Shadow Exploitation in Synthetic Aperture Radar

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An occluded or dark region in synthetic aperture radar (SAR) imagery, known as a shadow, is created when incident radar energy is obstructed by a target with height from illuminating resolution cells immediately behind the target in the ground plane. Shadows depend on the physical dimensions and mobility of a target, platform and radar imaging parameters, and scene clutter. Target shadow dimensions and intensity can be important radar observables in SAR imagery for target detection, location, and tracking or even identification. Stationary target shadows can provide insight as to the physical dimensions of a target, while moving target shadows may show more accurately the location and motion of the target over time versus Doppler energy which may be shifted or smeared outside the scene. However, SAR shadows prove difficult to capture as a target or platform moves, since the quality of the no-return area may quickly be washed-out in a scene over many clutter resolution cells during an aperture. Distinct computational needs also exist whether a human analyst or a computer algorithm are interpreting the shadows. Shadows are innately preferred by the human visual perception system for the interpretation of spatial environments, but foibles of that system can lead to erroneous assertions about objects and their spatial qualities, which must be mitigated. The general mathematics and computational aspects of radar shadow observables and imaging exploitation algorithms for both human and computer analysis is investigated in this talk. Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.