

基于核函数法及粒子滤波的煤矿井下定位算法研究

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摘要:

煤矿井下受限空间中, 射频信号强度受到多径衰落、阴影效应及人为因素的影响, 采用路径损耗模型的定位方法误差较大, 提出了基于核函数法及粒子滤波的定位算法。该算法利用指纹匹配技术结合贝叶斯估计, 基于核函数法构建模型, 搜索训练数据中接近未知节点指纹特征的位置并加权得到初步观测坐标, 最后利用粒子滤波将目标运动状态与观测值相融合, 平滑位置突变以追踪移动轨迹。实验证明, 对于静态目标定位, 核函数法效果优于确定型匹配算法和高斯分布模型; 对于动态目标定位, 所提算法比基于Markov状态转移的算法定位结果更精准。

关键词: 井下定位 核函数 粒子滤波 接收信号强度

Research on Underground Coal Mines Positioning Algorithms Based on Kernel Function and Particle Filter

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Abstract:

In the confined coal mine environment, RF signal strength is affected by the multipath fading, shadow effect and human factors. Utilizing a path loss model for position makes the error larger, so a novel positioning algorithm is proposed based on kernel function and the particle filter. By constructing a model based on kernel function, the algorithm combines the fingerprint matching technology with Bayesian estimation to search for training data, which are closer to unknown-node fingerprint characteristics. These locations of training data are weighted as preliminary observations. Finally, using particle filter integrate target motion state with observations for smoothing position mutations and tracking trajectories. Experiments show that, for static target location, the kernel function method outperforms the algorithms with deterministic matching or Gaussian distribution model; for dynamic targeting, positioning results of the proposed algorithm are more accurate than an algorithm using Markov state transition.

Keywords: mine localization; kernel function; particle filter; RSSI

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