MSc. Thesis Proposal

Title: ML-Based visual assessment of biomass in aquaculture cages

Supervisors
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Introduction
Motivation
Aquaculture is a growing industry in Portugal and represents a great opportunity to produce large amount of food with low carbon footprint. Fish biomass estimation is one of the most important aspects in aquaculture management since it allows to optimize daily feeding, control stocking densities, and ultimately determine the optimal time for harvesting. So far, this task is mostly based on manual sampling, which is usually invasive, and time and CO_2 consuming. Therefore, this task would greatly benefit from automation through machine learning.

Figure 1- Manual fish measurement.

SmartFisher
SmartFisher is an Artificial Intelligence (AI) based solution that allows the real time and automated monitoring of fish from underwater cameras. It allows the classification of fish, i.e., outputs the fish species, but also measures the fish size and biomass to gain critical insight on the livestock and facilitate decision-making. Another targeted field of application is marine conservation: the tool can be used to monitor the increase or decrease of a known fish population as well as the arrival of a new species in the monitored area. This could therefore enable the evaluation of restoration measures.

Existing work
blueOASIS developed a fish detection and tracking algorithm that provides a bounding box of the detected fish. In addition, blueOASIS developed an identification CNN that can identify 15 species of fish, based on a bounding box. Both algorithms work well on clear water conditions, but they have not been assembled into one pipeline yet.
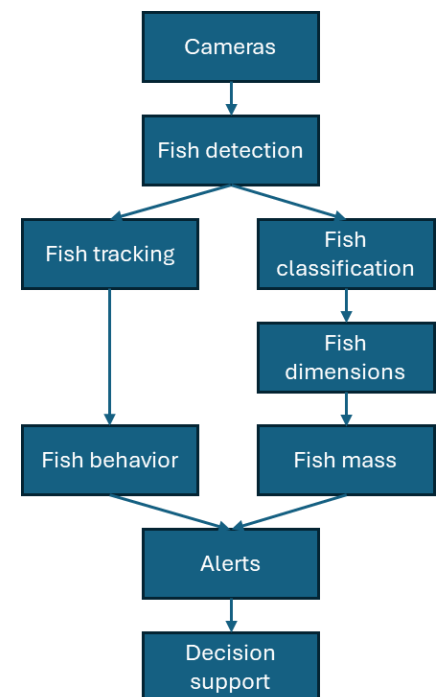

Figure 1: SmartFisher concept

Objectives
The objective of this thesis is to:
- Re-use and improvement of existing algorithms,
- Gather data in an aquarium (potentially in Vasco da Gama Aquarium in Lisbon) and setting up a fish live-stream,
- Develop a stereovision algorithm to measure the fish dimensions from camera images,
- Correlate the dimensions with biomass estimations,
- Assemble the different algorithms in an ensemble model.

Requisites

Applicants must have at least three of these requirements:

- General knowledge on fish species and fish biomass
- General knowledge on Artificial Intelligence
- Affinity with data processing and sensors installation
- Coding experience with python or similar

Good to have:

- Linux experience
- LaTeX experience
- Git experience

Location

blueOASIS (www.blueoasis.pt), Utrecht. The student **must be present at the office at least 3 days per week**. This is mandatory to pursue a thesis with blueOASIS.

Company involved

blueOASIS is a young team, originally based in Portugal with a recently opened office in Utrecht and Faial, Azores. Despite its recent creation, blueOASIS' team is composed of highly experienced engineers and biologists who all bring dedicated and state-of-the-art skills. blueOASIS focuses on offshore renewable energy and underwater impact assessment, mostly from an acoustic perspective. In each of their projects and products, blueOASIS strives towards digitalization, real-time data and optimization of its resources.