Target detection in low sample support maritime environments

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The use of airborne space time adaptive processing techniques for target detection in the maritime environments suffers performance degradation in homogeneous clutter environments. Another challenge for accurate target detection is the limited number of coherent pulses available in the context of fast-scanning radar systems.

While various data processing techniques to resolve this issue are documented in the literature, maritime clutter suppression remains an ongoing research area. The single data set (SDS) method operates exclusively on the cell under test, eliminating reliance of training data range bins and thus excelling in heterogeneous clutter environments [1].

The multistage Wiener Filter (MWF) is a well-known signal-dependent reduced-rank processing technique which is also useful for mitigating the impact of clutter heterogeneity [2]. It gradually constructs the clutter subspace basis using an adaptive criterion to determine the appropriate basis rank. It has been shown to outperform full-rank approaches when reduced sample support is available, in part due to the lack of sample matrix inversion required.

Considering how the SDS is a covariance-estimation approach like the AMF and NAMF, we propose a new implementation that is based on the MWF formulation. To evaluate the MWF-SDS algorithm, a Monte Carlo analysis is performed using both real and high fidelity simulated sea-clutter [3]. The MWF-SDS is shown to be superior to the SDS across the entire Doppler spectra, especially when the length of the coherent processing interval restricts the number of snapshots available.

References

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