Speckle Filtering of NASA/JPL POLSAR C- and L-band Data with Structural Feature and Scattering Property Preservation

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Polarimetric synthetic aperture radar (POLSAR) images are inherently corrupted by speckle noise due to the random interference of the backscattered radar waves from many elementary scatterers within the imaged resolution cell. This presence of speckle noise can significantly degrade the performance of post-processing applications, such as image segmentation and classification. The objective of this paper is to extend the two concepts of scattering property- based filtering (Yoon and Kim, 2003; Lee et al., 2003) by incorporating structural detectors (Schou et al., 2003; Schou, 2001). Two speckle filters for multi-look POLSAR imagery are proposed, which preserve structural features, i.e. edges and lines, as well as scattering properties. The central idea of the two proposed speckle filters is that the filtering operations are performed spatially variant for edge/line features along their orientations in order to preserve them. For homogeneous areas the filtering is performed based on the scattering properties. The capabilities of both filters are demonstrated for the NASA/JPL nine-look POLSAR C- and L-band data, which were acquired during the PACRIM-2 science mission over Malaysia in 2000. Also, comparisons with the Boxcar, Leerefined and Annealing filters are provided. All filters were assessed in terms of speckle removal, structural feature retention and radiometric preservation. From the obtained results it can be concluded that both proposed filters show an excellent performance in all the three before mentioned aspects. For the Boxcar filter a trade-off between the speckle removal capability and the structural feature retention can be observed. The Lee-refined filter was found to provide good performance, but the resultant standard deviation over a homogeneous area is slightly higher compared with the same window size employed in the Boxcar and both proposed filters. The Annealing filter is characterized through a good performance in both speckle removal and structural feature retention. However, it suffers from the inherent defection in radiometric preservation