MSc. Thesis Proposal

Title: **Acoustic detection of marine species and underwater noise with Machine Learning**

Supervisors

Bénédicte Dommergues (Msc): Ocean Cleaning and AI coordinator at blueOASIS
Guilherme Vaz (PhD): R&D manager at blueOASIS
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Introduction

Motivation

Underwater noise represents a significant threat to marine life, as much as other pollution such as oil spills or plastic debris. Indeed, marine mammals communicate and orient themselves with sounds. Noise from ships or offshore operations can interfere with their communication and it was proven by many studies that they lead to changes in behavior for many species. It is therefore crucial to better monitor underwater industry induced noise and marine mammals' activities around them.

Existing work

An algorithm was already developed that can assess the presence of ships, dolphins, or whales from a hydrophone recording. The algorithm includes several steps of data pre-processing to transform the sound recording into a specific spectrogram, which is then analyzed through a CNN. However, this work does not account for overlapping sounds and the distinction between ships is still simplistic.
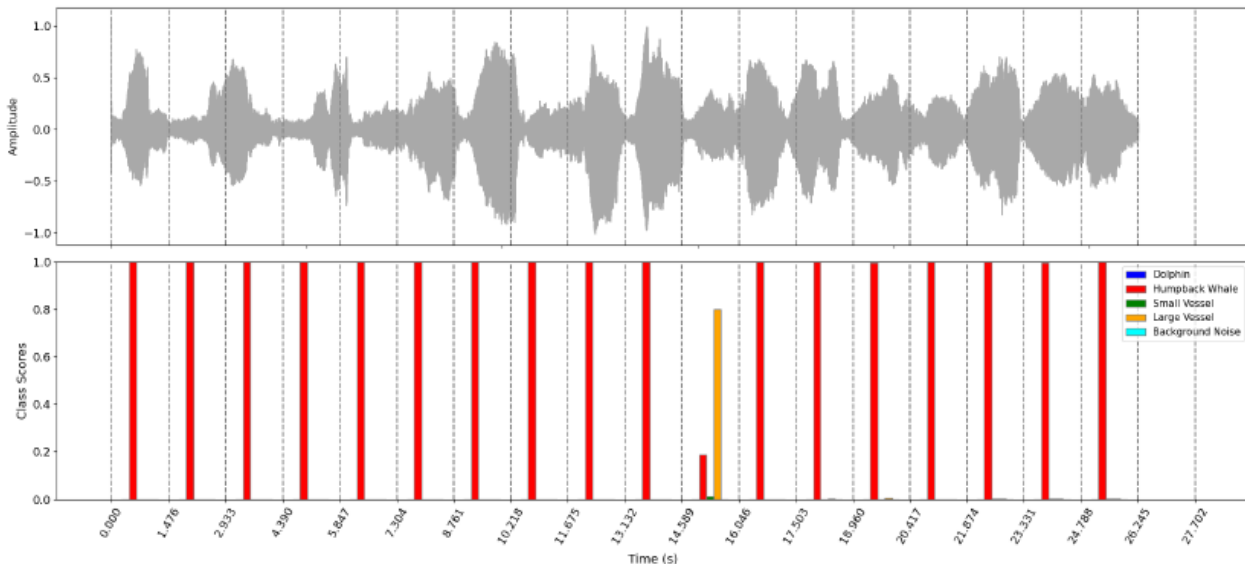

Figure 1: Analysis of a hydrophone recording

Objectives

The objective of this thesis is to further develop the algorithm to reach a product that can:

- Detect the type of noise (clicks or whistles) instead of outputting an animal type (dolphin or whales) to reach higher accuracy since clicks are used by both animals.
- Detect the category of ship following DNVGL description (slow/fast, small/big).
- Assess the distance of the ship based on the intensity of the signal.
- Be used as a live detection for an incoming signal.

To reach the objectives, data from the RepMUS exercise (RepMus21 presentation) will be used. During this exercise, 3 hydrophones were deployed at locations where dolphins are spotted daily, and the AIS of all ships participating were recorded. The data will be made available to the student. An accurate labelling of the recordings is extremely important to ensure the quality of the algorithm. The steps to follow are:

- Pre-labelled using the existing algorithm.
- Correlate the ship detection with the AIS.
- Separate the ship data in the four classes (slow-small, slow-big, fast-small, fast-big).
- Make the parts of the recording with marine mammals' sounds available to a marine biologist (collaborator of blueOASIS) for validation and update the labels accordingly.

Requisites

Applicants must have:

- General knowledge on Artificial Intelligence
- Affinity with data processing
- Coding experience with python or similar

Good to have:

- Linux experience
- LaTeX experience
- Git experience

Added value to have:

- Knowledge on sound data processing

Location

blueOASIS (www.blueoasis.pt) Edificio D.Pedro, Quinta da Fonte, R. Malhões, 2770-071 Lisboa The student is invited to join the team in the office when the supervisor is present (at least three days per week).

Companies Involved

blueOASIS is a young team with more than 45 years of combined knowledge and experience on Aerospace, Mechanical, Naval and Maritime engineering. The multicultural and multidisciplinary team is committed to make our oceans safer and greener, using state of the art numerical and data science tools. BlueOASIS focuses on renewable energies, ocean cleaning, decarbonization, sustainable offshore structures and green ships optimization.