A SPACE-BASED SOLUTION FOR OIL SPILL DETECTION

An innovative application to collect satellite images of the sea and detect areas polluted from oil releases in order to notify the national authorities and coast guards.

The challenge

Countries with large seawater areas or extended coastlines have to deal with the challenging issue of promptly detecting marine pollution, in order to minimise the environmental effects. Aquatic pollution may originate from oil spills, plastics, or debris from natural disasters and it can be caused either deliberately or accidentally. The large number of oil-based products on the market entails the increase of shipping routes that eventually raises the possibility of slicks occurring. Remote sensing, within the Copernicus Programme, can act as a beneficial monitoring tool that will allow early detection of slicks, provide size estimations, and predict the slick motion.

The space based solution

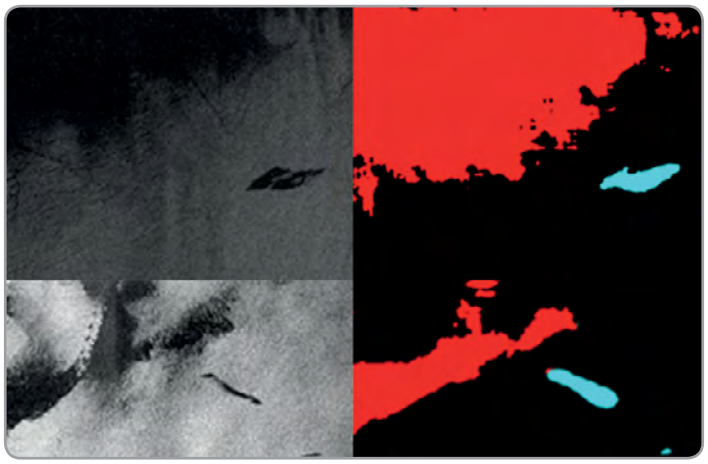
The solution involves a web application that tackles oil spill identification in EU maritime areas, aimed at triggering the awareness of the relevant authorities.

The application processes Synthetic Aperture Radar (SAR) images are acquired from Sentinel satellites provided by the Copernicus Open Access Hub. SAR images provide independence regarding the operational time and the environmental conditions, enhancing the functionalities of the Copernicus Marine Environment Monitoring Service (CMEMS). On the backend, SAR images are downloaded daily from the Copernicus services, noise is suppressed and semantic segmentation algorithms are applied to identify the oil spills. Contrary to current solutions, our service not only provides a wider-area detection scheme, but also annotates each pixel with a valid classification state. Analysed images are presented as detection masks, where turquoise areas define an oil spill, whilst red areas mark lookalikes. The service can identify pollutant areas with an accuracy of 91%, thus, the frequency of in situ verification by the authorities could be significantly limited. In case of a verified oil slick, users instantly receive an alert with the position and the size of the oil slick to act accordingly.

Benefits to Citizens

By exploiting Copernicus data, the proposed application aims to rapidly identify oil related events, mitigate the positive false alerts from the end-user side and thus trigger all the necessary mechanisms that are involved during such events, e.g. the coastguard. In this way, the application primarily contributes to avoiding the extension of ecological disasters and, consequently, benefits both the environment and the public health.

Moreover, by providing estimates of the size and the movement of the slick, the application can be invaluable in aiding clean-up operations or helping the authorities to identify the polluters. With regards to the latter, the application can be easily integrated into existing systems that concern maritime surveillance. No additional



Original satellite SAR images from the Mediterranean Sea (left) and detection masks (right) with oil spills and lookalikes.

Thematic Area: BIODIVERSITY AND ENVIRONMENTAL PROTECTION

Region of Application: CENTRAL MACEDONIA

Sentinel mission used: S1

Copernicus Service used: CMEMS

Usage Maturity Level: 3

human contribution is required in the identification process since the model is trained to identify the oil spills based on its natural attributes. Finally, it can significantly reduce the workload of the human operators of the agencies concerned due to the high accuracy identification, since this task is currently addressed manually (ships have to report pollution incidents), and, thus, it can optimise the utilisation of the personnel by assigning more complicated tasks.

A comparison between produced detection masks (left) and ground truth images (right).

Outlook to the future

Currently, the application supports the detection of oil spills, but the main objective is to extend its capability in identifying more pollution factors, i.e. debris from natural disasters. It is also expected that any evolution of the EO Copernicus solution will result in improvements of our system, e.g. enhanced detection or wider area covering. A more accurate discrimination of the phenomena that are currently denoted as "lookalikes" could constrain the false positive alerts as well as the identification of ships. Merging the latter with data from a ship's Automatic Identification System (AIS), the root of the pollution could be particularised.

"I strongly support that such an application could significantly transform the way that we respond in such events like oil spills whether they come from a single ship or an oil rig or other similar human action."

Spyridon Kintzios,
Commander HN, MSc

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ABOUT COPERNICUS4REGIONS

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