

Forecasting underwater sighting range using remote sensing and artificial intelligence

4 to 6 months MSc internship in 2020

Research field: artificial intelligence applied to oceanography

Location: Brest, Brittany, France

SHOM, a state agency:

SHOM (<http://www.shom.fr>) is the French hydrographic service. In oceanography, SHOM performs research and development in hydrodynamic modelling, satellite observations and conducts field campaigns deploying Oceanographic Research Vessels, Unmanned Underwater Vehicles and various moorings and buoys.

Background of internship:

The assessment of underwater sighting range is required in marine operations like mine clearance, submarine detection, offshore engineering, coastal management and leisure activities. Divers or optical sensors deployed undersea depend on visibility conditions that are a main function of the transparency of the surrounding waters. This transparency is mainly a function of the amount, size and nature of the microscopic particles in suspension within the water column. At the ocean surface, these particles of organic and mineral origin induce slight variations in water colour that can be detected from space. Deeper in the ocean, at basin to coastal scales, the fate of these particles can be modelled with hydrodynamic and biochemical equations. All this information, coming from satellites and models, can be merged into a single digital system aiming at forecasting and analysing underwater visibility for a given area of interest. Usual techniques for merging information that comes from satellite data and models are referred as “model-driven” assimilation methods, as they mainly rely on model equations. But these methods often require complex schemes; also they are computationally expensive and are sensitive to nonlinearities. New, upcoming methods referred as “data-driven” assimilations are emerging, mostly to overcome these difficulties. These methods make use of machine learning and artificial intelligence. Within a “Big Data” context, they benefit from the rising amount of data and model simulations available in the oceanographic community.

Purpose of internship:

In the field of geophysics and artificial intelligence, SHOM cooperates with two laboratories located at the Technopôle Brest Iroise of Plouzané: Lab-STICC (Laboratoire des Sciences et Techniques de l'Information, de la Communication et de la Connaissance) and LGO (Laboratoire Géosciences Océan) are developing data-driven approaches for the processing of time series of images acquired by oceanographic satellites in the visible or infrared domains, where large gaps in data occur because of the cloud cover masking the ocean. Moreover these methods can benefit from complementary information coming from output model simulations. Developed methods are notably tested on infrared satellite images of the ocean surface temperature, cf. Fablet et al 2019: “End-to-end learning of energy-based representations for irregularly-sampled signals and images”:

https://www.researchgate.net/publication/336208390_End-to-end_learning_of_energy-based_representations_for_irregularly-sampled_signals_and_images

The aim of this internship is to test these methods on satellite images of the ocean colour. The study will focus on the Bay of Biscay and the English Channel. For this analysis, a database of more than 15 years of acquired satellite images of the ocean colour in this region is available. The trainee will apply these methods on a partial set of data and will assess the accuracy of results using remaining data. The predictive capabilities of the forecasting of water transparency will also be studied. Depending on the progress, additional information from model simulations, also available at SHOM, could be included in the process.

Stipend and location:

Internship stipend amount is about 525€/month.

Internship will be conducted in SHOM and LGO, at following addresses:

- SHOM, 13 rue du Chatellier, 29200 Brest, France
- LGO, Technopôle Brest Iroise, 29280 Plouzané, France

Required skills:

MSc postgraduate student having skills in data-science (signal processing, statistics and applied mathematics, machine learning, artificial intelligence) with an interest in geosciences; or having skills in geoscience (physical oceanography, sediment dynamics, primary production) with an interest in data-science. Complementary desired skills are Python programming and academic English.

For further enquiries:

D^r Frédéric JOURDIN, email: jourdin@shom.fr.

How to apply:

Qualified individuals are encouraged to submit their application (CV and cover letter) by email to jourdin@shom.fr by December 15th, 2019.