

基于均值漂移和联合粒子滤波的移动节点定位算法

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摘要:

针对无线传感器网络移动节点定位面临的高精度和实时性要求, 本文把均值漂移算法引入联合粒子滤波(Joint Particle Filter)框架, 提出了基于均值漂移和联合粒子滤波的移动节点定位算法。它使用均值漂移算法构建粒子滤波的建议分布, 通过有效利用最新观测信息, 提高粒子状态估计的准确性, 使得采样粒子的状态分布与后验概率分布更接近, 减少了状态估计必需的粒子数目。该算法还提出了基于虚拟海明距离和交互势的权重计算方式, 减少相邻移动节点间的干扰。仿真实验结果表明, 基于均值漂移算法和联合粒子滤波的移动节点定位, 可获得比基本粒子滤波更高的定位精度, 其定位精度与无味粒子滤波(Unscented Particle Filter)相当, 而计算开销比无味粒子滤波减小至少50%。

关键词: 无线传感器网络; 移动节点定位; 粒子滤波; 均值漂移算法

Mobile Node Localization Based on Mean Shift and Joint Particle Filter in Wireless Sensor Networks

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Abstract:

In order to localize the mobile sensor nodes in real time and with high accuracy, by employing mean shift algorithm to generate the proposal distribution for the joint particle filter, a novel mobile node localization algorithm is proposed, which we called Mean Shift Particle Filter. The mean shift particle filter algorithm significantly improves the accuracy of the particle state estimation and reduces the necessary number of samples by using the current observations in sampling procedure to obtain a sample distribution, which is more close to the state posterior distribution. It also reduces the interference among multiple targets in close proximity by weighting samples according to the virtual hamming distances and interaction potentials. Extensive simulation results confirm that this localization approach outperforms basic particle filter and its localization accuracy is comparable to the unscented particle filter, but its computation cost is 50% less than that of unscented particle filter.

Keywords: wireless sensor networks; mobile node localization; particle filter; mean shift algorithm

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