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Praca dyplomowa - magisterska

Algorytmy ewolucyjne z uwzględnieniem płci w rozwiązywaniu wybranych problemów

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słowa kluczowe:
key words
different
can be placed here

krótkie streszczenie:

W pracy przedstawiono nową metaheurystykę ewolucyjną DSEA, uwzględniającą aspekt płci. Praca zawiera opis badań, których celem było porównanie skuteczności DSEA z rozwiązaniami znanymi z literatury.

Promotor:	dr hab. inż. Urszula Markowska-Kaczmar	....	....
	imię i nazwisko	*ocena*	*podpis*

Do celów archiwalnych pracę dyplomową zakwalifikowano do:*

a) kategorii A (akta wieczyste)

b) kategorii BE 50 (po 50 latach podlegające ekspertyzie)

*niepotrzebne skreślić

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Contents

Streszczenie

Tematem pracy jest zastosowanie algorytmów ewolucyjnych z uwzględnieniem płci do rozwiązania wybranych problemów optymalizacji. Zaproponowano metaheurystykę DSEA, korzystającą z dwóch operatorów selekcji. Jeden z nich ma za zadanie uwzględnienie płci osobnika w procesie krzyżowania. Drugi działa podobnie jak operator selekcji w klasycznym algorytmie ewolucyjnym. Proponowana metoda została porównana pod względem skuteczności z klasycznym algorytmem ewolucyjnym oraz wybranymi podejściami znanymi z literatury. W trakcie badań rozwiązywano problemy komiwojażera oraz binarny problem plecakowy. Wykorzystano publicznie dostępne zbiory danych o znanych optimach globalnych.

Abstract

This thesis focuses on evolutionary algorithms with regard to gender and their application in solving chosen optimization problems. DSEA metaheuristic using two selection operators is proposed. One of those operators introduces specimen's gender into the crossover process. The other one works similiarly to the selection operator in classical evolutionary algorithms. The proposed method's effectiveness is compared with classical evolutionary algorithm and selected existing methods. During experimentations travelling salesman problem and binary knapsack problem are solved. Publically available data sets with known global optima are used.

Introduction

Evolution is a process in nature that is responsible for the adaptation of individuals of a given species to the environment in which they live. The basis of this process is the survival principle of better adapted individuals and the phenomenon of inheritance and mutation.

Evolutionary algorithms are a family of heuristics that mimic the process of evolution to optimize [1]. A single element of the solution space is called an individual in them. Individuals can compare themselves in terms of the value of the optimized function for them, and the relation of minority (for minimization problems) or majority (for maximization problems) represents the relation of being better adapted to the environment. In addition, mutants and crosses are defined on the individuals to simulate the natural phenomena. Heuristics consists of multiple processing of the population (ie, collection of individuals) by using each operator with a certain probability. In each step (referred to in this case as a generation), the results of these operators are included in the current population, and then a new population is selected, used in the next step of the evolutionary algorithm. To reproduce the principle of survival of the best fit individuals, the next population is chosen with a higher probability of the individuals being better adapted.

In nature, multiplication of many species is closely related to the phenomenon of species division on the sex. In the available literature on the subject of evolutionary algorithms, it is rare to find works that take into account this aspect of the evolutionary process. The reason for this is rather the desire to simplify the operation of the heuristics itself, rather than the better quality of the results obtained without taking this aspect ([2, 3]).

The purpose of this paper is to develop an evolutionary algorithm that takes into account the sex of individuals and to examine its effectiveness on selected problems and to compare it with the classical evolutionary algorithm and the selected solutions known from the literature.

In addition, the author has developed a formal description of the evolutionary algorithm that takes into account gender. Based on this, a programming library was created, used to compare the quality of optimization of selected metaheuristics.

Bibliography

[1] Davis L. et al. *Handbook of genetic algorithms*, volume 115. Van Nostrand Reinhold New York, 1991.

[2] Rejeb J., AbuElhaij M. New gender genetic algorithm for solving graph partitioning problems. W: *Circuits and Systems, 2000. Proceedings of the 43rd IEEE Midwest Symposium on*, volume 1, s. 444–446 vol.1, 2000.

[3] Wagner S., Affenzeller M. SexualGA: Gender-specific selection for genetic algorithms. W: *WMSCI 2005 - The 9th World Multi-Conference on Systemics, Cybernetics and Informatics, Proceedings*, volume 4, s. 76–81, Institute for Formal Models and Verification, Johannes Kepler University, 2005.