



Doctoral Defense  
Friday, November 15, 2019  
Fitz Hall 568 at 10 a.m.  
All are welcome to attend.

Registration Algorithms for Flash Inverse Synthetic Aperture LiDAR

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### Abstract

This research demonstrates registration algorithms specific to Inverse Synthetic Aperture LiDAR (ISAL) complex data volumes. Two registration approaches are considered, a mutual information registration algorithm (MIRA) and an enhanced, range bin-summed cross-correlation algorithm. The theory for implementing both MIRA and cross-correlation enhancements is detailed and applied to a simulated sensitivity analysis that compares algorithm convergence and performance for different SNR, sub-aperture shift distances, and low-pixel supports. The enhanced cross-correlation algorithm showed significant gain in registration operability with respect to SNR and sub-aperture shift, giving new options for potential ISAL system design. An experimental Flash LiDAR system was constructed utilizing a multi-pixel temporal homodyne detection approach for simultaneous azimuth, elevation, range and phase real-time imaging of target, and this system was used to benchmark registration sensitivity for real data volumes. This is the first known application of a fast-focal plane array for low support flash temporal homodyne LiDAR for aperture synthesis.