

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, time and CO2 consuming, and laborious. This task would greatly benefit from automation through machine learning.



Figure 1- Manual fish measurement.

Existing work

Nowadays, several nonintrusive techniques based on machine vision, acoustics and environmental DNA are being developed and applied for in situ estimation of fish biomass, but the accuracy and intelligence still need to be improved to meet intensive aquaculture requirements [1]. The authors considered that deep learning models and artificial intelligence are the tool to overcome some of the current challenges related to these techniques, such as measuring free-swimming fish length and fish counting in crowded cages.

Objectives

The objective of this thesis is to:

- Assess the maturity and open access to existing machine learning solutions for biomass estimation.
- Gather datasets from various sources.
- Assess the performance of algorithms with proven image processing capacity to:
 - Count the number of fish in a picture
 - Assess their distance to the camera
- Wrap the machine learning identification with existing models to assess the biomass. [2]

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 ocean waves.



Location

blueOASIS (www.blueoasis.pt) Edifício D.Pedro, Quinta da Fonte, R. Malhões, 2770-071 Lisboa or Ericeira Business Factory, R. Prudêncio Franco da Trinitade 4, 2655-344 Ericeira.

The student **must be present at the office at least 4 days per week**. This is mandatory to pursue a thesis with blueOASIS.

Companies Involved

blueOASIS is a young team with more than 65 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.

Bibliography

- [1] Li, D., Hao, Y. and Duan, Y. (2020), Nonintrusive methods for biomass estimation in aquaculture with emphasis on fish: a review. *Rev Aquacult*, 12: 1390-1411. <https://doi.org/10.1111/raq.12388>
- [2] Samuel Shephard, David G. Reid, Hans D. Gerritsen, Keith D. Farnsworth, Estimating biomass, fishing mortality, and “total allowable discards” for surveyed non-target fish, *ICES Journal of Marine Science*, Volume 72, Issue 2, January/February 2015, Pages 458–466, <https://doi.org/10.1093/icesjms/fsu146>