

论文与报告

基于粒子滤波和点线相合的未知环境地图构建方法

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摘要

针对粒子滤波处理未知环境地图构建时存在存储空间负荷高、计算量大的问题, 本文使用线段特征描述环境信息, 将点线相合的增量式地图构建方法引入粒子滤波中. 在每个粒子中保存对已构建线段特征地图的假设; 使用点线相合的位姿估计算法将观测信息引入重要性函数, 确定采样空间; 通过观测信息与已构建线段特征地图之间的相合关系更新粒子权重; 最后通过选择性重采样去除因匹配不当和误差积累产生的错误地图. 分析表明, 该算法的复杂度较低. 在真实传感器数据上的实验结果验证了该算法构建室内环境地图的有效性和鲁棒性. 算法所需存储空间和粒子数远小于现有粒子滤波地图构建方法.

关键词 [同时定位与地图构建](#) [粒子滤波](#) [线段特征](#) [点线相合](#)

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A Simultaneous Localization and Mapping Approach by Combining Particle Filter and Dot-line Congruence

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Abstract

To reduce the memory and computation load of traditional simultaneous localization and mapping methods based on particle filter, this paper presents a new approach by introducing the incremental mapping algorithm based on dot-line congruence into particle filter, in which the unknown environment is described by segment-features map. In the approach, each particle carries an individual segment-features map of the environment. Both the motion and the observation information are considered in the importance function by using the dot-line congruence method to estimate the pose of a robot. The weight of the particle is updated according to the congruence between current measurement and segment features in previously built map. The wrong particles resulted from mis-matching or error accumulation are filtered with selective resampling. Analysis shows that the complexity of our method is low. Experimental results with real data are presented, which demonstrate the approach is effective and robust for indoor environment mapping. Both of the memory and particle numbers are quite smaller than those of the existing mapping methods using particle filter.

Key words [Simultaneous localization and mapping \(SLAM\)](#) [particle filter](#) [segment feature](#) [dot-line congruence](#)

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