主 論 文 要 旨

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論文題名 STUDY ON RANGE-FREE LOCALIZATION ALGORITHMS FOR WIRELESS AD-HOC AND SENSOR NETWORKS

ふりがな　ふぁん　ぞあん　ていん
学位申請者 PHAM DOAN TINH

主論文要旨

Today, the extremely fast development of wireless communications is beyond our imagination. Various localization approaches have been proposed in the field of wireless communications. Although Global Positioning System (GPS) receiver attached on wireless devices can answer this question under outdoor situations, localization has still been a challenging task to solve effectively under indoor and other environments where GPS cannot be applied.

This dissertation focuses on wireless range-free localization methods which require nodes to know connectivity information only. The first contribution of this work is to build an algorithm based on Self-Organizing Map (SOM) that is capable of determining the location of relatively stationary nodes in wireless networks. The algorithm has been verified under a variety of conditions, such as connectivity level, number of anchors (i.e., known nodes), radio irregularity of wireless propagation, etc. The simulation results in Matlab confirmed the advantages of the method in comparison with the state of the art methods including Multi-Dimensional Scaling Map (MDS-MAP).

The mobility of wireless nodes is unavoidable in practical scenarios. However, it raises more challenging issues for localization algorithms. The second contribution of our work is the adaptation of SOM-based localization to highly mobile environments. The simulation results in both our purpose-built software and Network Simulator 2 (NS-2) showed the effectiveness of our proposed method.

In practical deployment scenarios, nodes are not always uniformly deployed. The irregularity of topology leads to another challenging problem of accuracy for most existing localization methods. The third part of this thesis contributes a possible solution that improves the accuracy of localization based on SOM in such anisotropic topologies. The results from intensive simulation of this part have confirmed the accuracy improvement of localization in anisotropic networks.

As above described, this thesis has established the SOM-based localization algorithms applicable to various practical scenarios.