Package 'TreeRingShape'

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Type Package

Title Recording Tree-Ring Shapes of Tree Disks with Manual Digitizing and Interpolating Model

Version 3.0.1

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Description Record all tree-ring Shapefile of tree disk with GIS soft ('Qgis') and interpolating model from high resolution tree disk image.

License GPL (>= 2)

Depends R (>= 3.6.2)

Imports methods,
sf

Suggests testthat (>= 3.0.0),
knitr,
rmarkdown

VignetteBuilder knitr

Encoding UTF-8

LazyData true

RoxygenNote 7.3.1

URL https://github.com/ishidamgm/TreeRingShape, https://ishidamgm.github.io/TreeRingShape/, https://www.sanchikanri.com/treering/TreeRingShape.html

BugReports https://github.com/ishidamgm/TreeRingShape/issues

Config/testthat/edition 3

R topics documented:

`area` *Return a area from polygon xy coordinates*

Description

Return a area from polygon xy coordinates

Usage

```
area(xy)
```

Arguments

`xy`	a atrix or data frame of xy coordinates

Value

a vector of polygon area

Examples

```
xy<-data.frame(x=c(0,1,2,1),y=c(1,2,1,0))
plot(xy,type="b") ; polygon(xy)
area(xy)
```

`circumference` *Return circumference length of polygon line*

Description

Return circumference length of polygon line

Usage

```
circumference(l.)
```

Arguments

`l.`	data frame of line coordinates (x,y)

Value

a numeric of circumference length of polygon line

Examples

```
l. <- data.frame(x=c(0,0,1,1),y=c(0,1,1,0))
plot(l.,type="b") ; polygon(l.)
circumference(l.)
```

`classTreeRingShape-class` *class of TreeRingShape*

Description

class of TreeRingShape

Slots

`P_filename` character. file name of shape file (P) for tree ring points

`P_id.tag` character. column name of id in shape file (P), default is 'id'

`P_ring.tag` character. column name of ring no.(ordinaly year,outermost=0) in shape file (P), default is 'ring'

`P` data.frame. radial tree ring points (x,y,id,yr,r,deg)

`P00` numeric. x,y coordinates c(px00,py00) of tree ring center point, ordinarily a pith in a disk, a point of id==0 in P

`n_id` numeric. number of radial measurement points, length(unique(P$id))-1 (omit a original point id=0)

`YR_P` numeric. total number of tree rings, unique(P$ring)

`L_filename` character. file name of shape file (L) for tree ring lines

`L_ring.tag` character. column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'

`L` list. x,y coordinates of representative tree rings

`L_` data.frame. x,y coordinates of representative tree rings

`YR_L` numeric. cumulative tree rings number(year) from 0 (cambium layer) of L =dbf$ring, names(L)

`ln` numeric. total number of representative tree rings, length(L)

`L2_filename` character. file name of shape file (L2) for tree ring lines interpolated

`L2` list. x,y coordinates of representative + interpolated tree rings

`n_YR` numeric. total number of representative + interpolated tree rings = unique(P$yr), length(L2)

Examples

```
TR. <- new('classTreeRingShape')
TR.
slotNames(TR.)
str(TR.)
```

degree — *Constant for conversion from degree to radian ####*

Description

Constant for conversion from degree to radian ####

Usage

```
degree
```

Format

An object of class `numeric` of length 1.

dst — *Return a vector of distances from original a point (0,0) from a matrix or data frame of xy coordinates*

Description

Return a vector of distances from original a point (0,0) from a matrix or data frame of xy coordinates

Usage

```
dst(xy)
```

Arguments

`xy`	a matrix or data frame of xy coordinates

Value

a vector of distances from original a point

Examples

```
plot(TR@L[[1]])
plot(dst(TR@L[[1]]))
```

dstpp *Return vector for distance between adjacent two points*

Description

Return vector for distance between adjacent two points

Usage

```
dstpp(x, y)
```

Arguments

x	vector of x coordinates
y	vector of y coordinates

Value

vector for distance between adjacent two points

Examples

```
l.<-TR@L[[1]]
plot(l.)
x<-l.[,1] ;y<-l.[,2]
dstpp(x,y)
```

Ldeg360 *Return a vector of center angle 0 to 360(degree) for x y coordinate vector*

Description

Return a vector of center angle 0 to 360(degree) for x y coordinate vector

Usage

```
Ldeg360(x, y)
```

Arguments

x	a vector of x coordinates
y	a vector of y coordinates

Value

a vector of center angle 0 to 360(degree) for x y coordinate vector

Examples

```
xy <-TR@L[[1]]
plot(Ldeg360(xy[,1],xy[2]))
```

`Llist2dataframe` *Convert from a list of tree rings polygons (L) to data frame to a data frame with no.,year,x,y,r(radius),radian(center angle),degree. The data frame is sorted by degree(0 to 360).*

Description

Convert from a list of tree rings polygons (L) to data frame to a data frame with no.,year,x,y,r(radius),radian(center angle),degree. The data frame is sorted by degree(0 to 360).

Usage

```
Llist2dataframe(L)
```

Arguments

`L`	list of tree ring lines

Value

data frame

Examples

```
L_ <- Llist2dataframe(TR@L)
head(L_) ; tail(L_)
```

`Lmove` *Move the tree rings coordinates based on P00 (x,y movement coordinates).*

Description

Move the tree rings coordinates based on P00 (x,y movement coordinates).

Usage

```
Lmove(L, P00 = P00)
```

Arguments

L	a list of tree rings(x,y coordinates).
P00	x, y coordinates of a center point (usually a pith).

Value

moved L to center point 0,0

Examples

```
Lplot(TR@L)
sapply(Lmove(TR@L,c(3000,-3000)),lines,col="blue")
```

Lplot *Plot a graphics of tree rings*

Description

Plot a graphics of tree rings

Usage

```
Lplot(L, rn = 1:length(L), col = "red", ...)
```

Arguments

L	a list of tree rings polygon coordinates (X,Y)
rn	vector of ring number of list (L), default 1:length(L)
col	color of plot
...	other parameters to be passed through to plotting functions

Examples

```
Lplot(TR@L,main=TR@L_filename)
Lplot(TR@L,rn=1:20,col='blue',main=TR@L_filename)
```

Lplot2 *Draw a graphics of tree rings by 1 ring (3*3 in a screen)*

Description

Draw a graphics of tree rings by 1 ring (3*3 in a screen)

Usage

```
Lplot2(L, i.ring = 1:length(L), nrow = 3, ncol = 3, ask = "FALSE", ...)
```

Arguments

L	a list of tree rings polygon coordinates (X,Y)
i.ring	integer vector, tree ring number for drawing
nrow	par(mfrow=c(nrow,ncol))
ncol	par(mfrow=c(nrow,ncol))
ask	logical; if TRUE, the user is asked before each plot
...	other parameters to be passed through to plotting functions.

Examples

```
Lplot2(TR@L,i.ring=1:9, nrow=1,ncol=1,type='b')
Lplot2(TR@L,type='b')
```

Lrad.plot *Check center angle of points to input order*

Description

Check center angle of points to input order

Usage

```
Lrad.plot(L, i.ring = 1:9)
```

Arguments

L	list of tree rings
i.ring	integer vector, tree ring number for drawing

Examples

```
slotNames(TR)
Lplot(TR@L)
str(TR@L)
Lrad.plot(TR@L,11:19)
```

`Lrn` *Return a ring number of tree ring polygons list (L) from year*

Description

Return a ring number of tree ring polygons list (L) from year

Usage

```
Lrn(L, yr)
```

Arguments

`L`	tree ring polygons list (L)
`yr`	years (or rings)

Value

a ring number of tree ring polygons list (L)

Examples

```
Lrn(TR@L,8)  # 8 is the formation year (from outermost) of the tree ring
```

`Lsort` *Sort x,y coordinates of a tree ring line with center angle of each point*

Description

Sort x,y coordinates of a tree ring line with center angle of each point

Usage

```
Lsort(l.)
```

Arguments

`l.`	x,y coordinates matrix (ncol=2) or data.frame of an tree ring.

Value

ordered with center angle of each point

Examples

```
i<-seq(0,2*pi,0.1)
l.<-data.frame(x=sin(i),y=cos(i))
l.[10,]<-l.[20,]
plot(l.,type="b")
plot(Lsort(l.),type="b")
```

`Lsort_all` *Sort x,y coordinates of tree ring lines with center angle of each point apply Lsort to list of tree ring lines*

Description

Sort x,y coordinates of tree ring lines with center angle of each point apply Lsort to list of tree ring lines

Usage

```
Lsort_all(L)
```

Arguments

`L`	a list of tree ring lines (x,y)

Value

a list of tree ring lines (x,y) ordered with center angle of each point

Examples

```
str(Lsort_all(TR@L))
```

new_classTreeRingShape *Initial setting of a new classTreeRingShape (TR)*

Description

Initial setting of a new classTreeRingShape (TR)

Usage

```
new_classTreeRingShape(
  P_filename,
  L_filename,
  L2_filename,
  P_id.tag = "id",
  P_ring.tag = "ring",
  L_ring.tag = "ring"
)
```

Arguments

P_filename	file name of shape file (P) for tree ring points
L_filename	file name of shape file (L) for tree ring lines
L2_filename	file name of shape file (L2) for tree ring lines interpolated
P_id.tag	column name of id in shape file (P), default is 'id'
P_ring.tag	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'
L_ring.tag	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'

Value

generated new object from classTreeRingShape

Examples

```
## Not run:
(wd. <- getwd())
setwd('../Abies_277_h400')
dir()
TR.<-new_classTreeRingShape(
P_filename='Abies_277_h400_TreeRing_Points.shp',
L_filename='Abies_277_h400_TreeRing_Representative.shp',
L2_filename='Abies_277_h400_TreeRing.shp',
P_id.tag='id',
P_ring.tag='ring',
L_ring.tag='ring')
```

```
TR.
slotNames(TR.)
str(TR.)


## End(Not run)
```

---

nstP *Return a vector of row numbers of points that have nearest center angle*

Description

Return a vector of row numbers of points that have nearest center angle

Usage

```
nstP(z1, z2)
```

Arguments

z1	a data frame or a matrix of xy coordinates of a tree ring (usualy inner ring)
z2	a data frame or a matrix of xy coordinates of a tree ring (usualy outer ring)

Value

a vector of row numbers of z2, the length is nrow(z1)

Examples

```
L_out<-TR@L[[1]];L_in<-TR@L[[30]]
np<-nstP(L_out,L_in)
plot(L_out,col="red"); points(L_in)
segments(L_out[,1],L_out[,2],L_in[np,1],L_in[np,2],col="blue")
```

`plot_TreeRing` *Draw a plot of tree rings This function draws Tree rings of a disk from x, y list(x,y) with name of year.*

Description

Draw a plot of tree rings This function draws Tree rings of a disk from x, y list(x,y) with name of year.

Usage

```
plot_TreeRing(L, year = 0, ...)
```

Arguments

`L`	list(x,y) of Tree ring coordinates with name of year
`year`	name of column of Tree ring year (0(cambium),1,2,....,n(pith))
`...`	other parameters to be passed through to plotting functions

Examples

```
names(TR@L)
plot_TreeRing(TR@L)
plot_TreeRing(TR@L,year=10,type='l',col='blue')
```

`plot_TreeRings_df` *Plot tree rings from data fame This function draws Tree rings of a disk from data frame(x,y,year).*

Description

Plot tree rings from data fame This function draws Tree rings of a disk from data frame(x,y,year).

Usage

```
plot_TreeRings_df(df, year_label = "yr")
```

Arguments

`df`	name of a data frame
`year_label`	name of column of Tree ring year (0(cambium),1,2,....,n(pith))

See Also

`Llist2dataframe` for the data frame

Examples

```
TR@L_ <- Llist2dataframe(TR@L)     # data frame of tree rings
names(TR@L_)
plot_TreeRings_df(TR@L_)
```

`plot_TreeRing_df` *plot_TreeRing_df Draw a Tree ring of a disk from data frame(x,y,year)*

Description

plot_TreeRing_df Draw a Tree ring of a disk from data frame(x,y,year)

Usage

```
plot_TreeRing_df(df, year = 0, year_label = "yr")
```

Arguments

df	name of a data frame
year	integer vector of years to draw tree rings
year_label	name of column of Tree ring year (0(cambium),1,2,....,n(pith))

Examples

```
TR@L_ <- Llist2dataframe(TR@L)     # data frame of tree rings
plot_TreeRing_df(TR@L_, year =1)
```

`plot_year_RingArea` *Plot and return data frame of year_disk area and year_Tree ring area*

Description

Plot and return data frame of year_disk area and year_Tree ring area

Usage

```
plot_year_RingArea(L2, yr_end = 2018)
```

Arguments

L2	list of tree rings
yr_end	outermost year of tree ring

Value

list of Year_DiskArea and Year_TreeRingArea

See Also

TreeRingsInterpolation

Examples

```
## Not run:
plot_year_RingArea(TR@L2,2018)

## End(Not run)
```

---

rdst *Return relative distance between two representative tree rings*

Description

Return relative distance between two representative tree rings

Usage

```
rdst(L, P, yr)
```

Arguments

L	list of x,y coordinates of representative tree rings (TR@L)
P	data.frame (x,y,id,yr,r,deg) of radial tree ring points (TR@P)
yr	year

Value

a data frame with relative distance and center angle

Examples

```
rdst.<-rdst(TR@L,TR@P,73)
plot(rdst.)
spline<-smooth.spline(rdst.$rad,rdst.$rdst, spar =0.0002)
lines(predict(spline,seq(-pi,pi,0.01)),col="red")
```

rdst_MerginePlus *Return relative distance between two representative tree rings*

Description

Return relative distance between two representative tree rings

Usage

```
rdst_MerginePlus(L, P, yr)
```

Arguments

L	is a list of tree rings(x,y coordinates).
P	data.frame (x,y,id,yr,r,deg) of radial tree ring points (TR@P)
yr	integer of year

Value

a data frame with relative distance and center angle(degree) with mergine (-90 - 0 - 360 - 90)

Examples

```
year.<-73
rdst.<-rdst_MerginePlus(TR@L,TR@P,year.)
plot(rdst.,xlim=c(-200,200),main=year.)
spline<-smooth.spline(rdst.$deg,rdst.$rdst, spar =0.0002)
lines(predict(spline,seq(-202,220,1)),col="red")
```

ReadShapefile_P00 *Return x,y coordinates of a tree ring center point (P00) from shape file of tree ring points*

Description

Return x,y coordinates of a tree ring center point (P00) from shape file of tree ring points

Usage

```
ReadShapefile_P00(
  filename = "Abies_277_h400_TreeRing_Points.shp",
  id.tag = "id",
  ring.tag = "ring"
)
```

Arguments

filename	a shape file name of Tree ring points
id.tag	string, column name of id (attribute table)
ring.tag	string, column name of ring years (0 is cambium layer)

Value

numeric : x,y coordinates of a tree ring center point (P00)

Examples

```
# This example NOT be run examples
## Not run:
# read a original point P00 ####
filename <- '../Abies_277_h400/Abies_277_h400_TreeRing_Points.shp'
ReadShapefile_P00(filename)

## End(Not run)
```

ReadShapefile_TreeRingPoints

Read a shape file of Tree Ring Points (P : radial input and correction points)

Description

Read a shape file of Tree Ring Points (P : radial input and correction points)

Usage

```
ReadShapefile_TreeRingPoints(
  filename = "Abies_277_h400_TreeRing_Points.shp",
  id.tag = "id",
  ring.tag = "ring"
)
```

Arguments

filename	a file name of Tree ring points (shape file)
id.tag	string, column name of id (attribute table)
ring.tag	string, column name of ring years (0 is cambium layer)

Value

a data frame of TreeRingPoints (radial input and correction points)

Examples

```
## Not run:

# sample data of 'Abies_277_h400' can be download from
#https://www.sanchikanri.com/treering/Abies_277_h400.zip

file.path <- '../Abies_277_h400/Abies_277_h400_TreeRing_Points.shp'
ReadShapefile_TreeRingPoints(file.path,id.tag='id',ring.tag='ring')


## End(Not run)
```

ReadShapefile_TreeRings

Read Shapefile_TreeRings

Description

Read Shapefile_TreeRings

Usage

```
ReadShapefile_TreeRings(
  filename = "Abies_277_h400_TreeRing_Representative.shp",
  ring.tag = "ring"
)
```

Arguments

filename	a file name(path) of shape file written to disk.
ring.tag	string, column name of ring years (0 is cambium layer)

Value

a list of tree ring lines

Examples

```
## Not run:
filename <- '../Abies_277_h400/Abies_277_h400_TreeRing_Representative.shp'
Lplot(ReadShapefile_TreeRings(filename))

## End(Not run)
```

seq_deg *Return a vector of sequence of angles between start and end angle 0 to pi -pi to 0*

Description

Return a vector of sequence of angles between start and end angle 0 to pi -pi to 0

Usage

```
seq_deg(deg1, deg2, deg.by = 1)
```

Arguments

deg1	start angle
deg2	end angle
deg.by	step of sequence

Value

vector of sequence of angles between start and end angle

Examples

```
seq_deg(170,-170,.5)
```

TR *A sample object of class TreeRingShape*

Description

The data set contains tree ring shape data for Abies_277_h400 sampled from Tateyama, central Japan. Its disk image and shape files can be download from https://www.sanchikanri.com/treering/Abies_277_h400.zip It's intended to demonstrate the structure and use of 'TreeRingShape' class objects within the package.

Usage

```
TR
```

Format

An object of class classTreeRingShape of length 1.

Examples

```
# Access basic information about the TreeRingShape object
slotNames(TR)
str(TR)
# Plot the tree ring shape data
Lplot(TR@L)
```

`TreeRingIndex` *Calculate tree ring index from chronosequence data (year,growth)*

Description

Calculate tree ring index from chronosequence data (year,growth)

Usage

```
TreeRingIndex(ya, spar = 0.8)
```

Arguments

`ya`	data frame of chronosequence data (year,growth)
`spar`	smoothing parameter of spline curve

Value

list spline ; fitting parameter of Spline curve , idx ; data.frame(year,TreeRingIndex)

References

Cook, E., & Peters, K. (1981). The smoothing spline, a new approach to standardising forest interior tree-ring.Trre-ring Bulletin, 41, 45–53.

See Also

`TreeRingsInterpolation`

Examples

```
## Not run:
ya <- plot_year_RingArea(TR@L2, 2018)$Year_TreeRingArea
plot(ya,type='b')
tri. <- TreeRingIndex(ya)
lines(tri.$spline,col='red',lw=2)
plot(tri.$idx,type='b')
abline(h=1,col='red')

## End(Not run)
```

`TreeRingShape` *Construct a object (TR) of classTreeRingShape*

Description

Construct a object (TR) of classTreeRingShape

Usage

```
TreeRingShape(
  P_filename,
  L_filename,
  L2_filename,
  P_id.tag = "id",
  P_ring.tag = "ring",
  L_ring.tag = "ring"
)
```

Arguments

`P_filename`	file name of shape file (P) for tree ring points (without extention)
`L_filename`	file name of shape file (L) for tree ring lines (without extention)
`L2_filename`	file name of shape file (L2) for tree ring lines interpolated (without extention)
`P_id.tag`	column name of id in shape file (P), default is 'id'
`P_ring.tag`	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'
`L_ring.tag`	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'

Value

generated new object from classTreeRingShape

Examples

```
## Not run:

# sample data enable to download from
# https://www.sanchikanri.com/treering/Abies_277_h400.zip
setwd('../Abies_277_h400') #set working directory with shape files
TR.<-TreeRingShape(
P_filename='Abies_277_h400_TreeRing_Points.shp',
L_filename='Abies_277_h400_TreeRing_Representative.shp',
L2_filename='Abies_277_h400_TreeRing.shp',
P_id.tag='id',P_ring.tag='ring',
L_ring.tag='ring')
```

```
TR.
slotNames(TR.)
str(TR.)
Lplot(TR.@L2)


## End(Not run)
```

`TreeRingsInterpolation` *Interpolates tree ring between representative (manual input) tree rings with tree ring points*

Description

Interpolates tree ring between representative (manual input) tree rings with tree ring points

Usage

```
TreeRingsInterpolation(TR)
```

Arguments

TR	object of classTreeRingShape (without tree ring interpolated)

Value

TR object of classTreeRingShape (with tree ring interpolated)

Examples

```
slotNames(TR)
TR <- TreeRingsInterpolation(TR)
ya <- plot_year_RingArea(TR@L2, 2018)$Year_TreeRingArea
plot(ya,type='b')
tri. <- TreeRingIndex(ya)
lines(tri.$spline,col='red',lw=2)
plot(tri.$idx,type='b')
abline(h=1,col='red')
```

TreeRingsLines *Read representative tree ring lines from shape files*

Description

Read representative tree ring lines from shape files

Usage

```
TreeRingsLines(TR)
```

Arguments

TR	a tree ring class (classTreeRingShape)

Value

TR (TreeRing class TR@L<-L ; TR@L_<-L_ ; TR@YR_L <-YR_L ; TR@ln <- ln)

Examples

```
 ## Not run:
 setwd('../Abies_277_h400') #set working directory with shape files
 TR <- TreeRingsLines(TR)

## End(Not run)
```

TreeRingsPoints *Read TreeRingsPoints shape file, check and save parameters*

Description

Read TreeRingsPoints shape file, check and save parameters

Usage

```
TreeRingsPoints(TR)
```

Arguments

TR	a tree ring class (classTreeRingShape) #@return a list of (P,P00,YR_P,n_id,YR_P,n_YR)

Examples

```
## Not run:
 setwd('../Abies_277_h400') #set working directory with shape files
 TreeRingsPoints(TR)
#'
## End(Not run)
```

WriteShapefile_TreeRings

Write a shapefile of interpolated tree rings

Description

Write a shapefile of interpolated tree rings

Usage

```
WriteShapefile_TreeRings(L2, filename = "test.shp")
```

Arguments

L2	is as list of Tree ring polygons (X, Y)
filename	is a shape file(path) name written to disk.

Examples

```
## Not run: #'
WriteShapefile_TreeRings (TR@L2, tempfile("TreeRingShape_test",fileext = ".shp"))
dir(tempdir())

## End(Not run)
```

Index