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REFERENCE LIDAR SURFACES FOR ENHANCED AERIAL TRIANGULATION AND CAMERA CALIBRATION

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Abstract. Due to the complementary characteristics of lidar and photogrammetry, the integration of data derived from these techniques continues to receive attention from the relevant research communities. The research presented in this paper draws on this by adopting lidar data as a control surface from which aerial triangulation and camera system calibration can be performed. The research methodology implements automatic registration between the reference lidar DTM and dense photogrammetric point clouds which are derived using Integrated Sensing Orientation (ISO). This utilises a robust least squares surface matching algorithm, which is iterated to improve results by increasing the photogrammetric point quality through self-calibrating bundle adjustment. After a successful registration, well distributed lidar control points (LCPs) are automatically extracted from the transformed photogrammetric point clouds using predefined criteria. Finally, self-calibrating bundle block adjustment using different configurations of LCPs is performed to refine camera interior orientation (IO) parameters. The methodology has been assessed using imagery from a Vexcel UltraCamX large format camera. Analysis and the performance of the camera and its impact on the registration accuracy was performed. Furthermore, refinement of camera IO parameters was also applied using the derived LCPs. Tests also included investigations into the influence of the number and weight of LCPs in the accuracy of the bundle adjustment. Results from the UltraCamX block were compared with reference calibration results using ground control points in the test area, with good agreement found between the two approaches.

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