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Improving Cooperative PSO using Fuzzy Logic

Book	Research and Development in Intelligent Systems XXVI
Publisher	Springer London
DOI	10.1007/978-1-84882-983-1
Copyright	2010
ISBN	978-1-84882-982-4 (Print) 978-1-84882-983-1 (Online)
Part	Part 5
DOI	10.1007/978-1-84882-983-1_16
Pages	219-232
Subject Collection	Computer Science
SpringerLink Date	Wednesday, October 28, 2009

Research and Development in Intelligent Systems XXVI
Incorporating Applications and Innovations in Intelligent Systems XVII

10.1007/978-1-84882-983-1_16

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Abstract

PSO is a population-based technique for optimization, which simulates the social behaviour of the fish schooling or bird flocking. Two significant weaknesses of this method are: first, falling into local optimum and second, the curse of dimensionality. In this work we present the FCPSO-H to overcome these weaknesses. Our approach was implemented in the cooperative PSO, which employs fuzzy logic to control the acceleration coefficients in velocity equation of each particle. The proposed approach is validated by function optimization problem form the standard literature simulation result indicates that the approach is highly competitive specifically in its better general convergence performance.

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1 Introduction

Particle swarm optimization (PSO) was motivated from the simulation of simplified social behavior of animals (Kennedy and Eberhart 1995). It has already been applied successfully in many application areas where GA can be applied to (Eberhart and Shi 1998 b). However, the original PSO has difficulties in controlling the balance between exploration and exploitation where the environment itself is dynamically changed over the time. PSO cannot able to adapt dynamically to the changing environment and quickly converging toward an optimum in the first period of iteration. Another main drawback of the original PSO is that it may get stuck in a sub-optimal solution region and the problem usually gets harder for high-dimensional problems usually known as "curse of dimensionality". Hence, a new hybrid PSO algorithm is proposed in this paper. The proposed algorithm integrates both fuzzy logic and cooperative learning within a unified framework to further improve the performance. The use of fuzzy logic is suitable for dynamically tuning the programming coefficient C_1, C_2, since

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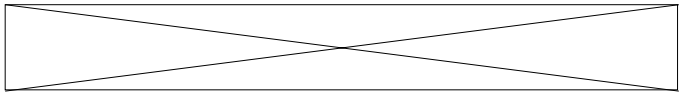
M. Bramer et al. (eds.), *Research and Development in Intelligent Systems XXVI*,
DOI 10.1007/978-1-84882-983-1_16,



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