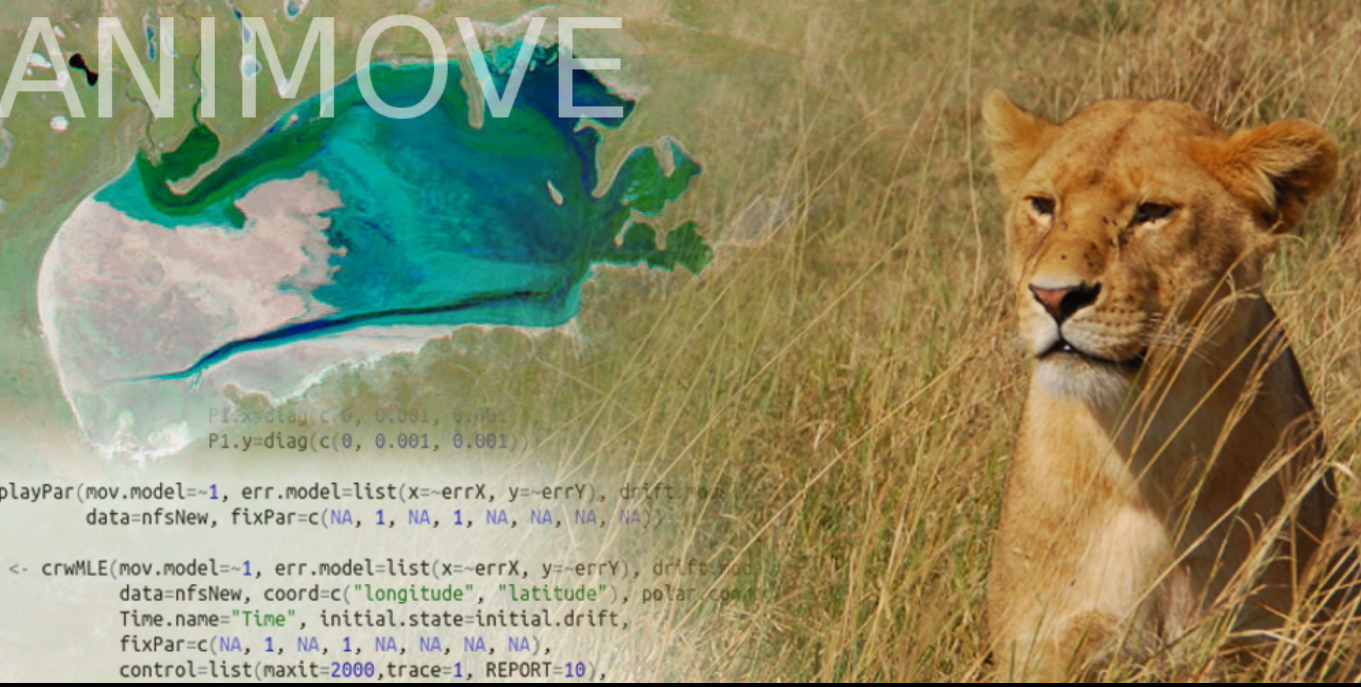
ANIMOVE
P1.y=diag(c(0, 0.001, 0.001))
playPar(mov.model=~1, err.model=list(x=~errX, y=~errY),
data=nfsNew, fixPar=c(NA, 1, NA, 1, NA, NA, NA, NA))
<- crwMLE(mov.model=~1, err.model=list(x=~errX, y=~errY),
data=nfsNew, coord=c("longitude", "latitude"),
Time.name="Time", initial.state=initial.drift,
fixPar=c(NA, 1, NA, 1, NA, NA, NA, NA),
control=list(maxit=2000,trace=1, REPORT=10),

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Movement data in R

Area centered analysis: space use

Concept of home range:
One of the fist definitions by Burt in 1943 [1]: "Area traversed by the individual in its normal activities of food gathering, mating, and caring for young. Occasional sallies outside the area, perhaps exploratory in nature, should not be considered as in part of the home range".
"Migratory animals have different home ranges during summer and winter, but migratory route is not part of a home range".
"Young adolescent animals often do a bit of wandering in search of a home region. During this time they do not have a home, nor a home range".

General understanding: "home range" is the area that an individual utilizes to maintain its own energetic and behavioral demands, due to technical and/or logistic limitations, the term "home range" nonetheless remains widely used and is often understood in a loose reference to the area a tagged individual was observed in during the time of the study period.

[1] Burt, W. H. (1943). Territoriality and home range concepts as applied to mammals. Journal of mammalogy, 24(3), 346-352.

Space use: MCP

MCP (Minimum Convex Polygon)

* polygon with the minimum area containing e.g. 95% of the points (MCP95)

\+ simple approach

- assumes independence between observations
- does not account for errors
- includes areas that maybe do not make sense
- intensity of space use is lost

Note: always reproject locations into equidistant projection before calculating MCP

Space use: KDE

KDE (Kernel-density estimation)

* calculates density of locations. Estimates the probability of encountering the animal given the independence of sampling.
- assumes independence between observations and regular sampling. Auto-correlation results in underestimating the area, often dramatically
- results highly dependent on the chosen h value

Space use: (t)-LoCoH

LoCoH (Local Convex-Hull)

* builds local MCP (Hulls) for each location with *k* neighbors, or in *r* radius, or in a *a* sum of distances
+ it takes into account that points are somewhat related
+ it excludes the areas that are not used
- choosing k, r or a values in non-trivial
- assumes independence between observations and regular sampling

t-LoCoH (Time Local Convex-Hull)

+ same as LoCoH but it includes distance and time component. Uses time-scaled distance to select nearest neighbors
- needs regular sampling
- choosing the correct s, k and a values is non-trivial

Space use: dBBMM

dBBMM (dynamic Brownian Bridge Movement Model)

* calculates the probability landscape for the transition between any two known consecutive locations given the amount of time it had available (assumes conditional random (Brownian) motion between locations)
* "dynamic" because it allows the variance to change along the trajectory (see Lesson 4)

\+ does not assume independence between locations

\+ irregular sampling is not a problem

! obtained area is highly scale dependent, it changes with sampling rate and with error of locations

Space use

Range distribution[2]:

- Lifetime space requirements of an animal ($\sim$ Home range)
- Provides a metric that should be comparable across individuals
- Ideally not affected by sample size and study duration (not the case for MPC, LoCoh and KDE)
- MCP, LoCoH, and KDE assume independent observations, but teleportation is not possible

* Targeted by MPC, LoCoH, KDE, **AKDE**(`ctmm`)

Occurrence distribution[2]:

- Estimates where an animal was located during the observation period
- Area cannot be compared across individuals (it would be comparing "lack of knowledge")
- Sensitive to sampling frequency but robust to data irregularity

* Targeted by dBBMM (`move`), ocurrence (`ctmm`)

[2] Fleming, et al. (2015). Rigorous home range estimation with movement data: a new auto-correlated kernel density estimator. Ecology, 96(5), 1182-1188.