

论文与技术报告

无线传感网中面向到达时差估计的数据压缩方法研究

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摘要:

基于传感网的无源定位系统中, 数据压缩是解决TDOA估计所需大规模数据传输与节点有限的能量、通信能力之间矛盾的重要方法。本文梳理了该领域的研究现状, 着重介绍了基于费舍尔信息的数据压缩方法, 针对原方法比特分配运算效率低的问题, 提出了以各频率分量在总的费舍尔信息量中的占比确定比特分配初始解的方法; 针对部分比特用于量化不携带时延信息的幅度谱, 提出了仅压缩和传输待定位信号的相位谱的方法。仿真证明, 改进的比特分配运算仅需要3次迭代即可完成, 运算效率有较大提高; 在相同的压缩率下, 改进后的数据压缩方法可获得更高的TDOA估计精度。

关键词: 费舍尔信息量; 到达时差估计; 数据压缩; 比特分配; 无线传感器网络

Study on Data Compression for TDOA Estimation in WSN Application

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Abstract:

Data compression is the key method to solve the conflicts between the limited sensor energy and communication capability in wireless sensor networks based passive location system. In this paper, a survey on the researches about compression for estimation is given, and the Fisher-information-based data compression method for TDOA estimation application is particular introduced. In order to improve the Lagrangian Multiplier based bit allocation method which the original data compression method used is not efficient, a rapid bit allocation method based on the proportion of Fisher-information each frequency components took in the total Fisher-information is proposed. In addition, due to the amplitude of the signal have no relation with the time delay, sending only the phase of the signal instead of the real and imaginary parts of the DFT coefficients is proposed. The simulation results show that the new bit allocation method's process time compare to the Lagrangian Multiplier based bit allocation method and the water-filling based bit allocation method is reduced, and only leads slight TDOA estimation accuracy's deterioration; In the same compression ratio, sending only the phase of the signal acquire a better TDOA estimation accuracy in high SNRs than sending the real and imaginary parts of the signal's DFT coefficients. Overall, the improved method is more operational than the original one.

Keywords: Fisher-Information Time Difference of Arrival estimation data compression bit allocation wireless sensor networks

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