))
```

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<table>
<thead>
<tr>
<th>lakesuperior</th>
<th>Lake Superior polygons.</th>
</tr>
</thead>
</table>

**Description**

See data-raw for original source.

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<table>
<thead>
<tr>
<th>map_world</th>
<th>The 'world' database from the maps package.</th>
</tr>
</thead>
</table>

**Description**

Data is in sf form. See data-raw for original source.
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