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Noise reduction from synthetic aperture radar imagery

In the past few years, interest in assessing and mapping with Synthetic Aperture Radar (SAR) data has steadily increased. Many of the digital analysis techniques and procedures developed and tested for use with optical (multispectral scanner) data do not work well with SAR data, due to the distinctly different inherent characteristics of SAR data, such as noise.

Characteristic of the noise in SAR images differs significantly from that of more conventional (passive) digital spaceborne or airborne images. The most important difficulty that arises from the coherent nature of the excitation is the occurrence of speckle. Reducing the speckle would improve the discrimination among different feature types. The noise appears as heavy granularity even in homogeneous areas containing no natural texture. Adaptiveness of the filter is required to reduce this granularity sufficiently while preserving meaningful edges and objects.

In this study an experimental comparative study among several radar image speckle reduction filters proposed in the literatures was made in order to investigate how these filters respond to the linear features is required to reduce this granularity sufficiently while preserving meaningful edges and objects.

In this study, an experimental comparative study among several radar image speckle reduction filters proposed in the literatures was made in order to investigate how these filters respond to the linear features in radar images. A quantitative and qualitative evaluation of several digital filters for speckle noise reduction is presented. Adopted digital filters are Median, Lee, Frost and Crimmins filters.

Attempting to reduce the speckle by preserving line features was the major criteria for evaluation. Theoretical hypothesis validity and influence checked with the signal to noise ratio improvement, linear features response in the histogram and visual interpretation techniques.

Data used in the study was the aircraft radar data of L-band (24.5cm wavelength) and HH-polarized. Nominal ground resolution of each pixel was approximately 10 mx10m.

From this evaluation procedures it can be concluded that:

All the considered filters are efficient to smooth the image when considering the signal to noise improvement.

The histogram and the visual study show that Crimmins and Frost filters used for one iteration are suitable for speckle reduction and at the same time they preserve the linear features.