

SCATTERING MATRIX DECOMPOSITION AND COLOR SPACES PERFORMANCE FOR SYNTHETIC APERTURE RADAR IMAGERY

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ABSTRACT:

Polarimetric Synthetic Aperture Radar (SAR) has been shown to be a powerful tool in remote sensing, because uses up to four simultaneous measurements thus giving additional degrees of freedom for processing. Typically, polarization decomposition techniques are applied to the polarization-dependent data to form colorful imagery that is easy for operator systems to interpret. Yet, the presumption is that the SAR system operates with maximum bandwidth, which requires extensive processing for near or real-time application. In this research, color space selection is investigated when processing sparse polarimetric SAR data, as in the case of the publicly available Volumetric SAR Data Set, Version 1:0". To improve information quality in resultant color imagery, three scattering matrix decompositions were investigated (linear, Pauli and Krogager) using two common color spaces (RGB, CMY) to determine the best combination for accurate feature extraction. A mathematical model is presented for each decomposition technique and color space to the Cramer-Rao lower bound (CRLB,) and quantify the performance bounds from an estimation perspective for a given SAR system and processing parameters. After a deep literature review in color science, the mathematical model for color spaces was not able to be computed together with the mathematical model for decomposition techniques. The color spaces used for this research were functions of variables that are out of the scope of electrical engineering research, and include factors such as human color sensing, environment influences in the color stimulus, and device technical characteristics used to display the SAR image. Hence, SAR imagery was computed for specific combinations of decomposition technique and color space, and allow the reader to gain an abstract view of the performance differences. The views expressed in this article are those of the authors and do not reflect the official policy of the U.S. Air Force, U.S. Department of Defense, or the U.S. Government.

TOPIC: Microwave remote sensing

ALTERNATIVE TOPIC: Image processing and pattern recognition