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Performance of parameter-domain and spatial-domain pole-like feature segmentation using single and multiple terrestrial laser scans

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Abstract. Terrestrial laser scanning (TLS) systems have been established as a leading tool for the acquisition of high density three-dimensional point clouds from physical objects. The collected point clouds by these systems can be utilized for a wide spectrum of object extraction, modelling, and monitoring applications. Pole-like features are among the most important objects that can be extracted from TLS data especially those acquired in urban areas and industrial sites. However, these features cannot be completely extracted and modelled using a single TLS scan due to significant local point density variations and occlusions caused by the other objects. Therefore, multiple TLS scans from different perspectives should be integrated through a registration procedure to provide a complete coverage of the pole-like features in a scene. To date, different segmentation approaches have been proposed for the extraction of pole-like features from either single or multiple-registered TLS scans. These approaches do not consider the internal characteristics of a TLS point cloud (local point density variations and noise level in data) and usually suffer from computational inefficiency. To overcome these problems, two recently-developed PCA-based parameter-domain and spatial-domain approaches for the segmentation of pole-like features are introduced, in this paper. Moreover, the performance of the proposed segmentation approaches for the extraction of pole-like features from a single or multiple-registered TLS scans is investigated in this paper. The alignment of the utilized TLS scans is implemented using an Iterative Closest Projected Point (ICPP) registration procedure. Qualitative and quantitative evaluation of the extracted pole-like features from single and multiple-registered TLS scans, using both of the proposed segmentation approaches, is conducted to verify the extraction of more complete pole-like features using multipleregistered TLS scans.