Department of Mathematics and Statistics Colloquium

Motion Estimation and Imaging of Complex Scenes with Synthetic Aperture Radar

Thomas Callaghan, Rice University, TX

Abstract: In synthetic aperture radar (SAR) imaging, two important applications are formation of high resolution images and motion estimation of moving targets on the ground. In scenes with both stationary targets and moving targets, two problems arise. Moving targets appear in the computed image as a blurred extended target in the wrong location. Also, the presence of many stationary targets in the vicinity of the moving targets prevents existing algorithms for monostatic SAR from estimating the motion of the moving targets.

In this talk I will first introduce SAR imaging and motion estimation. Then I will discuss the novel data pre-processing strategies I developed to address the challenge of motion estimation in complex scenes. The approach involves decomposing the SAR data into components that correspond to the stationary targets and the moving targets, respectively. Once the decomposition is computed, existing algorithms can be applied to compute images of the stationary targets alone. Similarly, the velocity estimation and imaging of the moving targets can then be carried out separately.

The approach for data decomposition utilizes ideas from layer annihilation in seismic imaging and robust principle component analysis (PCA) in optimization and compressed sensing. Classical results of Szego on Toeplitz matrices and more recent results on g-Toeplitz and g-Hankel matrices are used in the analysis. Numerical simulations will be presented.

Friday, February 1 at 3:45 in Roop 103

refreshments at 3:30