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Geometric Modelling of Octagonal Lamp Poles

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Abstract. Lamp poles are one of the most abundant highway and community components in modern cities. Their supporting parts are primarily tapered octagonal cones specifically designed for wind resistance. The geometry and the positions of the lamp poles are important information for various applications. For example, they are important to monitoring deformation of aged lamp poles, maintaining an efficient highway GIS system, and also facilitating possible feature-based calibration of mobile LiDAR systems. In this paper, we present a novel geometric model for octagonal lamp poles. The model consists of seven parameters in which a rotation about the z-axis is included, and points are constrained by the trigonometric property of 2D octagons after applying the rotations. For the geometric fitting of the lamp pole point cloud captured by a terrestrial LiDAR, accurate initial parameter values are essential. They can be estimated by first fitting the points to a circular cone model and this is followed by some basic point cloud processing techniques. The model was verified by fitting both simulated and real data. The real data includes several lamp pole point clouds captured by: (1) Faro Focus 3D and (2) Velodyne HDL-32E. The fitting results using the proposed model are promising, and up to 2.9 mm improvement in fitting accuracy was realized for the real lamp pole point clouds compared to using the conventional circular cone model. The overall result suggests that the proposed model is appropriate and rigorous.

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