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Tools and Technology in Support of Integrated Applications (1)

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EARLY WARNING OF OIL SPILLS BASED ON ON-BOARD IMAGERY PRE-PROCESSING
ALGORITHM

Abstract

Marine and coastal ecosystems fragility is often threatened by oil spills from offshore fields, super-tankers or accidents. Unfortunately, existing ground technologies do not provide a quick response to these events that, without contingency planning, could easily turn into environmental catastrophes. Thanks to the advent of the so-called New Space, even more companies are able to deliver public and private users global monitoring services relying on their own space infrastructures for Earth Observation based on cost-effective nano-satellites. This is the case of ICEYE, who is building a constellation of SAR satellites to support a service level where any location on Earth can be reliably imaged every 1-3 hours, initially launching a constellation of 18 SAR satellites by the end of 2020 and the case of ESA's FSSCat mission based on 6U Cubesats in support of the Copernicus Land and Marine Environment services. The extensive use of high performances off-the-shelf components enhanced small satellites capabilities paving the way for new mission concepts. In this context, it is introduced an on-board hyperspectral image pre-processing algorithm for oil spills detection. For instance in case of SAR imagery, the basic methodology could be summarized in four main steps: isolation of dark signatures; feature extraction; feature test against pre-defined or statistical values and finally, probabilities for each candidate spot are computed to determine whether it is an oil spill or a look-alike phenomenon. Results of a Hardware-In-the-Loop test campaign will be presented to demonstrate the on-board implementation capability of the algorithm. The proposed on-board image pre-processing algorithm represents a new approach to EO data exploitation: it quickly provides essential information, while streamlining data transfer. Due to the high revisit time, LEO small satellites will be able to detect potential oil spills rapidly, therefore, enabling a service of early warnings issue. In conclusion, New Space companies will be able to tackle environmental issues while sustainably addressing customer needs.