

ADOPT: AI for Detecting Ocean Plastic Pollution with Tracking

Emanuele Dalsasso¹, Marc Rußwurm², Michele Volpi³, Robin de Vries⁴, Devis Tuia¹

¹ECEO, EPFL; ²Wageningen University and Research; ³Swiss Data Science Center; ⁴The Ocean Cleanup Projects

Ecological and Scientific problem

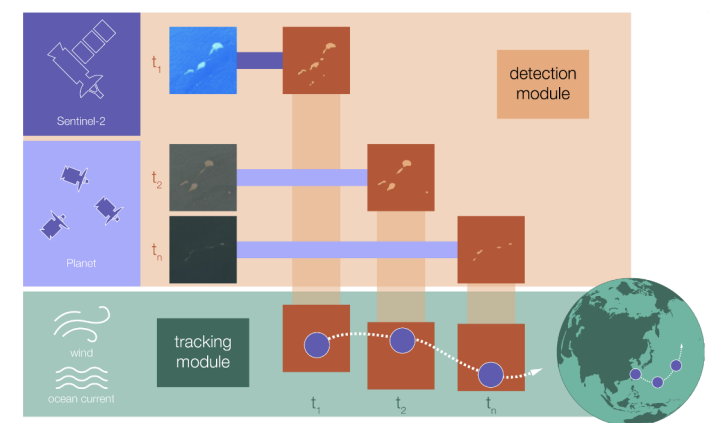
Address the growing ecological concern related to marine litter by enabling continuous and global monitoring:

- Detect litter objects with high accuracy
- Provide timely estimates of future locations

ADOPT is a hybrid model having two main components:

- A deep learning-based detection module
- A physical drift estimation module

A third hybridization step combines the first two modules into a unique deep learning-based physics informed module

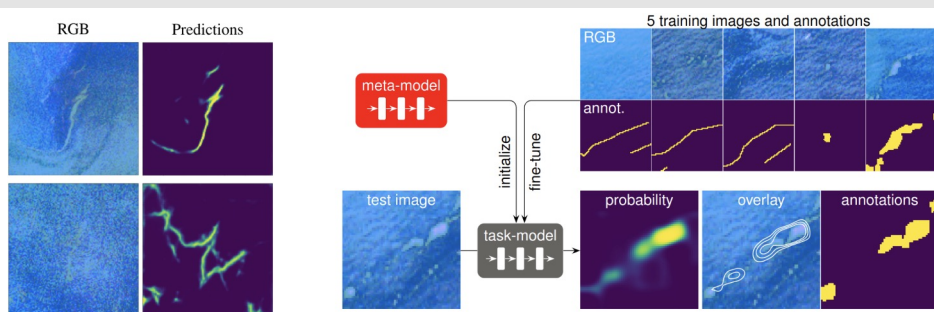


Overview of the working principle of ADOPT. The detection module (top) predicts the locations of floating objects from publicly available Sentinel-2 imagery. These detections are then projected in space and time by the tracking module (bottom)

Approach

Detection module

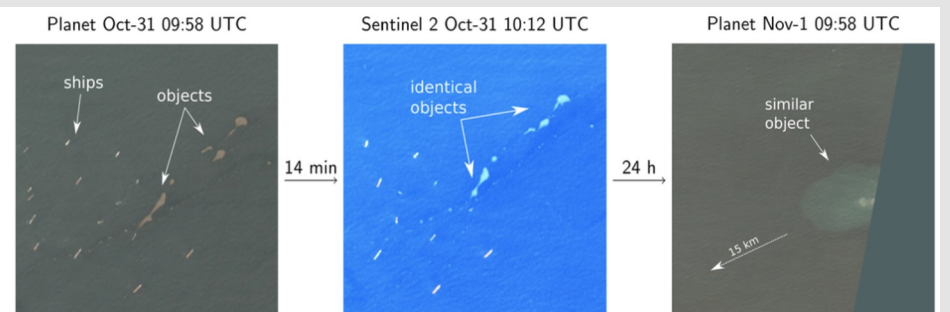
Predicts the probability of floating objects on a single Sentinel-2 image



Left: prediction results of U-Net analyzing floating object patches in two Sentinel-2 scenes of Mifdal & Russwurm (2021). Right: Initial experiments with the (coarse) segmentation of marine debris with the meta-learning model (Russwurm et al., under review), which is fine-tuned to segment marine debris with five annotated images (shown in the top row) only.

Tracking module

Project the pathways of detected debris over time to track them



Floating object (sargassum) re-identification with PlanetScope and Sentinel-2 imagery on a coastal region near Accra, Ghana (5.3°N 0.05°W) in 2018.

The two modules will be combined in a common framework to integrate the physical knowledge of the possible drift with the detection module

Available data

