Detection And Monitoring Of Aquaculture Activities Using Open-Source Sentinel Data And High-Resolution Imagery

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Motivation

Blue-Cloud addresses the "Future of Seas and Oceans Flagship Initiative". It aims at identifying long-term challenges and building a workflow to help researchers better understand and manage the many aspects of ocean sustainability. **This specific demonstrator focuses on detecting and monitoring aquaculture activities over predefined areas of interest using satellite imagery**. The service provided is almost fully automatic and is already operational and fully integrated on a platform.

Keywords: *Aquaculture, Sentinel-1, PlanetScope, Segmentation*

Study Areas and Data

The algorithm was first developed for applications in Puerto Montt in Chile, but has also been tested over Monastir in Tunisia.

Data

It uses open-source Sentinel-1 radar images with a resolution of 10m for high-scale detections, which are downloaded directly from WEkEO.

PlanetScope optical data (4m resolution) is then used for more detailed studies.

Methodology

The main workflow can be divided into three parts, as shown in Figure 1: (1) the location of the clusters, (2) the retrieval of high-resolution data and (3) the counting of cages.

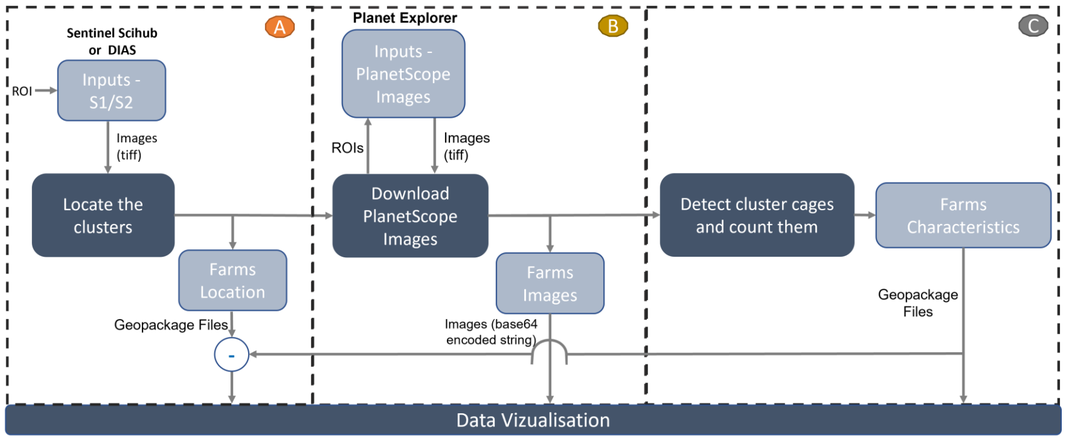

Figure 1: Aquaculture Monitoring Workflow

(1) Time-series of high-coverage radar images are first downloaded around the desired dates and Regions of Interests (ROI). They are then segmented to automatically detect water/non-water bodies, using Random Forest or standard image processing approaches. False negatives are filtered out to detect only aquaculture clusters.

(2) High-resolution data can be downloaded around the areas of interests detected in (1).

(3) PlanetScope images are processed to extract statistical information for each cluster, such as the number of cages, the farm surface, the average cage size.

These results are then sent to a platform for visualisation purposes.

Results

Location	Precision (%)	Recall (%)
Puerto Montt (Chile)	76	66
Monastir (Tunisia)	91	91

Table 1: Precision and Recall for tests in Puerto Montt and Monastir.

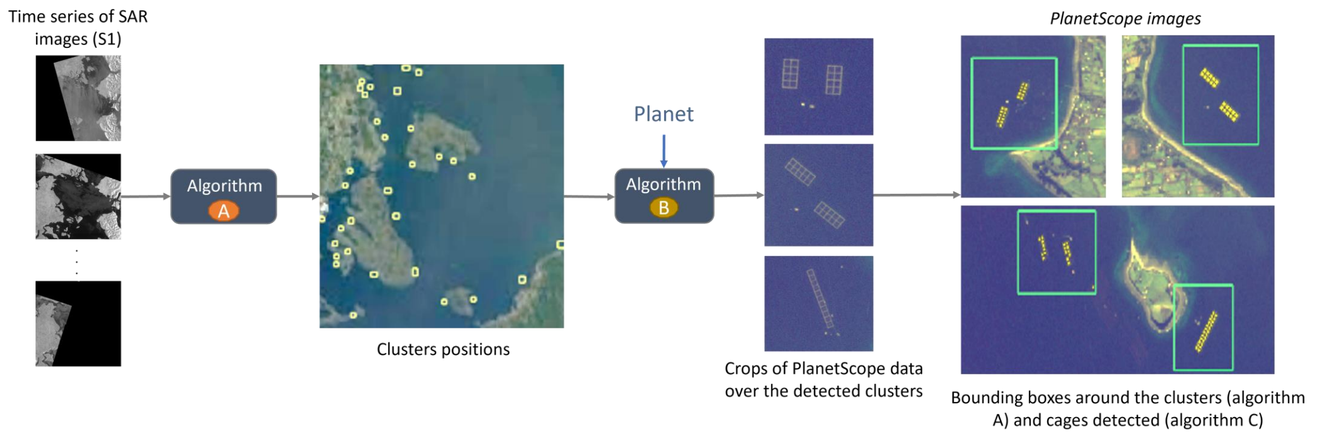

Figure 2: Results of the pipeline ran over Puerto Montt in Chile around the 2020/07/29

Figure 2 shows the whole pipeline applied to our case study in Chile. The clusters are first located with a precision of 76% (out of 131 clusters) using 5 Sentinel 1-images taken around the 2020/07/29. Then, each cage is individually detected (in yellow) using crops of the corresponding PlanetScope image. The main source of False Positives are small islands that are detected as non-water bodies and have a size comparable to aquaculture clusters.

Conclusions

The presented workflow is an end-to-end pipeline allowing users to detect and monitor aquaculture activities in areas of interests. Statistical informations such as the **number of cages**, the cluster surface and the **average cage size** can be calculated using high-resolution satellite images. Following this workflow over different dates can allow users to monitor the aquaculture activity over a whole area, and **detect statistical changes.**

The results over Chile have already been integrated on a platform for visualisation purposes and can be found in the references.

Perspectives

- ❑ Improving the performances (precision and recall) of the cluster detection.
- ❑ Testing the algorithm over new areas of interest.
- ❑ Monitoring activities using Very High Resolution.

References

Data

Copernicus Scihub https://scihub.copernicus.eu/

WEkEO https://www.wekeo.eu/

Planet Scihub https://www.planet.com/

BlueCloud

https://www.blue-cloud.org/

https://www.cls.fr/

http://www.fao.org/home/fr/

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