

# Master/Engineer student internship

## *AI-based image processing for the underwater environment*

ISEN Ouest - Maher JRIDI/Thibault NAPOLÉON

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**Start date:** February/Marsh 2025 - **Duration:** 5 months - **Location:** ISEN Nantes - 33Q avenue du champ de manœuvre, Carquefou 44470.

### Administrative context

As coordinator of the ANR CESAR project, which begins in 2025, the Vision-AD team at LabISEN is offering a Master's Research internship with the possibility of transitioning to a doctoral thesis starting in September 2025.

### Technical context

Human knowledge of the underwater environment remains limited and lacks reliability. Improving the understanding of the seafloor has become a major scientific challenge as well as a strategic goal for leading countries with recognized capabilities in this domain. In this context, France has listed the exploration of the seafloor as one of the ten objectives of the "France 2030" investment plan. This exploration is permitted by the collection of data acquired by sensors embedded in observation systems such as autonomous underwater vehicles (AUV) or remotely operated vehicles (ROV). Equipped with these observation tools, drones can map, monitor, detect environmental changes, track plankton evolution, analyze coral reef ecosystems, and monitor marine biodiversity.

It is found from our previous research that using cameras and AI-based image processing is operationally advantageous but suffers from generalization issues. For example, a dependence between the underwater zone being studied and the performance of classification/segmentation algorithms has been observed. When changing the underwater area, season, or even the time of day, classification performance drops from 92% to 56%. One of the CESAR project's objectives, to which this Master's internship is linked, is to enhance traditional AI algorithms by integrating heterogeneous data acquired from multiple sources, thereby reducing spatiotemporal dependence.

### Objectives

1. Familiarization: Explore existing databases where video data is available alongside environmental acquisition data.
2. Literature Review: Conduct a review of techniques for analyzing multimodal data. Techniques based on contrastive learning offer robust image-based learning, while curriculum learning allows for the gradual integration of environmental data.
3. Experimentation: Test and compare the performance of several learning techniques.

### Profile

The candidate should be enrolled in a Master (or bac + 5), with an interest in pursuing a Ph.D. Specializations in image processing, artificial intelligence, or related fields are required. Proficient in Python, C++, and/or Matlab, with knowledge in ML tools and/or image processing.

### Application

Please send an email to [maher.jridi@isen-ouest.yncrea.fr](mailto:maher.jridi@isen-ouest.yncrea.fr) and [thibault.napoleon@isen-ouest.yncrea.fr](mailto:thibault.napoleon@isen-ouest.yncrea.fr) with the following documents: CV, Cover letter, and any additional documents supporting your application.