



Efficiency of walking patterns for close-range photogrammetry 3D forest stand reconstruction

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Recent efforts for advances of forest inventory methods tend to develop alternative methods for fast and cost-effective collecting of highly precise inventory data. Special attention is given to non-contact measurement methods based on advanced technology and recent computer vision techniques. It has been shown that three-dimensional (3D) point clouds of forest stands obtained from terrestrial laser scanning or close-range photogrammetry are a valuable data source for deriving important forest trees and stand parameters, such as stand density, tree positions, diameters or taper. A photogrammetry point cloud for 3D reconstruction of forest stand is obtained using Structure from Motion technique from a set of images obtained from a handheld camera whereas each single reconstructed point must be identified in several images acquired from different angles. To increase the efficiency of data collection, it is crucial to identify the optimal distribution of camera positions and shooting angles in the forest stand for stop-and-go method, or the walking pattern for dynamic method, respectively. In our study, the walking patterns for terrestrial close-range photogrammetry 3D forest stand reconstruction were compared using an empirical approach of walking patterns simulations. In a mature pure beech forest a square sample plot (20 x 20 m) was established. The area of the sample plot, extended by two meters on each side, was overlaid by a square grid 1 x 1 m. Sixteen images with uniform angle differences were taken on each of the 625 grid points, which makes 10 000 images in total. Walking patterns were simulated by selecting a subset of images corresponding with the camera positions and angles in each pattern. The quality of resulting point clouds was evaluated as the stem detection rate and the accuracy of derived diameters of the trees with comparison with the point cloud resulting from the full set of images and the field measurements. The results of the comparison of the accuracy and efficiency of the walking patterns will be presented.