Package ‘RcppAlphahull’

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Type Package

Title alpha-convex hull and alpha-shape computation.

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Description This package performs alpha-convex hull and alpha-shape computation using C++ code and a library, MyGAL, to compute the Voronoi tesselation/Delaunay triangulation of a finite set of points in the plane.

License GPL (>= 2)

Depends R (>= 3.4.4)

Imports Rcpp (>= 1.0.1)

LinkingTo Rcpp

SystemRequirements C++14

RoxygenNote 6.1.1

Encoding UTF-8

R topics documented:

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;
- `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, alpha = 0.8)
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 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 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 containes 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 tesselation/Delanuay triangulation*

Description

Computing Voronoi diagram and Delanuay tesselation 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 tesselation 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 tesselation 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 tesselation edge;
- `mx2` and `my2`: coordinates of the second extreme, e2, of the Voronoi tesselation edge;
- `bp1` and `bp2`: denote wether 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 indeces 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 tesselation 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` *Determines if the provided point fall inside the α-hull or not.*

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.onj` 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 *Voronoi tesselation/Delanuay triangulation plot*

Description

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

Usage

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

Arguments

`add` if TRUE the plot is added to the active graphic window.

`wlines` a string specifying what has to be plotted:

- "vor": shows the Voronoi tesselation;
- "del": shows the Delanuay triangulation plot;
- "both": shows both of the above structures.

`wpoints` if true, the sites are added to the plot.

`number` if true, the plot shows the indeces of the sites between their locations.

`col` specifies in a vector the colors to be used for the different objects to be plotted and the order is:

- col[1] -> color of the points;
- col[2] -> color of Delanuay triangulation;
- col[3] -> color of Voronoi tesselation
- col[4] -> color for the numbers

Alternatively just one color can be provided.

`xlim` x axis limits.

`ylim` y axis limits.

`...` graphical arguments to be passes to methods (see `par`)

`x` object of class del.vor.

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”))
```

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