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An On-demand Coverage Based Self-deployment Algorithm for Big Data Perception in Mobile Sensing Networks☆

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Abstract

Mobile Sensing Networks have been widely applied to many fields for big data perception such as intelligent transportation, medical health and environment sensing. However, in some complex environments and unreachable regions of inconvenience for human, the establishment of the mobile sensing networks, the layout of the nodes and the control of the network topology to achieve high performance sensing of big data are increasingly becoming a main issue in the applications of the mobile sensing networks. To deal with this problem, we propose a novel on-demand coverage based self-deployment algorithm for big data perception based on mobile sensing networks in this paper. Firstly, by considering characteristics of mobile sensing nodes, we extend the cellular automata model and propose a new mobile cellular automata model for effectively characterizing the spatial-temporal evolutionary process of nodes. Secondly, based on the learning automata theory and the historical information of node movement, we further explore a new mobile cellular learning automata model, in which nodes can self-adaptively and intelligently decide the best direction of movement with low energy consumption. Finally, we propose a new optimization algorithm which can quickly solve the node self-adaptive deployment problem, thus, we derive the best deployment scheme of nodes in a short time. The extensive simulation results show that the proposed algorithm in this paper outperforms the existing algorithms by as much as 40% in terms of the degree of satisfaction of network coverage, the iterations of the algorithm, the average moving steps of nodes and the energy consumption of nodes. Hence, we believe that our work will make contributions to large-scale adaptive deployment and high performance sensing scenarios of the mobile sensing networks.

Keywords: Mobile sensing network, High performance sensing, Big data perception, Node self-deployment, On-demand coverage, Mobile cellular learning automata

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