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Classification and Segmentation of Radar Polarimetric Images

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Abstract

The development of remote sensing involves the introduction of new sensors as radar imagers (SAR, Synthetic Aperture Radar). SAR sensors operate at long wavelength (10cm-1m), can see through clouds and provide information complementary to "optical" sensors (visible and near-infrared). SAR imagers are active sensors using coherent waves. Phase differences between return signals of different scatters produce interference patterns and an important "speckle" noise that makes the processing of images very difficult.

Return signals from scatters are affected by wave polarization. A horizontal-vertical polarization reference system is used. Scatter types are characterized by horizontal and vertical responses to transmitted horizontal and vertical signals. The backscatter signal follows a zero mean multidimensional complex Gaussian distribution. The covariance matrix is used for multi-look signal and follows a Wishart distribution. We will show how the signal distribution could be used for signal classification and image segmentation (partition). We present a hierarchical segmentation technique with a stepwise criterion that optimizes the partition likelihood. The covariance matrix could also be decomposed into a set of attributes characterizing different backscatter mechanisms and useful for target classification.