Geometric Quality Assessment of Lidar Data Based on Swath Overlap
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Lidar has become the de-facto technology for 3D data collection. With increasing applications, including mission critical ones such as infrastructure, precision forestry, flood risk management, aviation safety, etc., it is important to understand the quality of lidar data. With the growth of national lidar programs like the 3D Elevation Program (3DEP), the need for improved geometric quality within lidar data has become apparent. A significant obstacle to this has been the lack of an industry wide accepted method for quantifying the precision of calibration and bore-sighting, in 3 dimensions, of lidar collections. We propose a new methodology for assessing the geometric quality of lidar data. Presented are definitions of new Data Quality Measures (DQM), the processes used to make the measurements, and the reduction of those measurements to useful metrics of geometric quality. An additional derived metric, Discrepancy Angle, describes systematic errors in the data. The process is based on analysis of points in one swath to the coincident surface in an overlapping swath. An automated process randomly and uniformly selects lidar checkpoints throughout the overlap regions. Inappropriate points are discarded. Unlike existing methods which compare only elevations, the proposed method assesses the 3-dimensional displacement between features in the swaths without requiring feature extraction.

The process then generates summary statistics quantifying the geometric differences between the swaths and produces a quantified description of the quality of the data calibration. The method assesses errors in both vertical and horizontal dimensions, and can be used to estimate other systematic errors in the data.

The research is a joint effort of the ASPRS Calibration/Validation Working Group and the U.S. Geological Survey.