

论文与报告

基于拓扑高程模型的室外三维环境建模与路径规划

闫飞, 庄严, 白明, 王伟

1. 大连理工大学信息与控制研究中心 大连 116024

2. 机器人学国家重点实验室 沈阳 110016

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摘要

针对复杂室外场景, 提出一种基于拓扑高程模型的三维环境建模方法. 采用自适应可变阈值聚类算法, 将映射到二维水平栅格中的激光点云划分为垂直单元和水平单元, 可实现三维场景中悬空环境特征的有效表述. 在此基础上对垂直单元进行高度离散采样, 从而构建与其相对应的拓扑结构, 并结合BOW (Bag of words)模型对室外三维环境中的典型景物进行辨识. 采用面向拓扑结构和高程图单元的分级匹配策略, 实现不同场景间的精确匹配, 构建具有全局一致性的拓扑高程地图. 利用辨识出来的环境特征和高程地图产生双重环境约束, 实现与室外地形相适应的自主路径规划. 实验结果和数据分析证明了本文环境建模与路径规划方法的有效性和实用性.

关键词 [拓扑高程模型](#) [三维环境建模](#) [场景匹配](#) [路径规划](#) [非结构化室外场景](#)

分类号

3D Outdoor Environment Modeling and Path Planning Based on Topology-elevation Model

YAN Fei, ZHUANG Yan, BAI Ming, WANG Wei

1. Research Center of Information and Control, Dalian University of Technology, Dalian 116024

2. State Key Laboratory of Robotics, Shenyang 110016

Abstract

An approach for 3D environment modeling is proposed to establish the topology-elevation model of outdoor scenes. After projecting laser points into 2D grids, the clustering algorithm classifies the points into vertical units and horizontal units for purpose of describing overhanging structures. The discrete samples of vertical units layered by height are connected to form topological structures, which are utilized to identify typical objects by means of BOW (Bag of words) classifier. A hierarchical strategy, in which topological structures and elevation units are used for scene matching separately, is presented for achieving a globally consistent registration. The constraints extracted from environment features and elevation map are used to guide mobile robot's autonomous path planning in outdoor environment. Experiment results and data analysis show the validity and practicability of the proposed approaches in 3D environment modeling and path planning.

Key words [Topology-elevation model](#) [3D environment modeling](#) [scene registration](#) [path planning](#) [unstructured outdoor scene](#)

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通讯作者 庄严 zhuang@dlut.edu.cn

作者个人主页 闫飞; 庄严; 白明; 王伟

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