SLU

Home range methods on indoor data

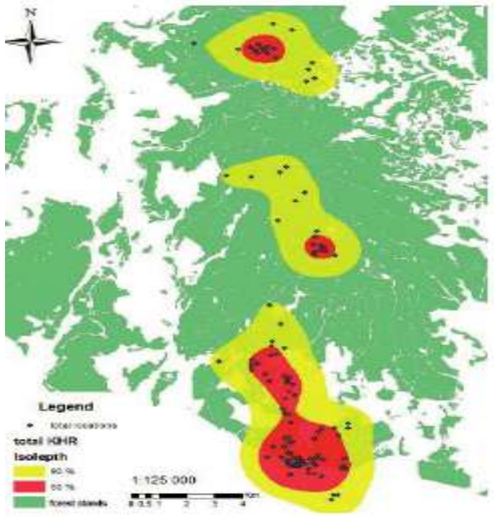
Hector Marina

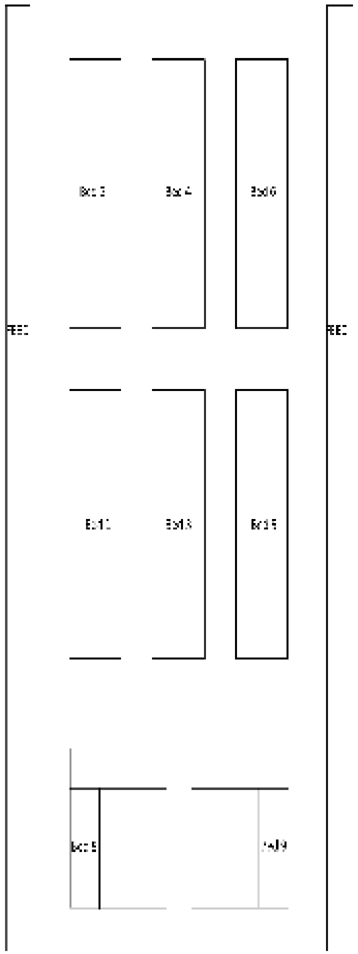
Brief introduction

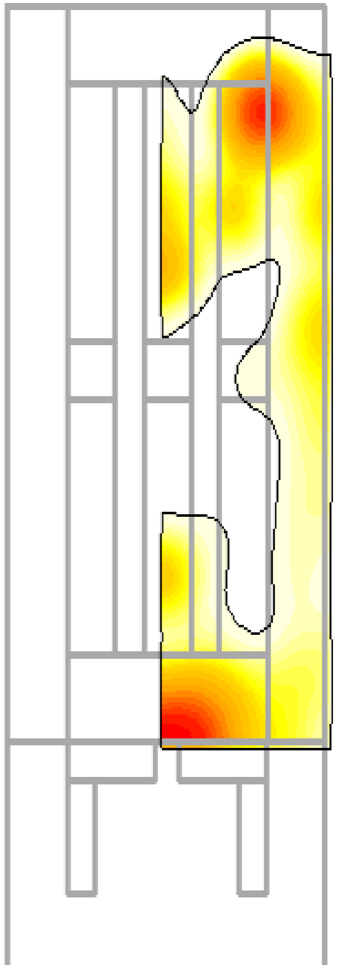
Home range:

- Area where it spends its time
- Encompasses all the resources the animal requires to survive and reproduce

(Burt, 1943)







Different methods

First-generation estimators

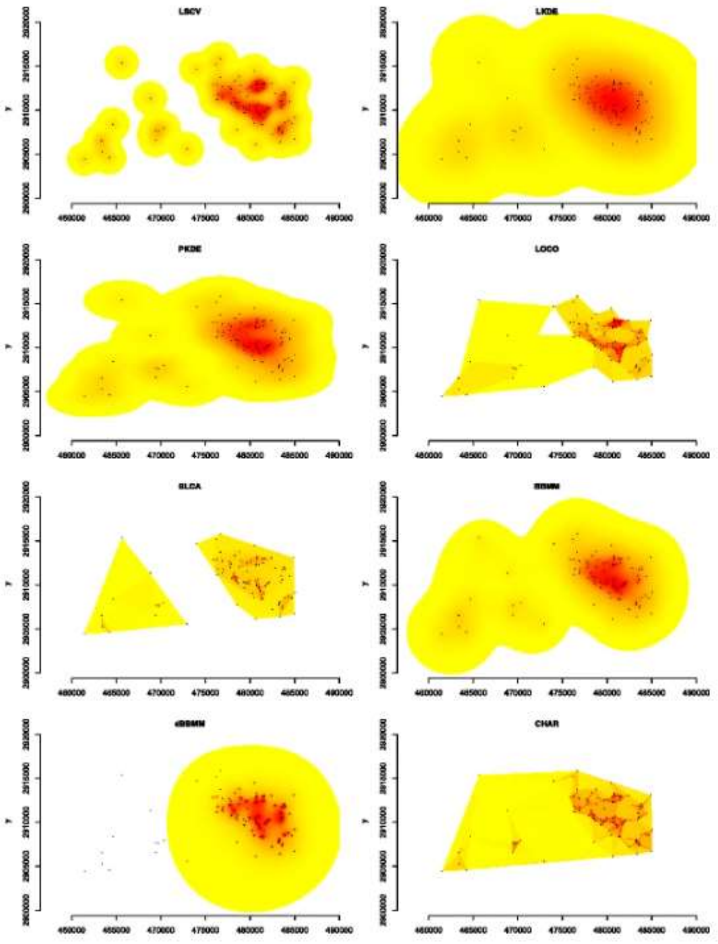
- Local convex hull
- Fixed kernel home range

Second-generation estimators

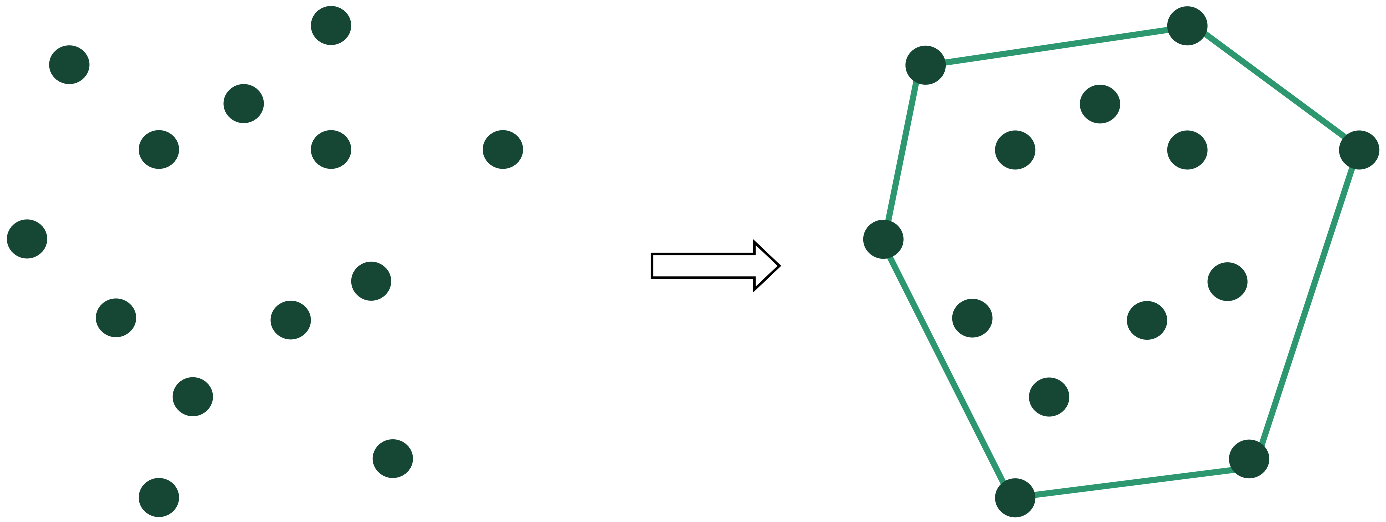
- Plug-in Kernel home range

Third generation estimators

- Movement-based kernel density estimator
- Brownian bridge movement model

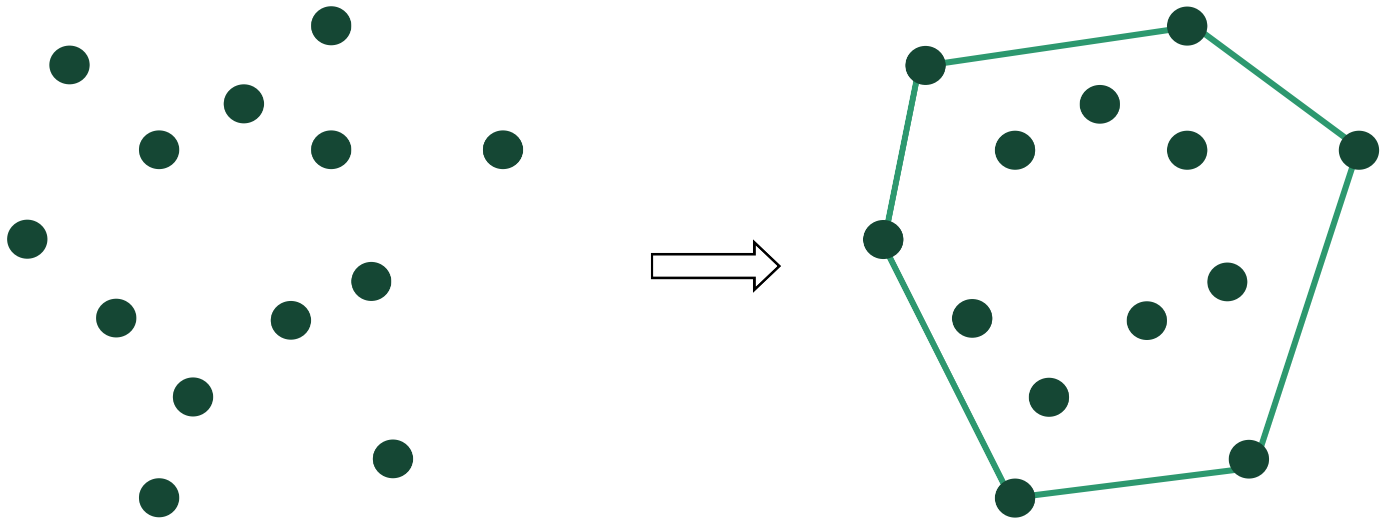


(Walter, 2015)



Minimum Convex Polygon

- Convex hull or convex envelope or convex closure



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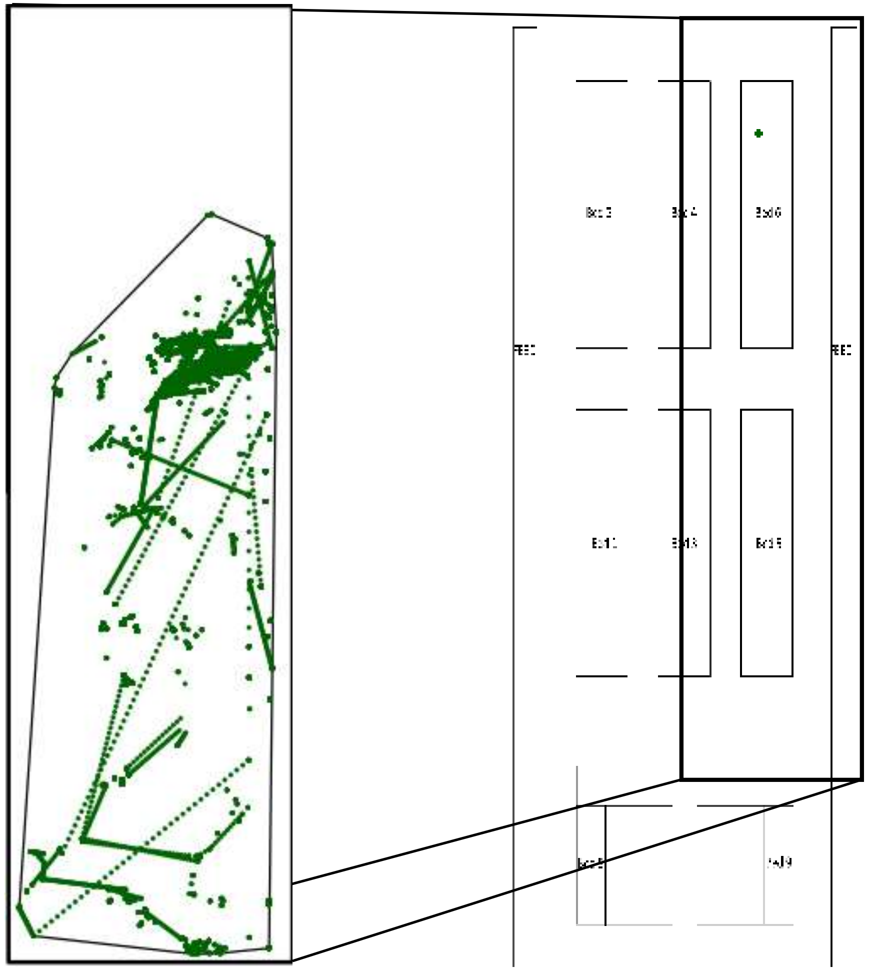

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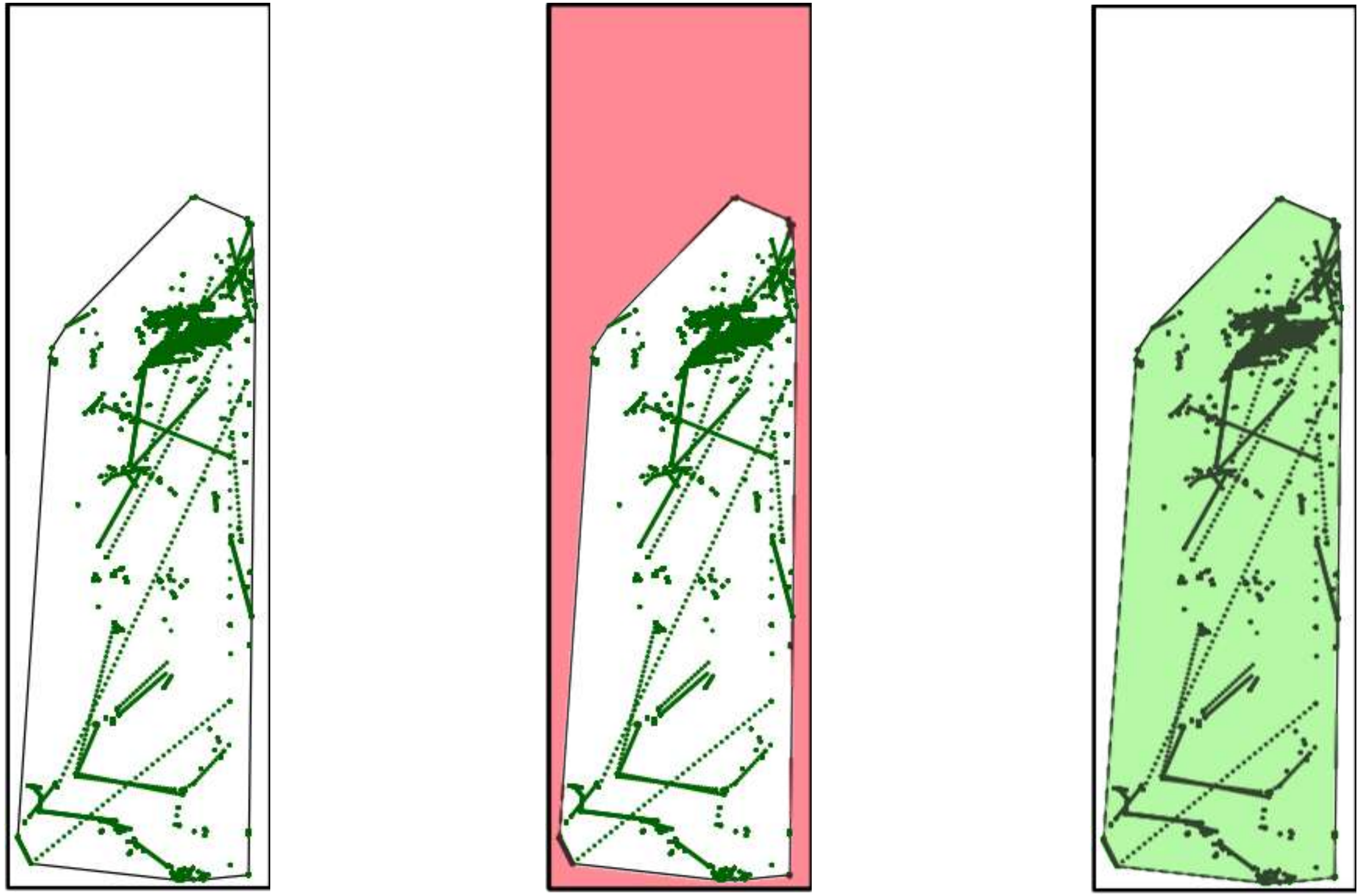
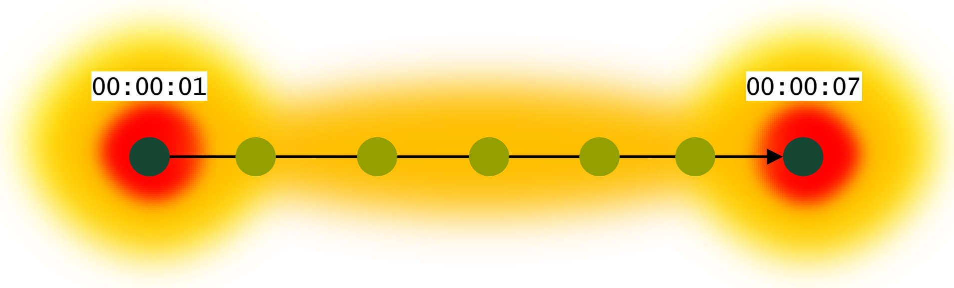
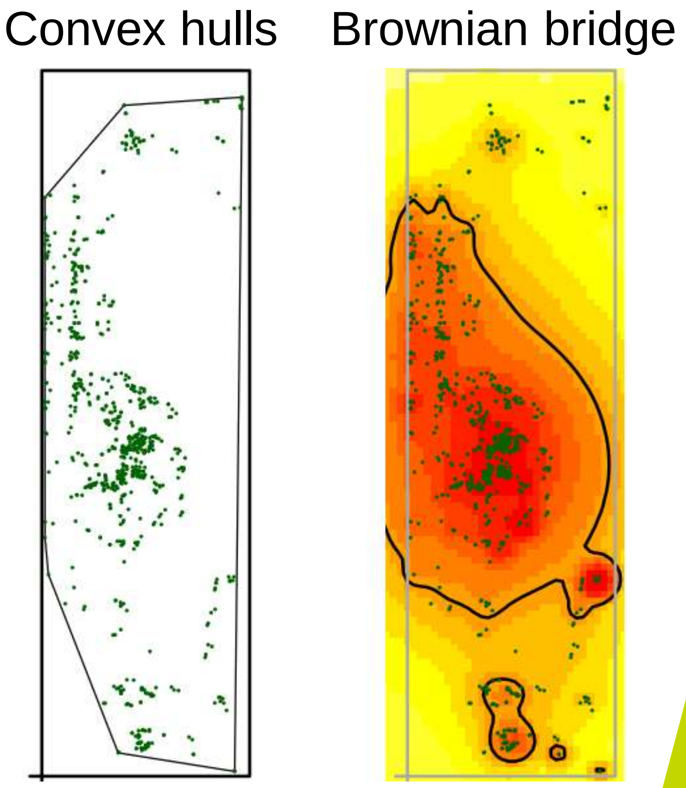


Utilization Distributions

- Brownian bridge movement model
  1. Sequential location data
  2. Estimated error
  3. Grid-cell size for utilization distribution

  – Paired locations becomes less realistic as the time interval increases





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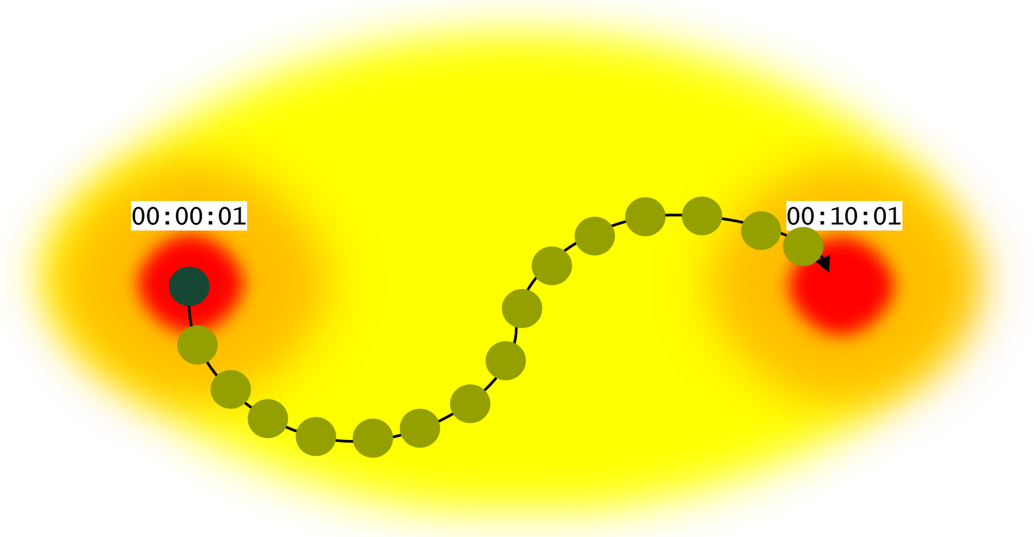
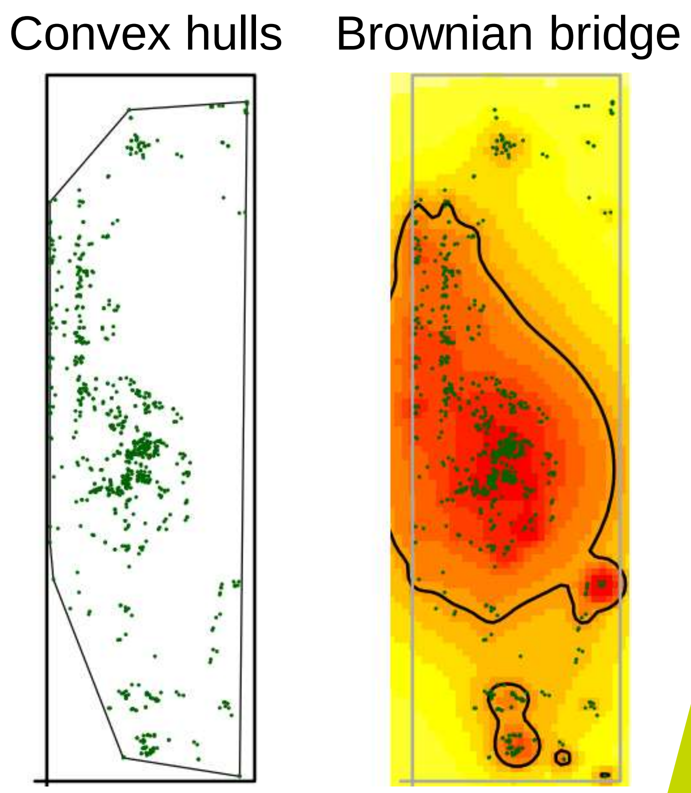




Utilization Distributions

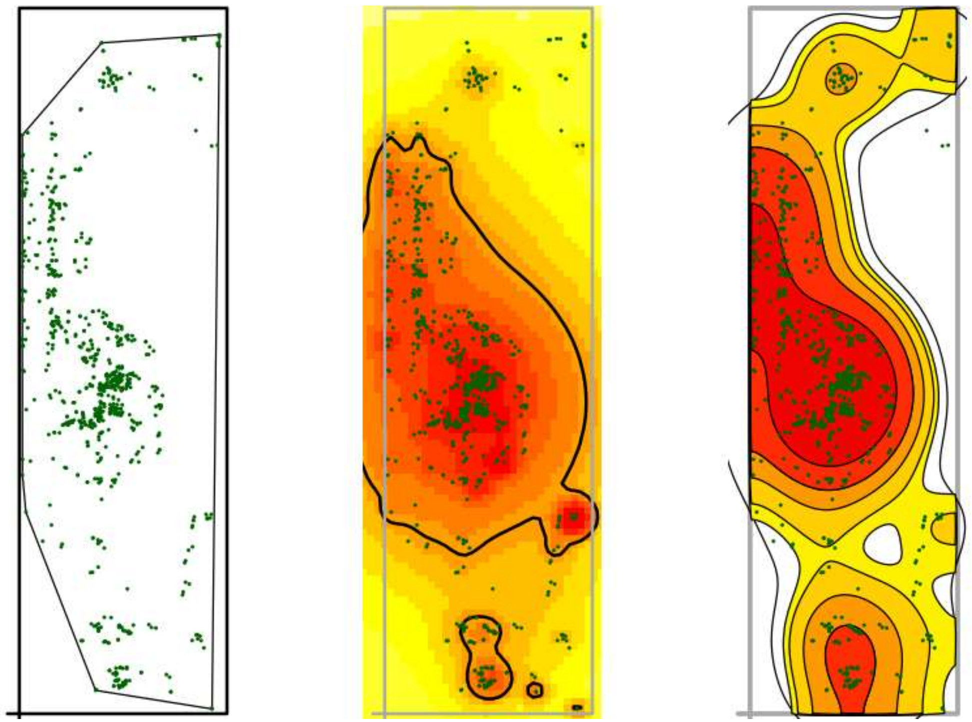
- Kernel density estimators
  - One of the most popular methods for measuring home ranges.
  - Several types of kernels
  - Similar results
  - Smoothing bandwidth (*ad hoc* method)

Number of data points

$$h = \sigma * n^{-1/6}$$

$$\boxed{\sigma^2 = 0.5(var(x) + var(y))}$$

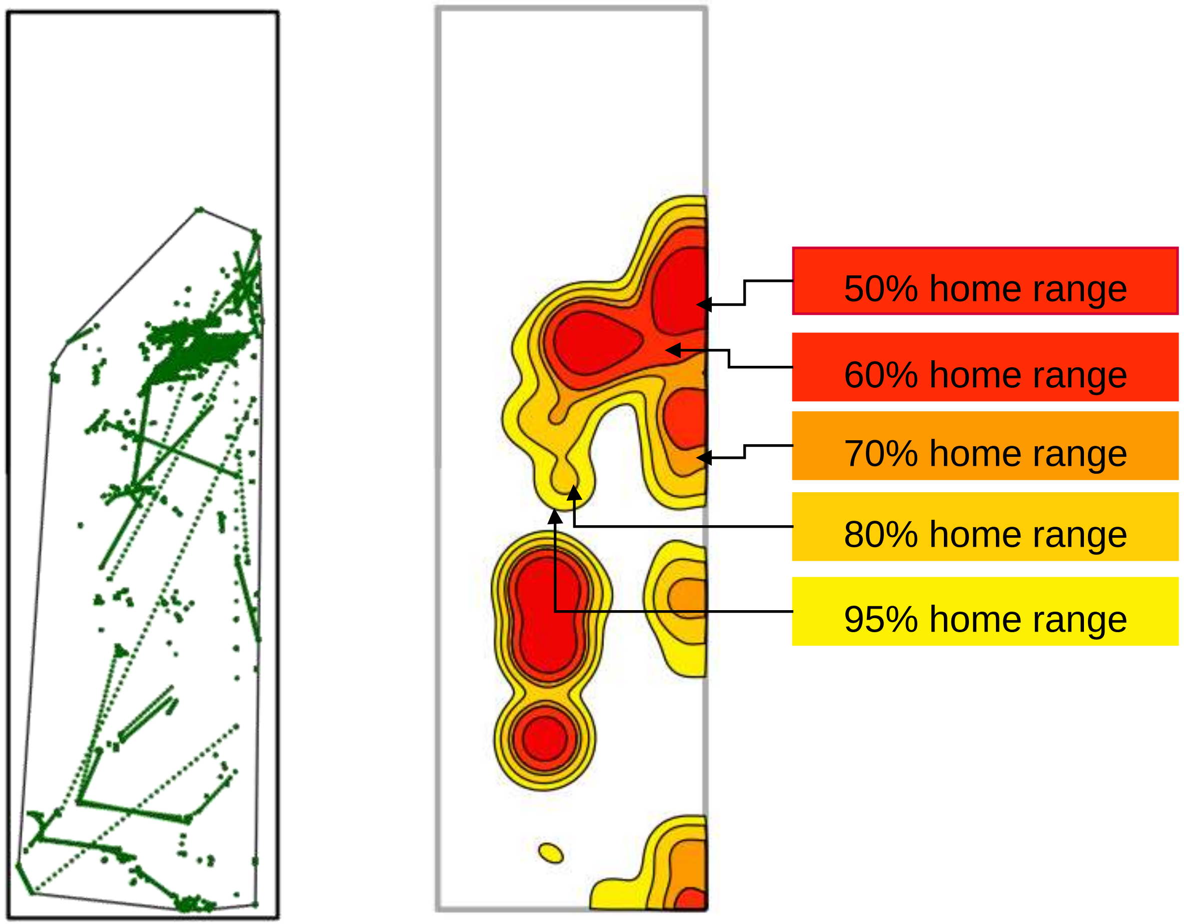
Convex hulls   Brownian bridge   Kernel



Krysten et al., (2014):
"*Examine the point distribution; justify the choice of smoothing parameter based on the objectives of the study.*"

Utilization Distributions

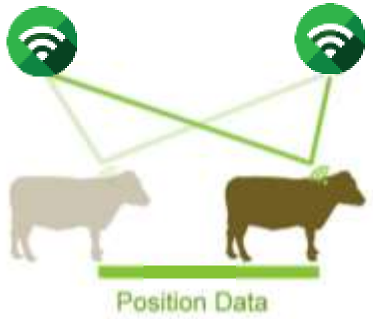
- Kernel density estimators

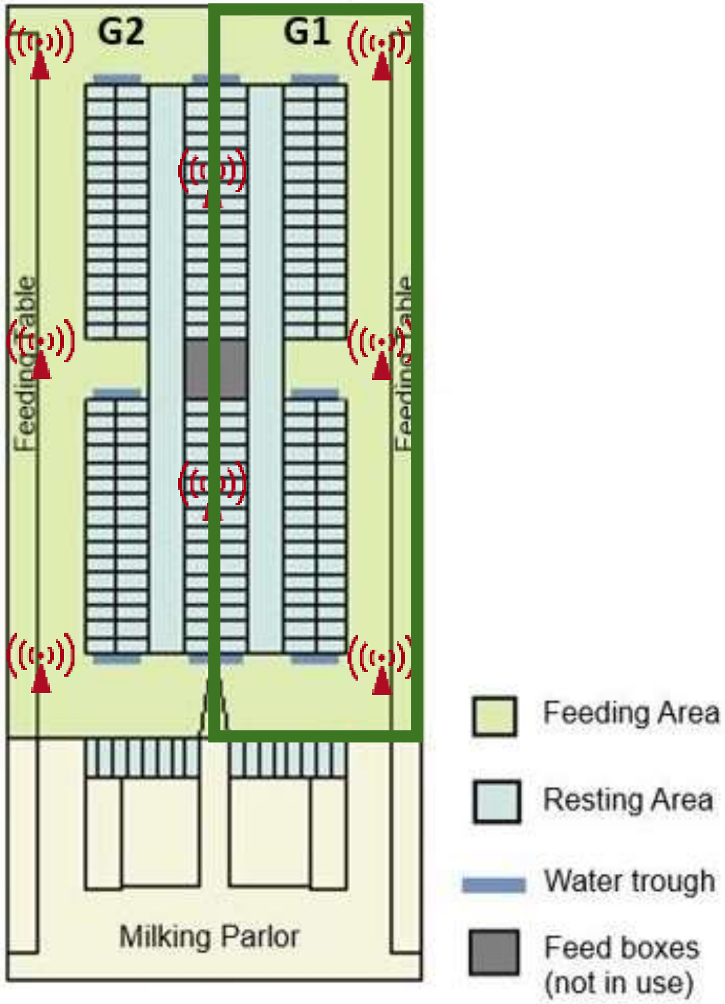


Data manipulation

Data manipulation

Real-time Location System

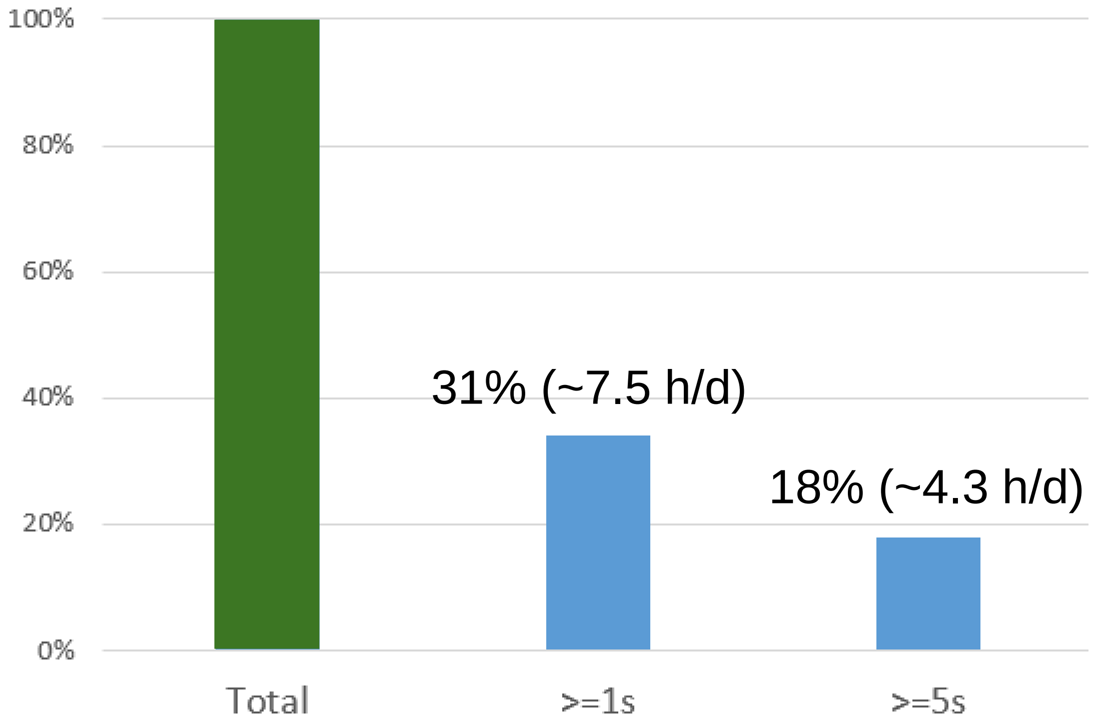




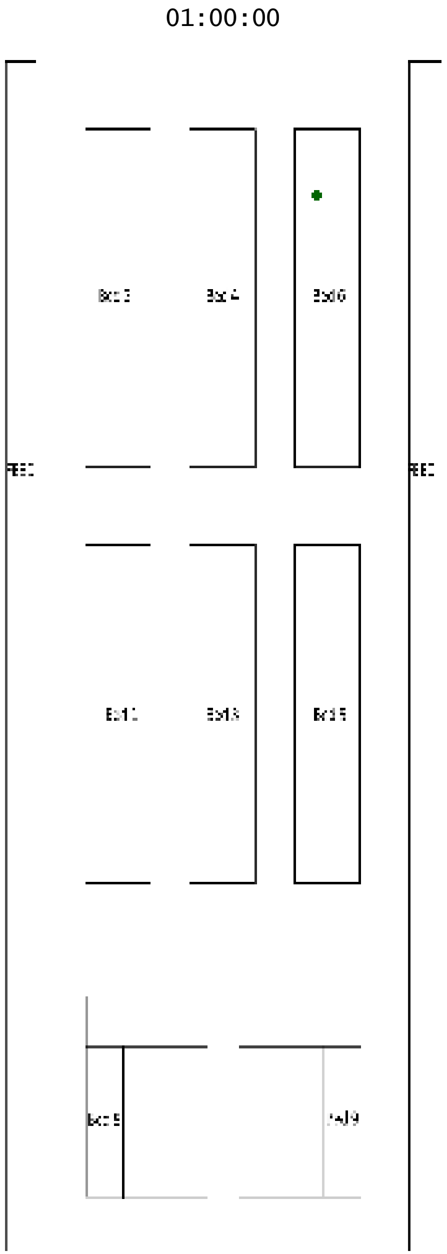
(Hansson et al., 2023)

Data manipulation

Interpolation methods



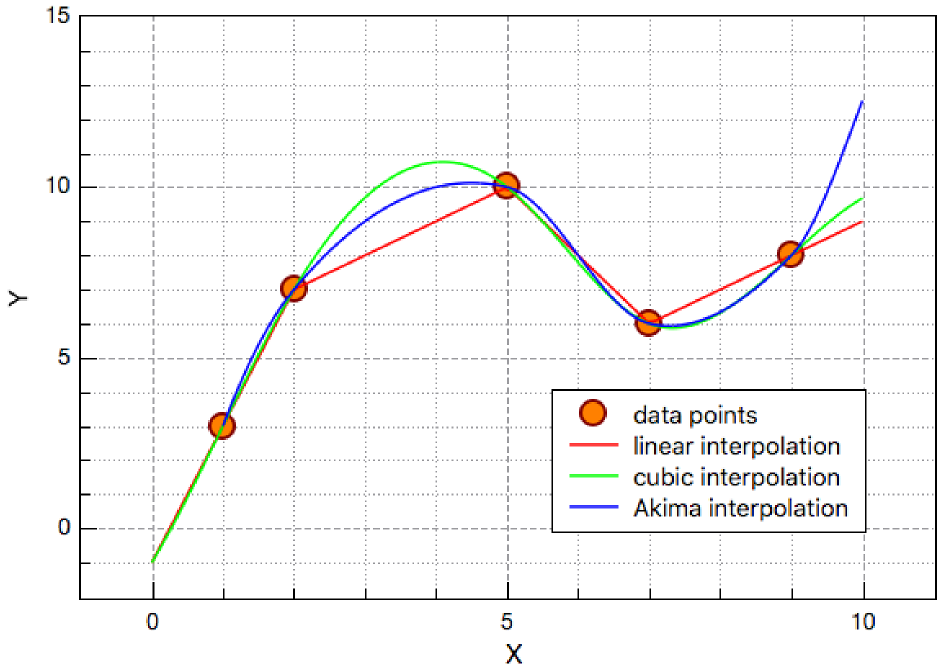
(Ren et al., 2021)



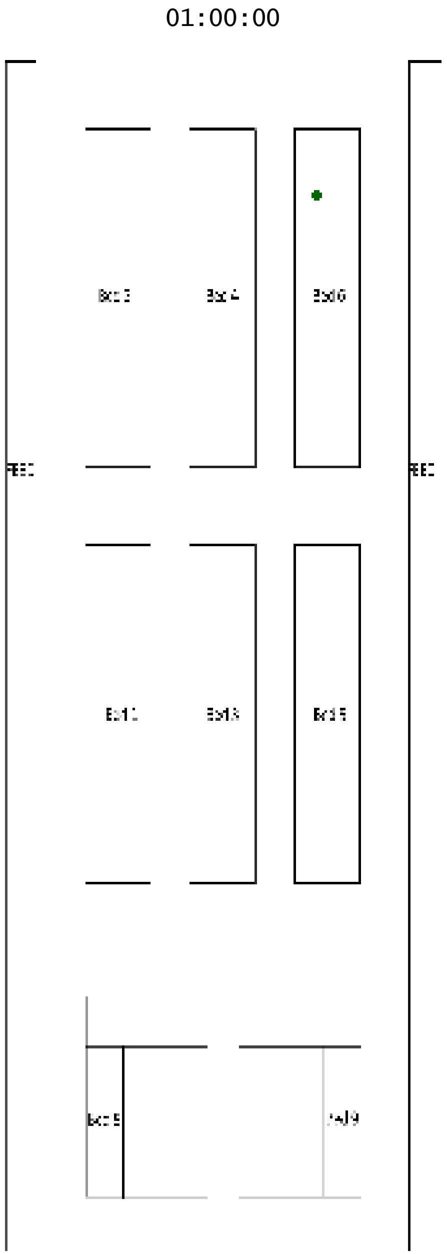
Data manipulation

Interpolation methods

- Maximising the information

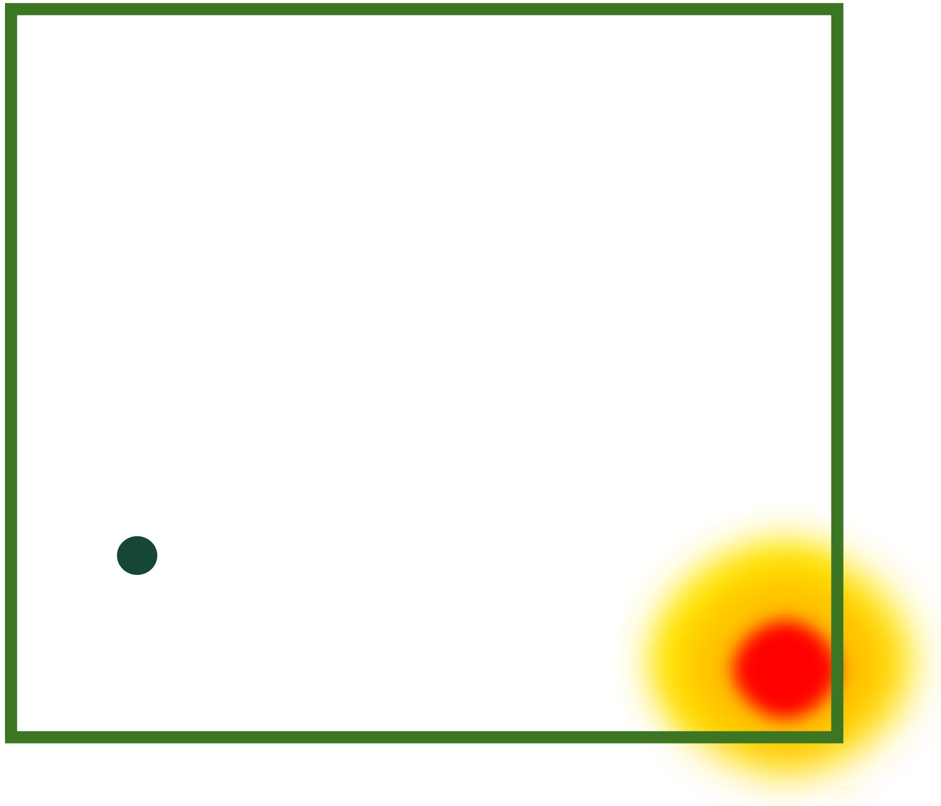


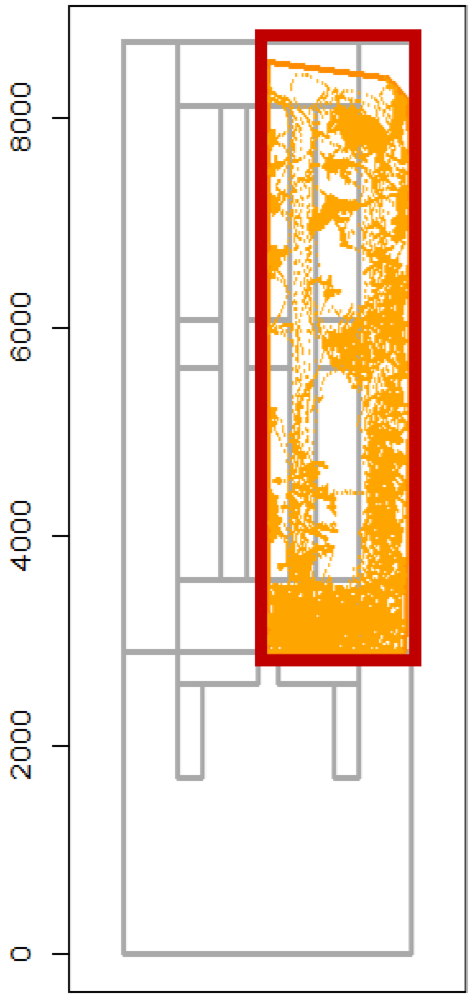
(Ren et al., 2022)

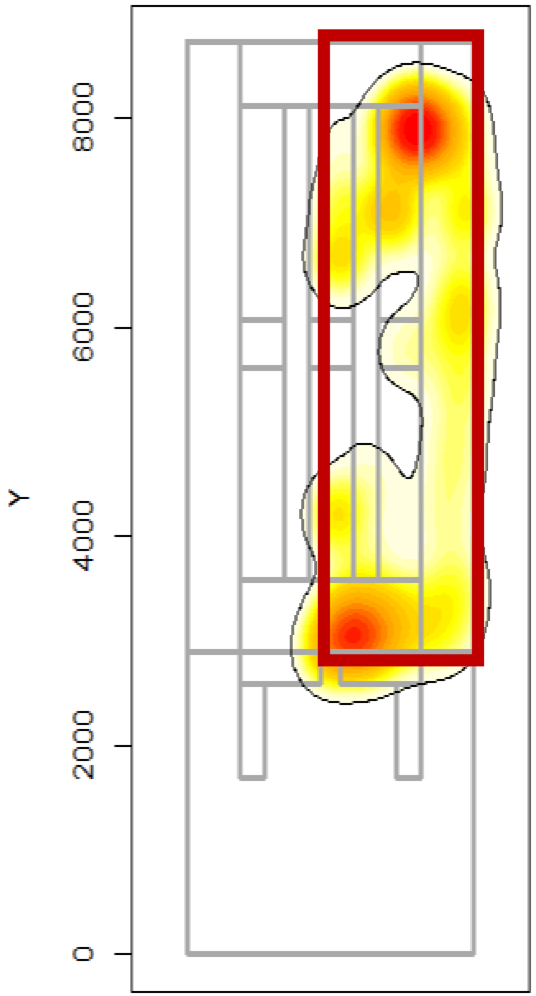


Data manipulation

Boundaries







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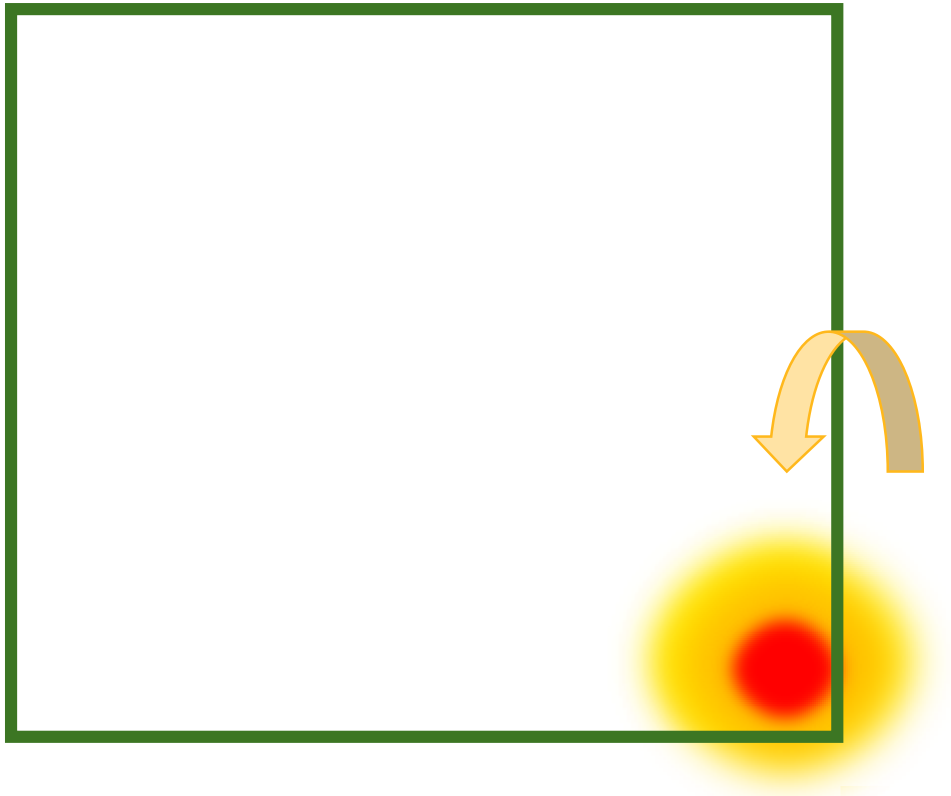
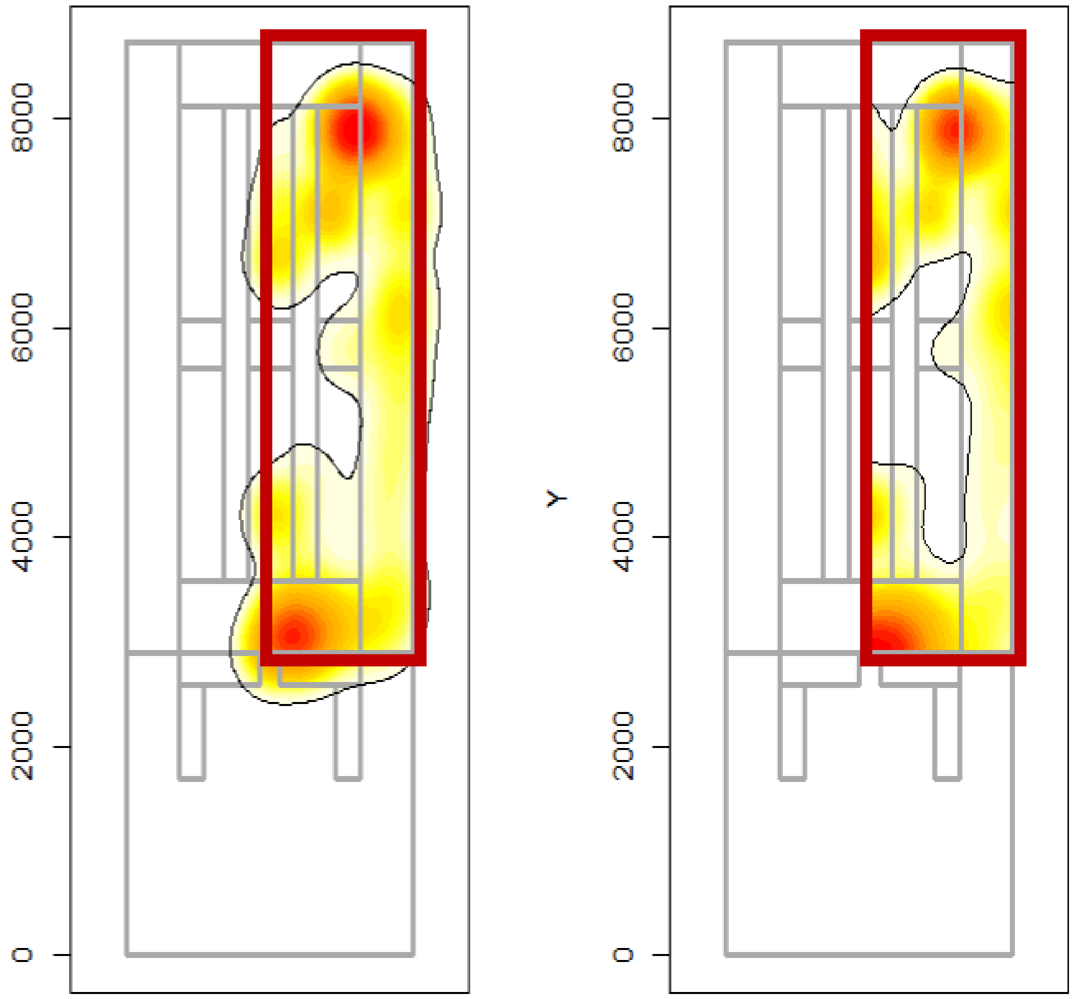


(Benhamou and Cornélis, 2010)



Indoor home ranges applications

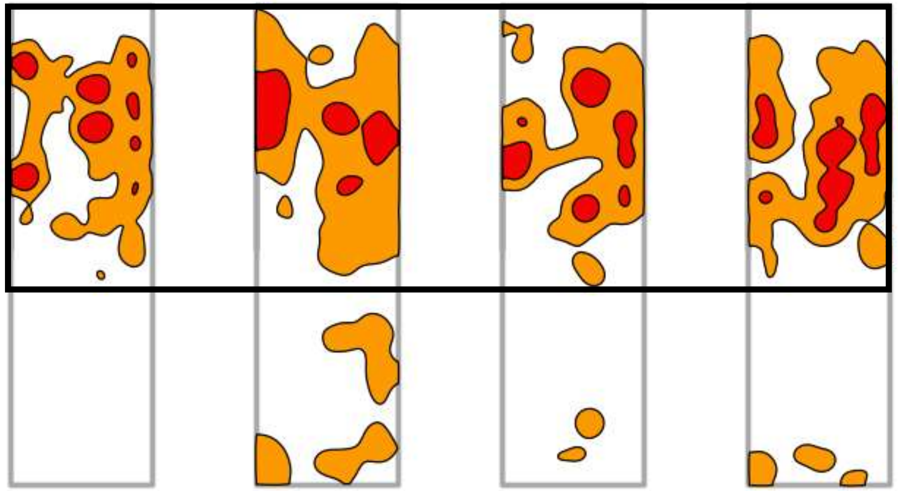
Applications of indoor home ranges

- Area usage of the animals
  - Cubical preference
  - Feed bunk preference

- Locate high density areas

Applications of indoor home ranges

- Barn area preference



- Detect changes in behaviour

Recommended literature

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7. Ren, K., Alam, M., Nielsen, P.P., Gussmann, M., Rönnegård, L., 2022. Interpolation Methods to Improve Data Quality of Indoor Positioning Data for Dairy Cattle. Front. Anim. Sci. 0, 53. https://doi.org/10.3389/FANIM.2022.896666
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10. Hansson, I., Silvera, A., Ren, K., Woudstra, S., Skarin, A., Fikse, W.F., Nielsen, P.P., Rönnegård, L., 2023. Cow characteristics associated with the variation in number of contacts between dairy cows. J. Dairy Sci. 106, 2685–2699. https://doi.org/10.3168/JDS.2022-21915


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Publications