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Extracting Terrain Points from Airborne Laser Scanning Data in Densely Forested Areas

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Abstract : Airborne Laser Scanning (ALS) is one of the main technologies for generating high-resolution digital terrain models (DTMs). DTMs are crucial to several applications, such as topographic mapping, flood zone delineation, geographic information systems (GIS), hydrological modelling, spatial analysis, etc. Laser scanning system generates irregularly spaced three-dimensional cloud of points. Raw ALS data are mainly ground points (that represent the bare earth) and non-ground points (that represent buildings, trees, cars, etc.). Removing all the non-ground points from the raw data is referred to as filtering. Filtering heavily forested areas is considered a difficult and challenging task as the canopy stops laser pulses from reaching the terrain surface. This research presents an approach for removing non-ground points from raw ALS data in densely forested areas. Smoothing splines are exploited to interpolate and fit the noisy ALS data. The presented filter utilizes a weight function to allocate weights for each point of the data. Furthermore, unlike most of the methods, the presented filtering algorithm is designed to be automatic. Three different forested areas in the United Kingdom are used to assess the performance of the algorithm. The results show that the generated DTMs from the filtered data are accurate (when compared against reference terrain data) and the performance of the method is stable for all the heavily forested data samples. The average root mean square error (RMSE) value is 0.35 m.

Keywords : airborne laser scanning, digital terrain models, filtering, forested areas
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