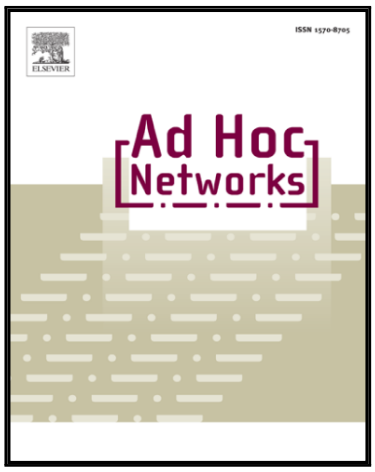

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Energy Efficient Tracking in Uncertain Sensor Networks

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Abstract

Uncertainty existed in sensor networks presents new challenges for target tracking. Besides energy conservation of the network, target tracking has to deal with different kinds of uncertainty, such as the impreciseness of positioning systems, environment noise and limited sensitivity of sensors. In this paper, we solve the problem of energy efficient tracking in uncertain sensor networks. We first investigate the uncertainty existed in sensor networks and propose a series of uncertain models. Then, we construct a grid based network model and incorporate it into tracking procedure, which makes nodes near the vertexes of involved grid units work and others sleep to save energy with tracking quality guarantee. To optimize the tracking algorithm with uncertainty consideration, we further introduce the problem of probabilistic k-nearest neighbors (PkNN) and provide an efficient tracking algorithm based on PkNN retrieval. Finally, a comprehensive set of simulations is presented. From the experimental results, we conclude that the proposed target tracking algorithm can yield excellent performance in terms of tracking accuracy and energy saving in wireless sensor networks.

Keywords: sensor networks; target tracking; uncertainty

1. Introduction

Target tracking has received considerable attention from wireless sensor network based applications in areas such as environment surveillance, intelligent transport, disaster predication and location-based services. Many excellent ideas have been proposed to track the target with guarantee of energy conservation and accuracy [1,2,3,4]. Most of existing works are based on the assumptions that the location of sensor nodes is exact and the sensed data collected by sensor nodes is accurate. However, uncertainty is ubiquitous in sensor networks due to factors