Improved Vessel Detection and Characterization for RADARSAT-2

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ABSTRACT

This talk will describe results from the Defence Industrial Research (DIR) project ‘Enhancing Canada’s Maritime Surveillance Capability’, which MDA recently completed for DRDC. The primary objective of this project was to enhance Canada’s maritime surveillance capabilities by improving both the quality and scope of RADARSAT-2 derived vessel information.

Based on operator feedback and emerging requirements, the project conducted an extensive update of the OceanSuite software used operationally by the Canadian Department of National Defence’s Polar Epsilon system for vessel detection and characterization. This included: adding capability to process imagery from other SAR satellites of interest; improving the user interface to allow operators to visualize, review and edit results more efficiently; enhancing the accuracy and robustness of underlying algorithms; and improving the information content of output vessel reports by adding support for additional metadata, image chips and alternative formats. The project has moved OceanSuite forward considerably in terms of accuracy, functionality, usability and maintainability, providing a much more capable vessel detection tool for both Polar Epsilon 1 and 2.

The project used an extensive and representative set of RADARSAT-2 and self-reporting data to independently validate and analyze OceanSuite performance at detecting and characterizing vessels. This performance analysis helped inform improvements to OceanSuite. Vessel detection analysis focused on determining how the new maritime surveillance modes (DVWF, OSVN) improve the detection of smaller vessels as compared to the ScanSAR mode (SCNB) used previously. DVWF has a clear advantage over OSVN and SCNB at detecting vessels in the range of 10 m to 70 m. Vessel characterization analysis focused on understanding the accuracy of measurements of vessel length, width and heading and how these vary with imaging parameters. Vessel length and width are often overestimated and the accuracy of these measurement is dependent on the orientation of the vessel relative to radar illumination.

In addition to providing an overview of the project the talk will focus on two specific topics:

- Vessel detection using alternate detection algorithms. Specifically, we compare the commonly used CFAR-based detection method to a method based on the Hermitian product of the off-diagonal elements of the inter-look covariance matrix and a method based on correlation of sub apertures.

- A new vessel characterization algorithm that is able to better estimate vessel length and heading in the presence of azimuth smearing, an artifact of SAR image formation that causes moving targets to appear stretched and smeared along the azimuth direction and subsequently cause OceanSuite’s currently implemented ship characterization algorithm to overestimate the vessel length.