Internship offer (MSc./Eng. Degree)

Deep learning inversion of sea surface processes from SAR imaging

Supervisor: Ronan Fablet (ronan.fablet@imt-atlantique.fr)
Research team: IMT Atlantique, Lab-STICC, TOMS, Brest
Expected duration: 6 months

Scientific context and specific objective:

This internship offer is open in the framework of AI chair OceaniX (https://cia-oceanix.github.io/), which develops Physics-Informed AI for Ocean Monitoring and Surveillance. PhD opportunities are likely to be offered for the successful candidate.

Data-driven and learning-based strategies for the analysis, modeling and reconstruction of dynamical systems are currently emerging as promising research directions as an alternative to classic model-driven approaches for a wide variety of application fields, including atmosphere and ocean science, remote sensing, computer vision.... [2,3,4]. Especially, deep learning schemes [1] are currently investigated to address inverse problems, i.e. reconstruction of signals or images from observations. Especially, recent works [e.g., 3,4] have shown that one can learn variational models and solvers for the reconstruction.

This internship will specifically investigate the development of deep learning inverse models for SAR imaging to retrieve sea surface geophysical parameters (e.g., wave fields, sea surface winds,..). Based on a review of the state-of-the-art [eg, 3,4,5], the goal will to propose, implement and evaluate different deep learning schemes. Case-studies with groundtruthed real SAR imaging datasets will be considered and implemented.

Keywords: deep learning, inverse problems, variational models, SAR imaging, ocean remote sensing.

Candidate profile

MSc. and/or engineer degree in Applied Math., Data Science and/or Computer Science with a strong theoretical background, proven programming skills (Python).

Advanced knowledge of deep learning models and a first experience with Pytorch would be a plus.

References

[1] LeCun et al. Deep learning. Nature, 521(7553) :436– 444, May 2015.
[2] Lguensat et al. The Analog Data Assimilation. Monthly Weather Review, 2017.
[3] R. Fablet, L. Drumetz, F. Rousseau. End-to-end learning of energy-based representations from irregularly-sampled data. arXiv, 2020.
[4] Kobler et al. Total Deep Variation for Linear Inverse Problems. arXiv, 2020.
[5] Brandon et al. Deep Learning for Predicting Significant Wave Height From Synthetic Aperture Radar. IEEE TGRS, 2020.