Outliers-Robust CFAR Detector of Gaussian Clutter Based on the Truncated-Maximum-Likelihood- Estimator in SAR Imagery

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Abstract— This paper proposes an outliers-robust constant false-alarm rate (OR-CFAR) detector of Gaussian clutter based on the truncated-maximum-likelihood estimator (TMLE) in SAR imagery. The proposed method aims at elevating the detection performance in multiple-target environment, where the sea clutter samples are often contaminated by the interfering target pixels, the azimuth ambiguities, and the breakwater. As a consequence, the parameters used for statistical modeling are over-estimated, resulting in a degradation of the CFAR detection rate. Inspired by the traditional two-parameter CFAR (TP-CFAR) detector of Gaussian clutter, OR-CFAR designs an adaptive threshold-based clutter truncation method to eliminate the high-intensity outliers from the clutter samples in the local reference window, and the probability density function (PDF) of the sea clutter can be accurately modeled through the newly raised TMLE. Furthermore, the optimal truncation depth used for clutter truncation and PDF modeling is evaluated and selected properly to get the best detection results. The OR-CFAR greatly enhances the CFAR detection rate in multiple-target environment, and it is computationally simple and efficient, which has a great application value. The Chinese Gaofen-3 SAR data are used for experiments to show the better detection performance of OR-CFAR.

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