

Inferring animal interactions from telemetry data using Gaussian processes

Context and objectives

Telemetry data, such as that collected from GPS collars, is now ubiquitous to study animal behaviors. Among the natural questions of interest is the quantification of the interaction between animals belonging to the same group. Inferring the existence of interactions from telemetry data is an open challenge in statistics. To this end, quantitative ecologists proposed different metrics and testing procedures based on classical statistical distances between time series (Long et al. (2014)). It is not clear, however, whether these methods are robust to some particularities of the data, such as the existence of a common attractive point (a common source of feeding, for instance), confinement to a restricted area (an island...) or nycthemeral rhythm. In machine learning community, a popular tool to model dependencies in time series are Gaussian processes, which have become increasingly popular in many machine learning applications (Roberts et al. (2013)).

In this project, in collaboration with the Norwegian University of Life Sciences, we focus on the movement of Norwegian red deer (*Cervus elaphus*). These animals live on an island, in semi-wild conditions, where they are partially fed by humans at a specific common place. Our goal is to investigate how Gaussian processes could be used in this context to infer the interactions between individuals. The intern will begin by reviewing existing methods in ecology, for instance via the available R package `wildlifeDI`, and by reviewing interaction modelling with Gaussian processes. Then, the intern will focus on a specific Gaussian process, the Ornstein–Uhlenbeck process, and investigate its use for inferring interactions.

Desired qualifications

- Master 2 student in statistics, machine learning, biostatistics or quantitative ecology.
- For students in statistics or machine learning, interest in ecology would be appreciated.
- For students coming from ecology, a strong quantitative background is required.

Application

- CV and cover letter by email to Matthieu Marbac (matthieu.marbac@univ-ubs.fr) and Pierre Gloaguen (pierre.gloaguen@univ-ubs.fr).

Conditions

- Duration: 6 months;
- Location: Université Bretagne-Sud (Vannes, France);
- Salary: 690 euros per month (in accordance with the rules governing internship compensation in France);
- Possibility of continuing with a PhD thesis;

References

Long, Jed A, Trisalyn A Nelson, Stephen L Webb, and Kenneth L Gee. 2014. “A Critical Examination of Indices of Dynamic Interaction for Wildlife Telemetry Studies.” *Journal of Animal Ecology* 83 (5): 1216–33.

Roberts, Stephen, Michael Osborne, Mark Ebden, Steven Reece, Neale Gibson, and Suzanne Aigrain. 2013. “Gaussian Processes for Time-Series Modelling.” *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 371 (1984): 20110550.