Call for Papers

AIMOCC

AI: Modeling Oceans and Climate Change

An ICRL 2021 Workshop

1 Summary

It is our distinct pleasure to invite you to the **AI: Modeling Oceans and Climate Change Workshop (AIMOCC 2021)** to be held in conjunction with the **Ninth International Conference on Learning Representations (ICLR 2021)** and hosted in virtual-only mode.

The Anthropocene has brought along a drastic impact on almost all life forms on the planet. Considering the importance and amount of water in this speck of dust in the middle of nowhere that we inhabit, we should have called it Planet Ocean. Oceans are not only important because of their volume but are also about the functions and contributions they provide to biodiversity, the human species included (Guidi et al., 2016).

The goal of this workshop is to bring together researchers that are interested and/or applying AI and ML techniques to problems related to marine biology, modeling, and climate change mitigation. We also expect to attract natural science researchers interested in learning about and applying modern AI and ML methods. Consequently, the workshop will be a first stone on building a multi-disciplinary community behind this research topic, with collaborating researchers that share problems, insights, code, data, benchmarks, training pipelines, etc. Together, we aim to ultimately address an urgent matter regarding the future of humankind, nature, and our planet.

Links

- Workshop schedule at ICRL 2021: https://iclr.cc/Conferences/2021/Schedule?showEvent=2123.
- Call for papers and further information: https://oceania.inria.cl/#aimocc.
- Shareable call for papers as PDF: https://oceania.inria.cl/assets/pdfs/AIMOCC_at_ICLR_2021__Workshop_call_for_papers.pdf.
- Shareable call for papers as TXT: https://oceania.inria.cl/assets/txts/AIMOCC_at_ICLR_2021__Workshop_call_for_papers.txt.
- AIMOCC 2021 CMT submission site: https://cmt3.research.microsoft.com/AIMOCC2021.

2 Submissions

We welcome submissions of long (8 pages) full papers and short (4 pages) summary papers. To prepare your submission, please use the ICLR 2021 LaTeX style files provided at: https://github.com/ICLR/Master-Template.

Use the following link to submit your proposal: https://cmt3.research.microsoft.com/AIMOCC2021.

3 Important dates

- Submission deadline: **March 19, 2021 (UTC-12)**.
- Notification of acceptance: **March 26, 2021**.
- Reception of final version: **April 11, 2021**.

4 Topics

The topics of interest of this workshop can be grouped into two sets: (i) one addressing and advancing the state of the art in areas like AI, ML, mathematical modeling and simulation, and (ii) the other one focusing on answering the questions from the application domain.

In regard to AI and modeling, the main focus is set on:

1. improving neural network handling of graph-structured information,
2. improving the capacity of ML methods to learn in small data contexts,
3. understanding causal relations, interpretability and explainability in AI,
4. integrating model-driven and data-driven approaches, and
5. to develop, calibrate, and validate existing mechanistic models.

In the domain application area, the main questions to be addressed are:

1. Which are the major patterns in plankton taxa and functional diversity?
2. Which are the major drivers of patterns and how do they interact?
3. How these patterns and drivers will likely change under climate change?
4. How will these changes affect the capacity of ocean ecosystems to sequester carbon from the atmosphere, that is the biological carbon pump?
5. What relations bind communities and local conditions?
6. What are the links between biodiversity functioning and structure?
7. How modern AI and computer vision can be applied as research and discovery support tools to understand planktonic communities?
8. How new biological knowledge can be derived from the application of anomaly detection, causal learning, and explainable AI.

5 Context

Oceans play a key role in the biosphere, regulating the carbon cycle; absorbing emitted CO_2 through the biological pump, and a large part of the heat that the remaining CO_2 and other greenhouse gases retained in the atmosphere. The biological pump is driven by photosynthetic microalgae, herbivores, and decomposing bacteria. Whales also play a prominent role by moving nutrients and providing mixing in the ocean (Häussermann et al., 2017; León-Munõz et al., 2018; Roman & Mccarthy, 2010). Understanding the drivers of micro and macro-organisms in the ocean is of paramount importance to understand the functioning of ecosystems and the efficiency of the biological pump in sequestering carbon and thus abating climate change.

This situation poses a substantial challenge to humanity as a whole. It is not only an urgent but also a scientifically demanding task. Consequently, it is a problem that must be addressed with a scientific cohort approach, where multi-disciplinary teams must collaborate to bring the best of different scientific areas: state-of-the-art artificial intelligence (AI), machine learning (ML), applied math, modeling, and simulation, and, of course, marine biology and oceanography.

Data is essential in this pursuit. The Foundation Tara Océans[1] has spearheaded the methodological sampling of the different phenomena that are taking place in our oceans. Despite these efforts, scientific data -even with the import contribution from Tara and infrastructures is not sufficient to adequately understand and quantify the consequence of these perturbations on the marine ecosystem. In particular, critical ecosystems need extensive surveys to characterize the biological acclimation to climate perturbations better.

AI, ML, and mathematical modeling tools are key to understanding oceans and climate change. In return, these problems also pose important challenges to the current state of the art in those fields making them also particularly attractive from a computer science point of view. For instance, in the case of ML, only recently

[1] https://oceans.taraexpeditions.org/en/

it has become feasible to handle structured information, like the one required to understand the networks created by interacting populations of different species.

Similarly, in spite of the important efforts on data gathering, the amount of data available conform to a scenario that can be denominated as *small data*, that heavily contrasts with the data-hungry methods that conform most of the current state of the art in ML. Yet another important issue lies the black-box approach of many ML methods that do not allow a feasible interpretation or explanation that can be used to articulate a better understanding of the process, which is essential to design new mitigation policies.

Along the same lines, existing modeling tools are hard to apply in biogeophysical contexts like the ones encountered in this project because of their computational complexity and high processing requirements. This situation could be overcome either by improving the modeling methods themselves or by taking a stab at developing mechanistic approaches that also seem to be capable of complementing AI and ML in the application domain (Baker et al., 2018).

6 Organizers

- **Nayat Sánchez-Pi** and **Luis Martí**, Inria Research Center in Chile.

Scientific committee

- **Julien Salomon** and **Jacques Sainte-Marie**, Inria Paris,
- **Olivier Bernard**, Inria Sophia-Antipolis,
- **Michèle Sebag** and **Marc Schoenauer**, Inria Saclay,
- **Alejandro Maass**, Center of Mathematical Modeling (CMM), Universidad de Chile.
- **Pablo Marquet**, Pontificia Universidad Católica de Chile (PUC).
- **André Abreu**, Fondation TARA Océan.
- **Colomban De Vargas**, GO-SEE CNRS Federation, and
- **Damien Eveillard**, ComBi, Université de Nantes.

7 Diversity commitment

We will seek diversity in all aspects, both in school of thought, nationalities, stages in the academic career, etc.

8 Access

We will publish the accepted papers and talk abstracts (before the event) and the slides of the speakers (after the event) on the workshop website. We will include a bibliography of most relevant research papers to facilitate cross pollination of ideas between these fields. We will record the workshop and publish it online.

References

Baker, R. E., Peña, J.-M., Jayamohan, J., & Jérusalem, A. (2018). Mechanistic models versus machine learning, a fight worth fighting for the biological community? *Biology Letters*, *14*(5), 20170660. https://doi.org/10.1098/rsbl.2017.0660 (cit. on p. 3)

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Häussermann, V., Gutstein, C. S., Beddington, M., Cassis, D., Olavarria, C., Dale, A. C., Valenzuela-Toro, A. M., Perez-Alvarez, M. J., Sepúlveda, H. H., McConnell, K. M., Horwitz, F. E., & Försterra, G. (2017). Largest baleen whale mass mortality during strong El Niño event is likely related to harmful toxic algal bloom. *PeerJ*, *2017*(5), 1–51. https://doi.org/10.7717/peerj.3123 (cit. on p. 2)

León-Munõz, J., Urbina, M. A., Garreaud, R., & Iriarte, J. L. (2018). Hydroclimatic conditions trigger record harmful algal bloom in western Patagonia (summer 2016). *Scientific Reports*, *8*(1), 1–10. https://doi.org/10.1038/s41598-018-19461-4 (cit. on p. 2)

Roman, J., & Mccarthy, J. J. (2010). The Whale Pump: Marine mammals enhance primary productivity in a coastal basin. *PLoS ONE*, *5*(10), 13255. https://doi.org/10.1371/journal.pone.0013255 (cit. on p. 2)