IAF EARTH OBSERVATION SYMPOSIUM (B1)
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SPECTRE: MARINE TRAFFIC MONITORING THROUGH AN INNOVATIVE AI-POWERED MULTI-SENSOR MULTI-MISSION FRAMEWORK

Abstract

Monitoring maritime traffic has always been a subject of study for researchers in the field of remote

sensing, and a key interest with undeniable strategical value for both the civil and military perspectives. In the current state of the field, illegal maritime activities, including human trafficking, poaching, smuggling, drug trafficking, and the concerning issue of voluntarily sunk unregistered ships, highlight the critical need for a tool capable of conducting thorough, regular, and ongoing surveillance of the Mediterranean. In fact, numerous Earth observation missions that are either already in orbit or planned in the future have the capabilities for ship detection, exploiting a plethora of different sensors with a wide variety of spectral characteristics and spatial resolutions. However, the use of single missions does not provide the required spatial and temporal capabilities necessary to properly monitor illegal or otherwise unreported maritime traffic. The project SPECTRE (ShiP dEteCTion based on aRtificial intElligence; agreement n. 2023-4-E.0) funded by the Italian Space Agency in the framework of RESEARCH DAY ASI 2020 program, has the objective to develop an AI-based tool that is able to integrate data from radar and optical satellite missions, nominally the Sentinel platforms, COSMO-SkyMed, and future missions such as Iride. The use of several missions with different capabilities and orbital parameters allows for much higher monitoring frequency, enabling tracking of single vessels through much wider areas and time frames than would otherwise be possible. Deep learning (DL) techniques are exploited for the processing chain of both optical and SAR products. In particular, super-resolution algorithms are applied on optical imagery to enhance their interpretability. All imagery is further pre-processed with knowledge of sea characterization, filtering-out surface phenomena that might interfere with ship hull detection. AI detection models are developed and trained for SAR and optical imagery, and an intelligent algorithm for temporal and spatial matching is used to pair products from different missions to track targets. At the end of the project a WEBGIS-based interface will be delivered to enable the monitoring of not collaborative vessels.