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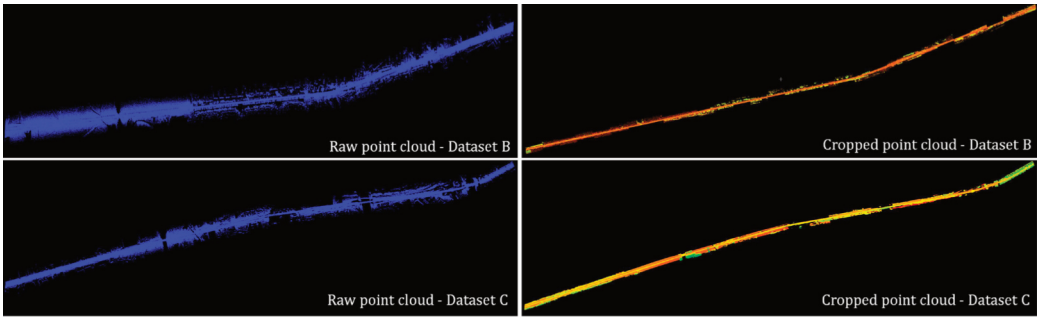
Digitally twinning the geometry of catenary masts in existing rail infrastructure

The time required for generating an object-oriented, geometric railway model of an existing railway from point cloud data is roughly ten times greater than laser scanning. Therefore, the cost and effort of modelling existing rail infrastructure from point clouds often outweighs the perceived benefits of the resulting model. This cost and effort can be reduced by automating the process of creating such models. To achieve such automation, the first challenge is detecting masts from air-borne LiDAR data, as their position and function is critical to the subsequent detection of other elements. This project presents a method that tackles this challenge by leveraging the highly regulated and standardised nature of railways. Railway infrastructure geometric relations remain roughly unchanged over long distances within established regions. Our method initially cleans the point cloud data and roughly detects its positioning and orientation. The resulting datasets are then processed to restrict the search for masts relative to the distance from the track centraline. Subsequently, the method verifies the masts' presence with the use of the RANSAC algorithm. The method also determines the coordinates of the identified masts and finally delivers detected point clusters of the masts as 3D models in IFC format. We implemented the method in a prototype and tested it on three railway point cloud datasets with a cumulative length of 18km. The results indicated that the method achieves an overall detection rate of 94%. This is the first method that automatically detects masts from air-borne LiDAR data.



Key Characteristics

Geometric railway model • Point clouds • Masts detection • LiDAR data