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Ground point filtering of UAV-based photogrammetric point clouds

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Unmanned Aerial Vehicles (UAVs) have proved invaluable for generating high-resolution and multi-temporal imagery. Based on photographic surveys, 3D surface reconstructions can be derived photogrammetrically so producing point clouds, orthophotos and surface models. For geomorphological or ecological applications it may be necessary to separate ground points from vegetation points. Existing filtering methods are designed for point clouds derived using other methods, e.g. laser scanning. The purpose of this paper is to test three filtering algorithms for the extraction of ground points from point clouds derived from low-altitude aerial photography.

Three subareas were selected from a single flight which represent different scenarios: 1) low relief, sparsely vegetated area, 2) low relief, moderately vegetated area, 3) medium relief and moderately vegetated area. The three filtering methods are used to classify ground points in different ways, based on 1) RGB color values from training samples, 2) TIN densification as implemented in LAStools, and 3) an iterative surface lowering algorithm. Ground points are then interpolated into a digital terrain model using inverse distance weighting. The results suggest that different landscapes require different filtering methods for optimal ground point extraction. While iterative surface lowering and TIN densification are fully automated, color-based classification require fine-tuning in order to optimize the filtering results. Finally, we conclude that filtering photogrammetric point clouds could provide a cheap alternative to laser scan surveys for creating digital terrain models in sparsely vegetated areas.