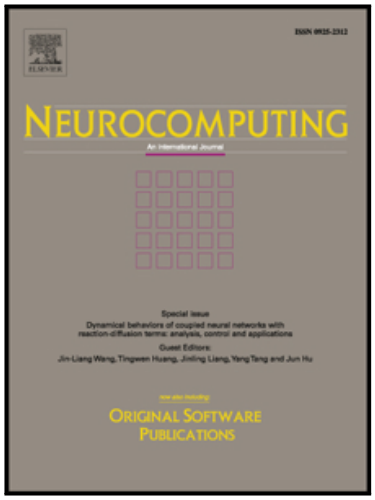
Communicated by Dr. Ma Lifeng Ma

Accepted Manuscript



A dynamic state transition algorithm with application to sensor network localization

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PII: S0925-2312(17)31359-0
DOI: 10.1016/j.neucom.2017.08.010
Reference: NEUCOM 18749

To appear in: *Neurocomputing*

Received date: 8 April 2017
Revised date: 22 July 2017
Accepted date: 8 August 2017

Please cite this article as: Xiaojun Zhou, Peng Shi, Cheng-Chew Lim, Chunhua Yang, Weihua Gui, A dynamic state transition algorithm with application to sensor network localization, *Neurocomputing* (2017), doi: 10.1016/j.neucom.2017.08.010

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A dynamic state transition algorithm with application to sensor network localization

Xiaojun Zhou[1], Peng Shi[2], Cheng-Chew Lim[2], Chunhua Yang[1], Weihua Gui[1]

Abstract

The sensor network localization (SNL) problem aims to reconstruct the positions of all the sensors in a network with given distance between pairs of sensors and within the radio range between them. It is proved that the computational complexity of the SNL problem is NP-hard, and semi-definite programming or second-order cone programming relaxation methods can only solve some special problems of this kind. In this study, a stochastic intelligent optimization method based on the state transition algorithm is introduced to solve the SNL problem without additional assumptions and conditions on the problem structure. To transcend local optimality, a novel dynamic adjustment strategy called "risk and restoration in probability" is incorporated into the state transition algorithm. An empirical study is investigated to appropriately choose the risk probability and restoration probability, yielding the dynamic state transition algorithm, which is further improved with gradient-based refinement. The refined dynamic state transition algorithm is applied to the SNL problem, and satisfactory simulation results show the effectiveness of the proposed approach.

Index Terms

State transition algorithm; Dynamic adjustment; Sensor network localization; Global optimization

I. Introduction

In recent decades, ad hoc wireless sensor networks have received considerable attention due to easy installation and simple operation [1]–[9]. A typical sensor network consists of a large set of sensors

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