Advances in Unsupervised Ship Detection with Multiscale Techniques

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Oceans are subject to a number of exploitative activities which prompt governments and industry to look for reliable means of marine surveillance. In that sense, satellite remote sensing constitutes a powerful monitoring solution. In particular, a growing interest on SAR sensors for monitoring of ship traffic and fishing activities has been confirmed.

Even, if a human operator is usually able to distinguish the presence of a vessel on a SAR image, unsupervised ship detection is an awkward process in heterogeneous scenarios. However, providing a robust automatic scheme is essential to guarantee repeatability and reliability on the results. Moreover, it allows a fast interpretation of large amounts of data which is a fundamental requirement if near-real time applications are envisaged. As an alternative to Constant False Alarm Rate techniques based on the evaluation of an adaptive threshold over a slidding window of fixed dimensions, a multiscale method based on a combination of wavelet subbands has been proposed in [1]. This approach has been tested on a large set of single channel RADARSAT, ERS and ENVISAT images and its particular features were compared to the ones of existing operational algorithms. The aim of this paper is to analyze the enhancement of the detection performance of this multiscale algorithm by adapting it to images acquired by RADARSAT-2, with multipolarization and improved resolution capabilities.

On the one hand, concerning the exploitation of several polarization channels for ship detection purposes, it must be noted that even before the availability of quad pol data, a number of research efforts were carried out in this direction. It was anticipated [2] [3] that the additional information contained in polarimetric data would improve ship detection capabilities, overcoming drawbacks of current single channel algorithms. Moreover, in [1], the multiscale technique proposed for ship detection mentioned earlier was adapted to be applied on ENVISAT AP images and it was shown that the availability of polarisation diversity could be successfully exploited to improve ship detection rates.

On the other hand, concerning increased resolution capabilities, it will be shown that the multiscale algorithm proposed is particularly well suited to identify dominant scatterers within the target's signature, specially when using the Ultra-Fine beam mode. The discrimination of the most reflective elements in the vessel permits a meaningful refinement of the method, by addressing target recognition issues.

After discussing the details of the extension of the multiscale method to quad pol data with fine resolution, the extended approaches will be tested on a set of RADARSAT-2 images of the area of Barcelona's harbor, in the Mediterranean Spanish coast. The availability of in situ ground truth data will allow cross checking the results obtained and evaluating precisely the advantages and limitations of the technique.

The images considered in this research work have been provided by RADARSAT in the scope of the projects SOAR 3077 and 3084.

References:

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