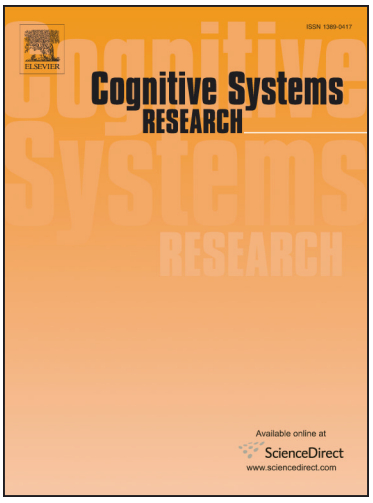

A New Chaotic Hybrid Cognitive Optimization Algorithm

Yuhong Zhou, Ke Su, Limin Shao

PII: S1389-0417(18)30295-X
DOI: https://doi.org/10.1016/j.cogsys.2018.08.001
Reference: COGSYS 687

To appear in: *Cognitive Systems Research*

Received Date: 21 June 2018
Revised Date: 24 July 2018
Accepted Date: 1 August 2018

Please cite this article as: Zhou, Y., Su, K., Shao, L., A New Chaotic Hybrid Cognitive Optimization Algorithm, *Cognitive Systems Research* (2018), doi: https://doi.org/10.1016/j.cogsys.2018.08.001

A New Chaotic Hybrid Cognitive Optimization Algorithm

Yuhong Zhou, Ke Su, Limin Shao*

College of Mechanical and Electrical Engineering, Hebei Agricultural University, Baoding, China

Abstract: To solve the optimization problems in port planning and operation management, particle swarm optimization, Cat mapping, and cloud model were combined. A Chaos Cloud Particle Swarm Optimization (CCPSO) algorithm was proposed. It was used in port planning management. Its application in port throughput forecasting and berthing and pontoon bridge allocation was explored and studied. By analyzing the mixed properties of Cat maps, the chaotic characteristics of the map were good. Thus, it was introduced into the hybrid optimization algorithm for chaotic perturbation of poor individuals in a particle swarm. The selection of the parameter combination of the Gauss-SVAR model was troublesome. The parameter combination of Guass-vSVR model was optimized by CCPSO algorithm, and the Guass-vSVR-CCPSO model was obtained. Using CCPSO algorithm, a discrete berth bridge allocation model was established. The results showed that the particle feasible integer processing module was developed. Therefore, a new method for multi-objective discrete berth shore-bridge allocation based on CCPSO algorithm is feasible.

Keywords: chaos; particle swarm optimization (PSO); hybrid optimization algorithm

1. Introduction

The port throughput forecast is the basis for optimizing the port architecture and infrastructure. It plays an important role in determining the layout of the port planning, the scale of infrastructure investment, the development strategy, the construction of the collection and transportation system and the operation strategy [1]. The reasonableness of the port throughput forecast results directly affects the actual operation results after the port is completed. The small port throughput forecasting value will reduce the design scale of the port and slow the construction progress of the port, resulting in a large number of cargo backlogs [2]. It will further exacerbate the phenomenon of pressure in the harbour. The operation and development of the port is in a passive situation. The predicted value of port throughput is relatively large, and the actual supply of goods after the completion of the port will be insufficient [3]. There will be excessive port construction scale, excessive construction progress, and excessive investment in port infrastructure, which will result in idle resources and waste of funds. Therefore, the port throughput should be accurately predicted. This can ensure the scientific and rationality of the port planning and construction and the optimized layout of the port architecture.

In addition to being influenced by the size of the port, its layout and infrastructure, the port's core competitive advantage is also affected by factors such as production scheduling and port management during the port operation period [4]. In the production scheduling of the port, as the berths and shore bridges with scarce shoreline resources, the initial input costs are relatively high. However, due to the unreasonable configuration of some ports, most of the scarce resources are underutilized. Container terminals are the focus of capital. Port resources are rationally configured, which can ensure the efficient operation of the port. Scarce resources such as berths and quayside bridges are allocated rationally [5]. This minimizes the time of vessels in the port and improves the overall service level of the port. On the basis of ensuring existing ships, more ship anchorages are attracted. It is the basis for the survival and development of the port in fierce competition [6]. Therefore, it is of great practical significance to effectively, scientifically, and reasonably allocate resources such as berths and quayside bridges to achieve efficient operation of terminals and improve the benefits of ports.

The emergence of intelligent optimization methods and their wide application have greatly promoted the development of port throughput prediction techniques and berthing and pontoon bridge allocation methods. Domestic and foreign scholars, starting from different perspectives, have proposed port throughput prediction models that are applicable to various environments [7]. A variety of berth bridge distribution models have been established and corresponding algorithms have been designed. The port throughput forecasting and berthing and quay-bridge allocation theory have been further improved. It provides important technical support for port construction and management. However, with the development of port construction and management activities, the accuracy of port throughput prediction and the effect of berthing bridge allocation are getting higher and higher. Therefore, it is still necessary to carry out more in-depth research on port throughput forecasting technology and berthing pontoon bridge allocation methods and related optimization methods to find the deficiencies of existing models [8]. Reasonable and accurate forecasting models of port throughput and berthing pontoon bridge allocation methods were explored.

In view of this, PSO algorithm, cloud model and Cat mapping are combined based on the research results of existing optimization methods. A chaotic cloud particle swarm hybrid optimization algorithm is proposed and applied to the port throughput prediction and berth-shore-bridge allocation optimization. It is expected to improve the accuracy of throughput forecasting, provide more reliable data support for the port's pre-planning, design, upgrade, and development strategy, further optimize the berth of the port-shore bridge resources, and