Using of DWT based MMRF segmentation method for SAR images

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SAR images are one of the most important sources for remote sensingstudies in meterology, oceanography, astronomy, geology, etc. In this paper, we present an efficient way for segmentation of SAR images, to reduce the effects of over-segmentation caused by speckles.Conventional segmentation methods often lead to over-segmentation, because of the high energy of speckles. The over-segmentation problem worsens when the image is composed of complicated textures.

Our proposed algorithm is based on the Discrete Wavelet Transform (DWT) and Multiresolution Markov Random Field (MMRF). In the first step, a SAR image is decomposed into multiple levels ofsubband images. Then, MMRF segmentation is applied to each LL subband image from the coarsest level to the finest level. The K-means algorithm is applied to the LL subband image at the lowest resolution level during the segmentation procedure and the segmentation at the next resolution is initialized from the results from the previous (lower) resolution using the "4 to 1" mapping relationship between two adjacent levels. Because wavelet filters act as lowpass filters during the DWT procedure, high frequency components, including the speckles, detailed local structures in the original SAR images, are rejected from the LL subband images. To meet resolution requirements (of segmentation) for different applications, we adjust the starting level of the segmentation procedure, and the weights of MRF cliques accordingly.

To show the effectiveness of our proposed algorithm, we apply this technique to the Region-of-Interest (ROI) compression of SAR images. Our segmentation algorithm can avoid the over-segmenting problem and segment the processed image into regions according to the their textures. This way, different compression parameters are assigned to ROI's in the post-processing Steps in order to save the storage space and transmission time.