Research on the City Emergency Logistics Scheduling Decision Based on Cloud Theory-Based Genetic Algorithm

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Abstract. The city emergency logistics scheduling is an important part of the city emergency management. When there are many candidate base station exist in a city, the issue belongs to multiple rescue-single object question. We think the time factor as the first consideration, and improve on the original Genetic Algorithm, use the Cloud Theory-Based Genetic Algorithm to resolve the issue of the city emergency logistics scheduling. The experimental result shows that when using the Cloud Theory-Based Genetic Algorithm to make decision for emergency logistics scheduling, we can get the optimum solution only a few genetic algebras with high accuracy and good immediacy.

Keywords: Emergency Logistics, Emergency Logistics Scheduling, Cloud Theory-Based Genetic Algorithm.

Introduction

Genetic algorithm is a kind of random search algorithm, which simulate the natural process [1]. It has the resolution ability of complex mystery of space. Therefore, the Genetic algorithm is often used in the problems of task assigning and scheduling. The problems of task assigning and scheduling is to assign the public resources in real time to achieve a certain purpose, it is a real NP problem [2]. The Cloud model is a transition model, which use a natural language to express its qualitative concept and use the quantitative data to represent its uncertainty. It reflects the uncertainty and random of concepts in the objective world and human knowledge, and combine the two perfectly to process information quantitatively and qualitatively. The Cloud Theory-Based Genetic Algorithm followed the ideology of Genetic Algorithm, inherited the cross and variation. In this algorithm, Y-conditional cloud generator is used as the cross operator, and basic cloud generator as the mutation operator [3]. Because of the random and the stable orientation, The Cloud Theory-Based Genetic Algorithm can maintain the characteristics of the individual, in order to avoid getting into a local optimum solution. And the feature of stable orientation can give the better protection of the superior individual, then carry out the self-fitness position in global group.

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1 Problem Description

An important requirement of the city emergency incidents is timeliness, we must find the optimum solution and make a feasible decision in a short time. Controlling the time is the key to resolving the problems in emergency field [4]. We establish two layers multiple goals optimize model based on time and space for city emergency logistics scheduling. The emergency logistics scheduling issues that triggered by the city emergency incident could be described as follows [5,6]: Set $F_1, F_2, F_3, \ldots, F_n$ as rescue points, the number is n, character W indicate the demand of emergency resources, character t_i indicates the time from F_i to E, character L indicates the total lose from the incident happened to the end of the rescue, and character P indicates the rescue time. Now the question is to select a plan which can minimize T and L while meeting the constraint condition. The optional solutions can be shown as a collection:

$$\Omega = \left[(\mathrm{F_{i1}}, \mathrm{w}'_{i1}), (\mathrm{F_{i2}}, \mathrm{w}'_{i2}), \ldots, (\mathrm{F_{im}}, \mathrm{w}'_{im}) \right] \tag{1}$$

Where: $0 \le \mathrm{w}'_{ik} \le w_{ik}$, $\sum_{k=1}^{m} w'_{ik} = w, i_1, i_2, \ldots, i_{\mathrm{m}}$ is an permutation of *1,2,,,…,n.*

We consider the rescue time is the time that the last rescue equipment arrived at the place emergency incident happened, it is indicated by $T(\Omega)$, so

$$\mathrm{T}(\Omega) = \max_{j=1,2,\ldots,m} t_{ij} \tag{2}$$

If the time that one of the rescue equipment arrived at the incident happened site is more than T, then the plan which include this rescue equipment is not feasible, and will be ruled out. If character S indicates the time that the rescue start in some rescue point, character V indicates the speed of the loss when the emergency incident happened, then the relationship $P=s+w/v$ is tenable.If $L(\Omega)$ indicates the loss of the plan Ω, then the emergency logistics scheduling issue in this paper can be conclude as follows:

$$\min \begin{bmatrix} T(\Omega) \\ L(\Omega) \end{bmatrix}, \Omega = \left[(F_{i1}, w'_{i1}), (F_{i2}, w'_{i2}), \ldots, (F_{im}, w'_{im}) \right] \tag{3}$$

2 Use Cloud Theory-Based Genetic Algorithm to Solve the Problem

Step 1 Initialize population. The Initialization population is that generated individuals randomly by system, the amount of the individuals is indicated by μ . This individuals are constitute by objective variables X and standard deviation σ . Each individual includes two components, that is $(X, \sigma)=((x_1,x_2), (\sigma_1, \sigma_2))$. The two variables are corresponding to T and L separately, that is the time rescue equipments arrived and the total loss. For the individuals are generated randomly, so their standard deviation is $\sigma(0)=2.0$ .The relationship between them is: