4.8 Local Convex Hull (LoCoH)

Manual of Applied Spatial Ecology

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Local convex hull nonparametric kernel method (LoCoH), which generalizes the minimum convex polygon method, produces bounded home ranges and better convergence properties than parametric kernel methods as sample size increases (Getz et al. 2007, Getz and Wilmers 2004). The use of LoCoH also has been investigated for identifying hard boundaries (i.e. rivers, canyons) of home ranges because it is essentially a non-parametric kernel method using minimum convex polygon construction. The use of polygons instead of kernels gives LoCoH the ability to produced hard edges or boundaries that will not overlap into unused spaces common to kernel methods (Getz et al. 2007). Without getting into to much detail, LoCoH has 3 modifications that reference the k-nearest neighbor convex hulls (NNCH) in some form. The 3 terms are fixed k, fixed radius (r-NNCH), and adaptive (a-NNCH) that are comparable to kernel smoothing of href, lscv, and plug-in, respectively.

1. Exercise 4.8 - Download and extract zip folder into your preferred location

2. Set working directory to the extracted folder in R under Session - Set Working Directory…

3. Now open the script "Locohscript.Rmd" and run code directly from the script

4. First we need to load the packages needed for the exercise

```
library(adehabitatHR)
library(rgdal)
```

5. Now let's have a separate section of code to include projection information we will use throughout the exercise. In previous versions, these lines of code were within each block of code

```
utm17.crs <- CRS("+proj=utm +zone=17N +ellps=WGS84")
```

```
## Warning in showSRID(uprojargs, format = "PROJ", multiline = "NO", prefer_proj
## = prefer_proj): Discarded datum Unknown based on WGS84 ellipsoid in Proj4
## definition
```

6. Run code directly from the script

```
#Get input file
panther <- read.csv("pantherjitter2.csv")
panther$CatID <- as.factor(panther$CatID)

#Or explore with one panther with 381 relocations
cat159 <- subset(panther, CatID=="159")
cat159$CatID <- factor(cat159$CatID)

#Get the relocation data from the source file
data.xy = cat159[c("x","y")]

xysp <- SpatialPoints(data.xy)
```

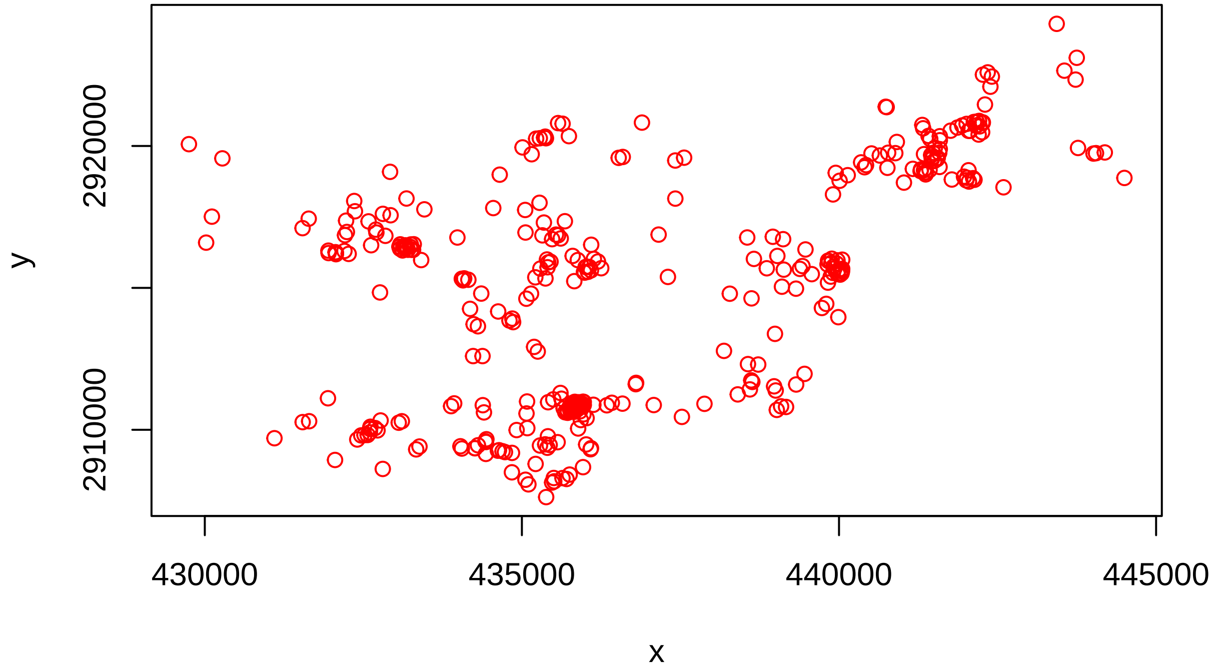
```
#Creates a Spatial Data Frame from
sppt<-data.frame(xysp)
#Creates a spatial data frame of ID
idsp<-data.frame(cat159[1])
#Adds ID and Date data frame with locations data frame
coordinates(idsp)<-sppt
proj4string(idsp) <- CRS("+proj=utm +zone=17 +ellps=WGS84")
```

```
## Warning in showSRID(uprojargs, format = "PROJ", multiline = "NO", prefer_proj
## = prefer_proj): Discarded datum Unknown based on WGS84 ellipsoid in Proj4
## definition
```

```
locsdf <-as.data.frame(idsp)
head(locsdf)
```

```
##      CatID        x       y
## 4310   159 435794.4 2910781
## 4311   159 435756.7 2910734
## 4312   159 435840.8 2910796
## 4313   159 435880.1 2910750
## 4314   159 435845.9 2910839
## 4315   159 435962.5 2910821
```

```
## Shows the relocations
plot(data.xy, col="red")
```

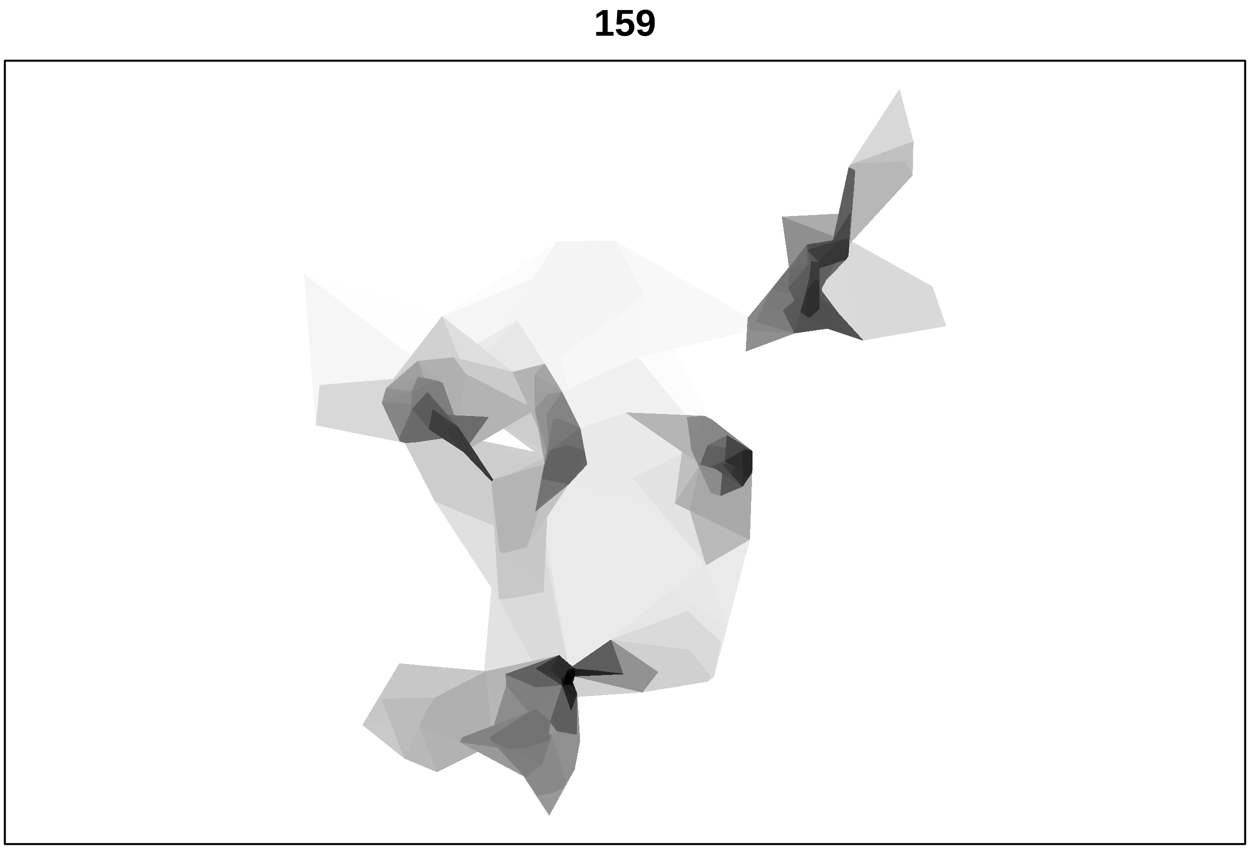


```
## Examinates the changes in home-range size for various values of k
## Be patient! the algorithm can be very long
```

```r
#LoC.area <- LoCoH.k.area(idsp, k=c(18:24))
## 24 points seems to be a good choice (rough asymptote for all animals)
## the k-LoCoH method:
nn <- LoCoH.k(idsp[,1], k=19)
```

```
## Warning in proj4string(xy): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(xy): Discarded datum Unknown based on WGS84 ellipsoid in Proj4 definition

## Warning in proj4string(xy): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html
```

```r
## Graphical display of the results
plot(nn, border=NA)
```



```r
## the object nn is a list of objects of class
## SpatialPolygonsDataFrame
length(nn)
```

```
## [1] 1
```

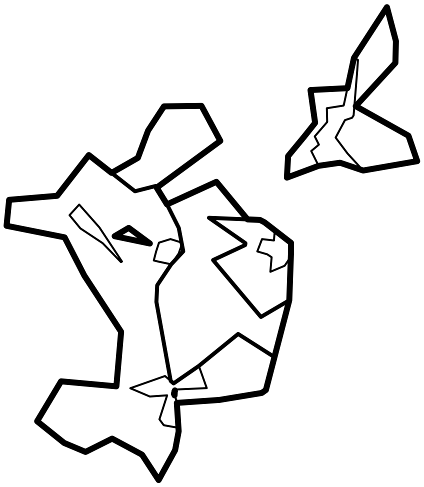
```r
names(nn)
```

```
## [1] "159"
```

```r
class(nn[[1]])
```

```
## [1] "SpatialPolygonsDataFrame"
## attr(,"package")
## [1] "sp"
```

```r
## The 95% home range is the smallest area for which the
## proportion of relocations included is larger or equal
## to 95% In this case, it is the 339th row of the
## SpatialPolygonsDataFrame.
plot(nn[[1]][339,],lwd=2)

#The 50% home range code is on line 146
plot(nn[[1]][146,],add=TRUE)

#The 99% home range code is on line 359
plot(nn[[1]][359,],lwd=3, add=TRUE)
```



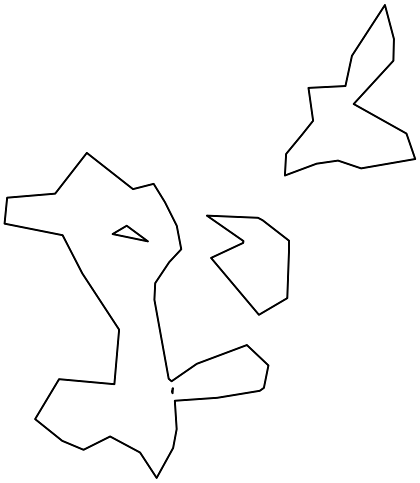
```r
#Save shapefiles of resulting home range
ver <- getverticeshr(nn)
```

```
## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(obj): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html
```

```r
ver
```

```
## Object of class "SpatialPolygonsDataFrame" (package sp):
##
## Number of SpatialPolygons:  1
##
## Variables measured:
##    id     area
## 1 159 5416.902
```

```
plot(ver)
```



```
#writeOGR(ver,dsn="FixedK",layer="FixedK24", driver = "ESRI Shapefile", overwrite=TRUE)
##Overwrite will not work so must edit path so "FixedK" folder is created with code below.
ver50 <-getverticeshr(nn, percent=50)
```

```
## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(obj): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html
```

```
#writeOGR(ver50,dsn="FixedK",layer="50FixedK24", driver = "ESRI Shapefile",overwrite=TRUE)
ver95 <-getverticeshr(nn, percent=95)
```

```
## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html
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## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(obj): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html
```

```
#writeOGR(ver95,dsn="FixedK",layer="95FixedK24", driver = "ESRI Shapefile",overwrite=TRUE)
ver99 <-getverticeshr(nn, percent=99)
```

```
## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(x[[1]]): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html

## Warning in proj4string(obj): CRS object has comment, which is lost in output; in tests, see
## https://cran.r-project.org/web/packages/sp/vignettes/CRS_warnings.html
```

```
#writeOGR(ver99,dsn="FixedK",layer="99FixedK24", driver = "ESRI Shapefile",overwrite=TRUE)
```