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学术研究

快速SLAM算法的一种新的滤波架构

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摘要 FastSLAM算法是同时定位与地图创建领域的一类重要方法，UPF-IEKF FastSLAM 2.0算法采用UPF估计机器人的路径，地图估计则采用IEKF算法。UPF算法使粒子向后验概率高的区域运动，提高了估计精度，并且UPF算法比普通粒子滤波算法需要更少的粒子数，因而可以降低计算复杂度；IEKF算法通过迭代观测更新过程来提高估计精度。仿真实验表明，当迭代次数小于等于2时，UPF-IEKF FastSLAM 2.0算法的地图估计累计时间比UPF-UKF FastSLAM 2.0算法短；当迭代次数为2时，其估计精度高于UPF-UKF FastSLAM 2.0算法。综合考虑估计精度和计算复杂度，认为“UPF-IEKF”是一种更合理的FastSLAM算法滤波架构。

关键词 同时定位与地图创建 粒子滤波器 Unscented卡尔曼滤波器 迭代扩展卡尔曼滤波器

分类号

A new filter framework for FastSLAM algorithm

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Abstract

FastSLAM algorithm is an important kind of method for SLAM. UPF-IEKF FastSLAM 2.0 estimates the robot path with UPF， and the map with IEKF. UPF makes the particles move towards the area of high posterior likelihood. Therefore， UPF can improve estimation accuracy to some extent， and the computational effort will decrease greatly for the reason that UPF needs fewer particles than general particle filter. IEKF improves estimation accuracy with the iteration of observation update. Simulation results indicate that the cumulative time of map building for UPF-IEKF FastSLAM 2.0 is shorter than that for UPF-UKF FastSLAM 2.0 when iteration number is equal or less than two， and it performs better than UPF-UKF FastSLAM 2.0 in estimation accuracy when the iteration number equals two. Taking into account of both estimation accuracy and computational effort， “UPF-IEKF” is regarded as a much more reasonable framework for FastSLAM algorithm.

Key words simultaneous localization and map building particle filter Unscented Kalman filter iterated extended Kalman filter

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