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Earth Observation Applications, Societal Challenges and Economic Benefits (5)

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WAKE-BASED DETECTION OF DARK SHIPS IN SAR IMAGES FOR IMPROVING SECURITY OF SEAS

Abstract

Earth Observation (EO) data are generating added value- products and services for meeting societal challenges and addressing new commercial approaches. The most disparate ambits are gaining benefits from EO data exploitation, from agriculture to fishery, from security to environmental monitoring. This paper focuses on maritime domain monitoring based on Synthetic Aperture Radar (SAR) data. Different projects and tools are under development for improving our awareness of the maritime domain and to establish operative services allowing for a continuous and effective global monitoring of the seas, thanks to radar and optical data integrated with ancillary information. In addition to the most assessed deterministic techniques, deep learning techniques such as Convolutional Neural Networks (CNNs) have been recently suggested for image-based feature extraction. In the ambit of maritime surveillance, most approaches using deep learning techniques mainly focus on methods for the detection of artificial targets such as ships but only few results of CNN-based detection of ship wake exist. In [1], even with a limited number of available SAR images, the authors show that the CNN is a useful tool for detecting the presence of wake on wide area SAR images with an accuracy even better than classic deterministic approach. Such concept is particularly interesting referring to the so-called "go-fast ships". They usually have a length between 10 to 15 meters, and they can reach speeds greater than 80 knots in calm water, and up to 50 knots in rough sea depending on their operational limits. Their geometry and materials are also thought with the specific aim to strongly reduce the radar returns. However, due to their high velocity and narrow beam, the go-fast boats are likely to produce long visible wakes. Such wakes are very persistent, lasting for distances of several kilometers, and they can be observed in SAR imagery. This paper shows advances in the applications of SAR data processing to improve the maritime domain awareness, as well as the societal challenges and economic benefits that the detection of go-fast ships could involve. In fact, such ships are called also dark ships and used for illegal affairs, from piracy to trafficking.

[1] K. Kang and D. Kim, "Ship Velocity Estimation From Ship Wakes Detected Using Convolutional Neural Networks," IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens., vol. 12, no. 11, pp. 4379–4388, 2019.