# Polarimetric 3D-ISAR

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In an airborne maritime radar, inverse synthetic aperture radar (ISAR) is used to image and classify non-cooperative targets. By automating the target classification, the operator workload will be reduced significantly, and the accuracy can be improved. Three dimensional (3D)-ISAR has been developed to improve the target representation and provide more accurate estimates of a target's geometric features, including its length, width and height. The accuracy of target classification relies on the quality of ISAR images, which is influenced by the signal-to-noise ratio (SNR) of the target scatterers and its motion during the integration time.

Polarimetry provides additional scattering information which has been exploited in the remote sensing community to enhance the quality of ISAR imagery. In prior work, 3D-ISAR techniques have been limited to a single polarisation. A polarimetric extension is proposed to a temporal-based 3D-ISAR algorithm. This technique works as optimally combined the signals from all co-polarised and cross-polarised receiving channels to maximise the scatterers signal-to-noise ratio (SNR) and the ISAR image quality. These enhancements offer improved accuracy of the geometric feature estimates for 3D-ISAR.

In this work, we demonstrate the advantage of polarimetric (pol)-ISAR as a complement to the 3D-ISAR image formation process using a high fidelity ISAR simulation with a fully-polarimetric scattering model, and with real data collected by the Ingara airborne X-band radar. The performance of the polarimetric 3D-ISAR results are compared with those produced by a single polarisation.