

Package ‘RcppAlphahull’

August 7, 2019

Type Package

Title What the package does.

Version 1.0

Date 2019-07-31

Author Your Name

Maintainer Your Name <your.name@mail.it>

Description

License GPL (>= 2)

Depends R (>= 3.4.4)

Imports Rcpp (>= 1.0.1)

LinkingTo Rcpp

RoxygenNote 6.1.1

R topics documented:

RcppAlphahull-package	2
ahull	2
ashape	3
complement	4
delvor	5
inahull	7
plot.delvor	7
Index	9

RcppAlphahull-package *RcppAlphahull*

Description

RcppAlphahull is package aimed to compute Voronoi diagrams and Delanuay tesslations for sets of points using the C++ package **MyGAL**. The package is inspired by the R/Fortran package alphahull which does the same job, but much slower. Plot of some graphs are done by using this package functions.

Details

Voronoi tessellation/Delanuay triangulation, α -shape and α -hull computation using a C++ library.

Author(s)

Federico Airoldi <federico2.airoldi@mail.polimi.it>

References

Edelsbrunner, H., Kirkpatrick, D. G., Seidel, R. 1983, 'On the Shape of a Set of Points in the Plane', *IEEE Transactions on Information Theory*, vol. 29, no. 4, pp. 551-559.

ahull *α -hull computation*

Description

Computes the α -hull for the given set of points.

Usage

```
ahull(x, y = NULL, alpha)
```

Arguments

x	x coordinates of the sites. Alternatively, a matrix with two columns containing both sites coordinates, an object of class delvor or an object of class ashape.
y	y coordinates of the sites; do not insert if x is not a vector of coordinates (see x).
alpha	a strictly positive value for α (NULL if x is of class ashape).

Value

A list with the following components:

- arcs: a matrix containing the arcs that form the boundary of the α -hull;
- xahull: 2-column matrix containing coordinates of those sites that are on the boundary of the α -hull and other endpoints of the boundary arcs that are not sites;
- length: length of the α -hull boundary;
- complement: a matrix describing the complement of the α -hull, see function [complement](#) for a detailed description;
- alpha: the value of α for which the shape is computed;
- ashape: output of function [ashape](#).

See Also

[delvor](#), [ashape](#), [complement](#)

Examples

```
x = runif(10)
y = runif(10)
a.hull = ahull(x, y)
plot(a.hull)
```

ashape

 α -shape computation

Description

Computes the α -shape for the given set of points.

Usage

```
ashape(x, y = NULL, alpha)
```

Arguments

x	x coordinates of the sites. Alternatively, a matrix with two columns containing both sites coordinates or an object of class <code>delvor</code> .
y	y coordinates of the sites; do not insert if x is not a vector of coordinates (see x).
alpha	a strictly positive value for α .

Value

A list with the following components:

edges a mesh describing the α -shape, this object is a submatrix of the mesh matrix contained in a "delvor" object since the alpha shape is a subset of the Delanuay triangulation.

length length of the alpha shape.

alpha the value of α for which the shape is computed.

alpha.extremes contains the indices of those sites that are α -extremes.

delvor.obj a delvor object returned by the function delvor, if a delvor object is provided instead of the sites coordinates, this field contains such object

See Also

[delvor](#)

Examples

```
x = runif(10)
y = runif(10)
a.shape = ashape(x, y, alpha = 0.8)
plot(a.shape)
```

complement

Complementary α -hull computation

Description

Computes the complement of an α -hull for the given value of α provided.

Usage

```
complement(x, y = NULL, alpha)
```

Arguments

x	coordinates of the sites. Alternatively, a matrix with two columns containing both sites coordinates or an object of class delvor.
y	y coordinates of the sites; do not insert if x is not a vector of coordinates (see x).
alpha	a strictly positive value for α .

Value

A matrix containing information about balls and halfplanes constituting the complement of the α hull, each row describes either an open ball or an open halfplane such that balls are saved in the following way:

- c1: x coordinate of the center of the ball;
- c2: y coordinate of the center of the ball;
- r: radius of the ball;

If the row refers to an halfplane then `complement[i, 1:3]` has the following forms:

- $x > a + bx$: (a, b, -1);
- $x < a + bx$: (a, b, -2);
- $x > a$: (a, 0, -3);
- $x < a$: (a, 0, -4).

See Also

[ahull](#)

Examples

```
x = runif(10)
y = runif(10)
alpha = 2
ahull.compl = complement(x, y, alpha)
```

delvor

Voronoi tessellation/Delanuay triangulation

Description

Computing Voronoi diagram and Delanuay tessellation for the specified set of points employing the C++ library **MyGAL**.

Usage

```
delvor(x, y = NULL)
```

Arguments

- | | |
|---|--|
| x | x coordinates of the sites or a matrix with two columns containing both sites coordinates. |
| y | y coordinates of the sites. Alternatively a single argument can be provided (see x). |

Details

This function retrieves the Voronoi tessellation and the Delanuay triangulation of a given set of points in the plane; results are returned in a list of three elements (see Value).

Each row of **mesh** contains information about one of the edges of the tessellation and its dual:

- ind1 and ind2: indices of the sites to which the edge refers to;
- x1 and y1: coordinates of the site denoted by ind1;
- x2 and y2: coordinates of the site denoted by ind2;
- mx1 and my1: coordinates of the first extreme, e1, of the Voronoi tessellation edge;
- mx2 and my2: coordinates of the second extreme, e2, of the Voronoi tessellation edge;
- bp1 and bp2: denote whether one of the direction of the Voronoi edge is infinite, either from the side of e1 or e2.

tri.obj, S3 object of class "tri.mod", is a list of four elements that describe the Delanuay triangulation:

- n: number of sites of the triangulation;
- x: x coordinates of the sites;
- y: y coordinates of the sites;
- neighbours: a list of integer vectors where the i-th vectors contains the indices of neighbours sites of the i-th site in the triangulation.

Value

An invisible object of class "del.vor", a list, with the following components:

mesh a matrix describing the Voronoi tessellation and the Delanuay triangulation.

x a 2-column matrix containing the coordinates of the sites.

tri.obj an S3 object of class "tri.mod" describing the triangulation similar to the one of the package tri.mesh.

See Also

[plot.delvor](#)

Examples

```
x = runif(10)
y = runif(10)
del.vor = delvor(x, y)
plot(del.vor)
```

inahull	<i>Determines if the provided point fall inside the α-hull or not.</i>
---------	--

Description

Determines if the provided point fall inside the α -hull or not calling an external C++ function.

Usage

```
inahull(ahull.obj, x, y = NULL, alpha)
```

Arguments

x	x coordinates of the sites. Alternatively, a matrix with two columns containing both sites coordinates.
y	y coordinates of the sites.
ahull.obj	an object class "ahull" like the one returned by the function ahull

Value

A list with the following components: A logical vector of the same length of the number of points and such that the i-th element denotes if the i-th point is in the α -hull or not.

See Also

[ahull](#), [complement](#)

Examples

```
x = runif(10)
y = runif(10)
inahull(ahull.obj, x, y)
```

plot.delvor	<i>Voronoi tessellation/Delaunay triangulation plot</i>
-------------	---

Description

Plot of an object "del.vor" with a "tri.mod" tri object.

Usage

```
## S3 method for class 'delvor'
plot(x, add = FALSE, wlines = c("both", "del", "vor"),
     wpoints = TRUE, number = FALSE, col = NULL, xlim = NULL,
     ylim = NULL, ...)
```

Arguments

<code>x</code>	object of class <code>del.vor</code> .
<code>add</code>	if TRUE the plot is added to the active graphic window.
<code>wlines</code>	a string specifying what has to be plotted: <ul style="list-style-type: none"> • "vor": shows the Voronoi tessellation; • "del": shows the Delanuay triangulation plot; • "both": shows both of the above structures.
<code>wpoints</code>	if true, the sites are added to the plot.
<code>number</code>	if true, the plot shows the indeces of the sites between their locations.
<code>col</code>	specifies in a vector the colors to be used for the different objects to be plotted and the order is: <ul style="list-style-type: none"> • <code>col[1]</code> -> color of the points; • <code>col[2]</code> -> color of Delanuay triangulation; • <code>col[3]</code> -> color of Voronoi tessellation • <code>col[4]</code> -> color for the numbers <p>Alternatively just one color can be provided.</p>
<code>xlim</code>	x axis limits.
<code>ylim</code>	y axis limits.
<code>...</code>	graphical arguments to be passes to methods (see par)

See Also[delvor](#)**Examples**

```
x = runif(10)
y = runif(10)
del.vor = delvor(x, y)

plot.delvor(vor.del, wlines = "both", wpoints = FALSE, number = TRUE,
            col = c("black", "blue", "red", "black"))
```


Index

*Topic **Delanuay**

RcppAlphahull-package, [2](#)

*Topic **Voronoi**

RcppAlphahull-package, [2](#)

*Topic **diagram,**

RcppAlphahull-package, [2](#)

*Topic **tesselation**

RcppAlphahull-package, [2](#)

ahull, [2](#), [5](#), [7](#)

ashape, [3](#), [3](#)

complement, [3](#), [4](#), [7](#)

delvor, [3](#), [4](#), [5](#), [8](#)

inahull, [7](#)

par, [8](#)

plot.delvor, [6](#), [7](#)

RcppAlphahull (RcppAlphahull-package), [2](#)

RcppAlphahull-package, [2](#)