Weak supervision learning for semantic segmentation of metoceanic processes

Aurélien Colin, Nicolas Longépé, Ronan Fablet, Pierre Tandeo, Samir Saoudi

WEAK SUPERVISION LEARNING FOR SEMANTIC SEGMENTATION OF METOCEANIC PROCESSES

Aurélien COLIN[1,2], Nicolas LONGEPE[2], Ronan FABLET[1], Pierre TANDEO[1], Samir SAOUDI[1]

1 - IMT Atlantique, Brest, France,
2 - Collecte Localisation Satellite (CLS), Brest, France

I. MOTIVATIONS

Synthetic Aperture Radar (SAR) ocean remote sensing has been used for a wide range of applications including oil spill or vessel detection, wind, waves and current retrieval [1]. Since 2014, the Copernicus program has acquired vast quantities of SAR data through Sentinel-1 (S-1) mission (more than 5.0 TiB daily). The potential of these data remain highly underexploited and advocate for the development of novel processing techniques.

In this context, deep learning has led to very significant breakthroughs in the semantic interpretation of signals and images. These breakthroughs strongly rely on the existence of fully-groundtruthed datasets, including representative sets of segmented images. In ocean remote sensing, the absence of such groundtruthed datasets make particularly challenging the semantic interpretation of ocean scences from the SAR imagery.

In this paper, we address these challenges and investigate the extent to which we may benefit from existing categorization datasets to deliver a semantic segmentation of metoceanic processes from SAR data.

II. DATA

The TenGeoP-SARwv dataset [2] is composed of 37k images from ten meteoceanic process (as listed in the legend of the figure 1). Each observation covers an oceanic region of 20x20 km and is given a single label. If this categorization may be adequate for mesoscale phenomena (like wind streaks) as they are likely to appear in the entire image, this assumption does not hold for local phenomena such as icebergs. Moreover, the shapes of metocean features are also diverse, like narrow curves for fronts, aggregation of disconnected areas for biological slicks or wide regions for low wind areas.

We aim to develop deep learning strategies for the semantic segmentation of SAR ocean observations when we are only provided with a global categorization of the observed scenes, i.e. in the absence of groundtruthed segmentation data.

III. PROPOSED APPROACH

Following [3], we consider a weakly supervised learning strategy, which benefits from the single-class annotation of the considered dataset. Jackson et al. [3] proved that such a strategy makes possible to infer location information of the different phenomena.

More precisely, we proceed as follows. A categorizer is build, with slicing layers to convert an input of shape $(512, 512)$ into a shape $(7, 7, 128, 128)$. The two first dimensions correspond to overlapping tiles extracted from the input. These tiles enter an InceptionV3 model to create $(7, 7, 10)$ outputs. Then, the mean (for local phenomena) and the max (for global phenomena) are computed over the tiles and used as the output of the model to have the categorization vector. After the training, the last layers are discarded to keep $(7, 7)$ segmentations that can be used as groundtruths in a semi-supervised framework. Preliminary results are illustrated in the figure 1.

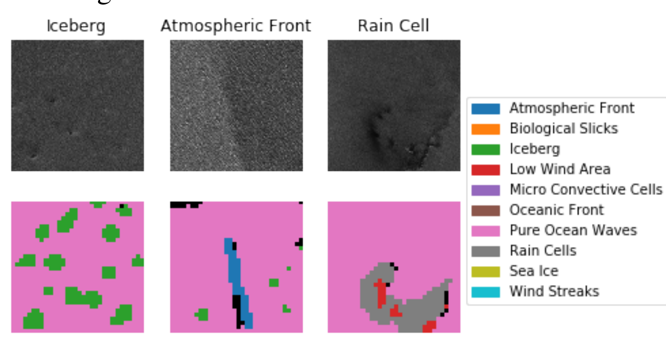

Fig. 1. Preliminary results.First column is the SAR image (with its label as title), second is the output of proposed approach.

REFERENCES

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