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Improved Genetic Algorithm (VNS-GA) using polar coordinate classification for workload balanced multiple Traveling Salesman Problem (mTSP)

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ABSTRACT

The multiple traveling salesman problem (mTSP) is an extension of the traveling salesman problem (TSP), which has wider applications in real life than the traveling salesman problem such as transportation and delivery, task allocation, etc. In this paper, an improved genetic algorithm (VNS-GA) that uses polar coordinate classification to generate the initial solutions is proposed. It integrates the variable neighbourhood algorithm to solve the multiple objective optimization of the mTSP with workload balance. Aiming to workload balance, the first design of this paper is about generating initial solutions based on the polar coordinate classification. Then a distance comparison insertion operator is designed as a neighbourhood action for allocating paths in a targeted manner. Finally, the neighbourhood descent process in the variable neighbourhood algorithm is fused into the genetic algorithm for the expansion of search space. The improved algorithm is tested on the TSPLIB standard data set and compared with other genetic algorithms. The results show that the improved genetic algorithm can increase computational efficiency and obtain a better solution for workload balance and this algorithm has wild applications in real life such as multiple robots task allocation, school bus routing problem and other optimization problems.

ARTICLE INFO

Keywords:
Multiple traveling salesman problem (mTSP);
Workload balance;
Variable neighbourhood search algorithm (VNS);
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Izvirni znanstveni članek

Izboljšan genetski algoritem (VNS-GA) z uporabo klasifikacije s pomočjo polarnih koordinat za problem več trgovskih potnikov (mTSP) z uravnoteženo delovno obremenitvijo

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POVZETEK

Problem več trgovskih potnikov (mTSP) je razširitev problema trgovskega potnika (TSP) in ima v resničnem življenju širše področje uporabe kot problem trgovskega potnika, npr. prevoz in dostava, dodeljevanje nalog itd. V članku je predlagan izboljšan genetski algoritem (VNS-GA), ki uporablja klasifikacijo s pomočjo polarnih koordinat za ustvarjanje začetnih rešitev in vključuje algoritem spremenljive soseske za reševanje večkriterijske optimizacije mTSP z uravnoteženjem delovne obremenitve. Z namenom uravnoteženja delovne obremenitve je najprej predstavljeno ustvarjanje začetnih rešitev na podlagi klasifikacije s pomočjo polarnih koordinat. Za ciljno dodeljevanje poti je nato vključen operator primerjave razdalje. Na koncu se – za razširitev iskalnega prostora – postopek spuščanja po soseščini v algoritmu spremenljive soseske vključi v genetski algoritem. Izboljšani algoritem je testiran na standardnem nizu podatkov TSPLIB in primerjan z drugimi genetskimi algoritmi. Rezultati kažejo, da lahko izboljšan genetski algoritem poveča računsko učinkovitost in pridobi boljšo rešitev za ravnovesje delovne obremenitve; ta algoritem pa ima mnogo možnosti uporabe v resničnem življenju, kot so dodeljevanje nalog več robotom, usmerjanje poti šolskega avtobusa in drugi optimizacijski problemi.

PODATKI O ČLANKU

Ključne besede:
Problem več trgovskih potnikov (mTSP);
Ravnovesje delovne obremenitve;
Algoritem spremenljive soseske (VNS);
Genetski algoritem (GA);
Polarne koordinate;
Klasifikacija

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