PhD position on Deep Learning and Oceanography

Supervisor: R. Fablet (IMT Atlantique, Lab-STICC)
Hosting team: IMT Atlantique, INRIA Odyssey team, Brest
Duration: 3-year PhD scholarship
Expected starting date: from fall 2024

Keywords: ocean modelling and forecasting, deep learning, ocean data assimilation

Context and objectives. This position is open in the framework of AI Chair OceaniX (https://cia-oceanix.github.io/). It will be hosted on IMT Atlantique campus in Brest by the newly created INRIA team Odyssey (https://team.inria.fr/odyssey).

Recent developments in artificial intelligence (AI) open many interesting opportunities in the context of operational oceanography and ocean forecasting systems. Current operational forecasting systems face important challenges. Ocean models and data assimilation methods, which are the scientific underpinning of these operational systems, are highly computationally-demanding when addressing large ensemble simulations with increasingly fine spatial resolution and their ability to fully exploit available data sources remains limited. Deep learning and differentiable programming are opening many opportunities in computational fluid dynamics and ocean science (Vinuesa and Brunton, 2021; Zanna and Bolton 2021) as well as to solve inverse problems (Cranmer et al. 2021; Fablet et al. 2021, Hartfield et al., 2021). Deep learning especially benefits GPU acceleration as well as from an application-centric viewpoint to better address specific application-dependent requirements.

The open position will contribute to the uptake of deep learning paradigms and technologies for the deployment of digital twins of the ocean.

Skills: Applications are encouraged from candidates with a MSc./engineer degree in applied math/machine learning/data assimilation with interest in ocean science or a MSc./engineer in ocean science and a strong interest in deep learning.

Application: Send CV, statement of research interests and the contact information of at least two references to ronan.fablet@imt-atlantique.fr. Review of applications will begin immediately and continue until the position is filled.

References

Fablet, R. et al. (2021). Learning variational data assimilation models and solvers. *JAMES*, *13*(10). https://doi.org/10.1029/2021MS002572

Hatfield, S. et al (2021). Building Tangent Linear and Adjoint Models for Data Assimilation With Neural Networks. JAMES. https://doi.org/10.1029/2021ms002521

Kochkov, D. et al, S. (2021). Machine learning–accelerated computational fluid dynamics. *PNAS*, *118*(21), e2101784118. https://doi.org/10.1073/pnas.2101784118

Vinuesa, R., & Brunton, S. L. (2021). The potential of machine learning to enhance computational fluid dynamics. *ArXiv:2110.02085 [Physics]*. http://arxiv.org/abs/2110.02085

Zanna, L., & Bolton, T. (2021). Deep learning of unresolved turbulent ocean processes in climate models. In G. Camps Valls, D. Tuia, X. X. Zhu, & M. Reichstein (Eds.), *DL for the Earth Sciences*. https://doi.org/10.1002/9781119646181.ch20