# INTERSNSHIP POSITION

## Topic

**Categorization of marine organisms detected by seal-borne active acoustic loggers (microsonars) using machine learning methods.**

## Keywords

**Biologging ; Content classification ; Machine learning ; Pattern Recognition**

## Context and summary of the proposed position

Marine ecosystems are currently subject to drastic and rapid changes particularly in both polar areas. However, consequences of these changes on ecosystem functioning often remain poorly assessed. It is therefore essential to better assess the horizontal and vertical distributions of marine organisms, including the zooplankton and fish populations, in relation to environmental parameters, as well as the impact these have on the distribution and foraging behaviours of top marine predators, such as southern elephant seals (*Mirounga leonina*).

To do so, a state-of-the-art custom-made active micro-sonar has been recently developed to be deployed on the head of seals and record echograms of organisms encountered during their trips at sea. Twenty southern elephant seals – 14 from Kerguelen islands, and 6 from Argentina – were equipped with these new micro-sonars, together with a GPS, a pressure sensor and a tri-axial accelerometer that provide behavioural data for the seals. The micro-sonars recorded for 30 days on average and at ping rate of 12-25Hz. The volume of recovered high-resolution acoustic data prohibits manual analysis in their entirety and consequently requires the development of accurate and relevant data processing methods.

Consequently, the objective of this study is to develop a methodology based on machine learning approaches to first extract the part of the dataset where relevant signals of prey encounters are present within the echograms. A second step will consist in classifying these extracted signals into isolated versus schooling prey, active versus passive prey, as well as categories of size and intensity of the acoustic signals.

## Topic description and expected tasks

A former study done in 2021 proposed an automatic prey detection algorithm which tends to segments preys from the echogram images. Based on these results, the work proposed in this position will be mainly focused on the use of classification algorithms and machine learning techniques to classify them and propose a first recognition process.

The first work will consist in comparing supervised or unsupervised approaches for the classification step. Unsupervised approaches will tend to cluster similar preys, while the supervised ones will rely on the use of annotations obtained by experts during the 2021 year.

To this end, a training subset of the available echograms (~10%) have already been categorized to help with the accuracy assessment process. These results will then be matched with dive and accelerometer data recorded simultaneously to determine the characteristics of prey preferably targeted by elephant seals and the associated differences in foraging behaviours, depending on geographic area and depth of foraging.

The focus of the intern will consist in implementing various algorithms from the literature, of setting up an automatic evaluation process to make the comparison easier, and of qualitatively assessing the performances with experts / end-users.

## Skills

- Students who apply should be in a Master 2 degree or equivalent (Last engineer school…)
- The candidate should master at least one programming language (Python, C++, Matlab…)
- Some skills in pattern recognition, image processing or datamining are requested
- The applicant should speak French or English

## Location and teams

Researchers from the CEBC (Ecology lab) and the L3i laboratory (Computer Science lab) of La Rochelle University will supervise the work. The position will take place in the L3i laboratory facilities, in La Rochelle France.

## Contacts

The application should be sent before 19th of November midnight by email, with a resume and a motivation letter. Recommendation letters could be joined but are not mandatory.

E-mail: mickael.coustaty@univ-lr.fr ; tiphaine.jeanniard-du-dot@cebc.cnrs.fr