Research on some Lidar data clustering algorithms

Hoang Xuan Thuong

Abstract: This study investigates several clustering algorithms for processing Light Detection and Ranging (LiDAR) data, a critical step in autonomous navigation and environmental mapping. LiDAR point clouds are characterized by high density, irregular spatial distribution, and varying noise levels, posing significant challenges for traditional clustering methods. The research evaluates the performance of Density-Based Spatial Clustering of Applications with Noise (DBSCAN), K-means, and a hierarchical clustering approach on real-world urban and forest datasets. Key metrics including computational efficiency, accuracy, and robustness to noise are analyzed. Experimental results demonstrate that DBSCAN outperforms K-means in handling non-spherical clusters and variable point densities, while hierarchical clustering offers superior segmentation for multi-scale objects. However, DBSCAN's sensitivity to its epsilon parameter remains a limitation. The study proposes an adaptive parameter selection method to mitigate this issue, achieving a 15% improvement in the F1-score. These findings provide practical guidance for selecting and tuning LiDAR clustering algorithms for applications such as obstacle detection and terrain classification.

Keywords: data clustering, Lidar, algorithm, spatial data processing