An Improved Bees Algorithm Local Search Mechanism for Numerical dataset

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Abstrak

Bees Algorithm (BA), satu prosedur pengoptimuman heuristik, merupakan salah satu teknik carian asas yang berdasarkan kepada aktiviti pencarian makanan lebah. Algoritma ini menjalankan sejenis eksploitasi di tetangga digabungkan dengan gelintaran penerokaan rawak. Walau bagaimanapun, isu utama BA ialah ia memerlukan masa pengiraan yang lama serta pelbagai proses pengiraan untuk mendapatkan penyelesaian yang baik, terutamanya dalam isu-isu yang lebih rumit. Pendekatan ini tidak menjamin apa-apa penyelesaian optimum bagi masalah terutamanya masalah kekurangan ketepatan. Untuk menyelesaikan isu ini, gelintaran setempat dalam BA itu disiasat menggunakan Simple swap, 2-Opt dan 3-Opt telah dicadangkan sebagai kaedah asal untuk Bees Algorithm Feature Selection (BAFS). Dalam kajian ini, cadangan lanjutan kaedah asal adalah 4-Opt sebagai gelintaran yang dibentangkan. Cadangan ini telah dilaksanakan dan membandingkan secara komprehensif dan menganalisis prestasi mereka berkaitan dengan kejituan dan masa. Tambahan pula, dalam kajian ini algoritma pemilihan ciri dilaksanakan dan diuji menggunakan set data paling popular dari (UCI) Machine Learning Repository. Keputusan yang diperolehi daripada kerja-kerja eksperimen mengesahkan bahawa cadangan lanjutan carian komuniti termasuk pendekatan 4 Opt telah menyediakan ramalan ketepatan yang lebih baik dengan masa yang sesuai daripada BAFS asal.

Kata Kunci : Bees Algorithm (BA), Feature selection, Local search, Simple swap, 2-Opt and 3-Opt, 4-Opt.

Abstract

Bees Algorithm (BA), a heuristic optimization procedure, represents one of the fundamental search techniques is based on the food foraging activities of bees. This algorithm performs a kind of exploitative neighbourhoods search combined with random explorative search. However, the main issue of BA is that it requires long computational time as well as numerous computational processes to obtain a good solution, especially in more complicated issues. This approach does not guarantee any optimum solutions for the problem mainly because of lack of accuracy. To solve this issue, the local search in the BA is investigated by Simple swap, 2-Opt and 3-Opt were proposed as Massudi methods for Bees Algorithm Feature Selection (BAFS). In this study, the proposed extension methods is 4-Opt as search neighbourhood is presented. This proposal was implemented and comprehensively compares and analyse their performances with respect to accuracy and time. Furthermore, in this study the feature selection algorithm is implemented and tested using most popular dataset from Machine Learning Repository (UCI). The obtained results from experimental work confirmed that the proposed extension of the search neighbourhood including 4-Opt approach has provided better accuracy with suitable time than the Massudi methods.

Keywords: Bees Algorithm (BA), Feature selection, Local search, Simple swap, 2-Opt and 3-Opt, 4-Opt approaches.

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Abbreviations

BA	Bees Algorithm
FS	Feature Selection
BAFS	Bees Algorithm Feature Selection
GA	Genetic Algorithm
ML	Machine Learning
MLP	Multilayer Perceptron
PSO	Particle Swarm Optimisation
TSP	Travel Salesman Problem
N	Total number of features in a data set
Ns	Total number of evaluated features
Nt	Total number of selected features
m	Number of sites selected for neighbourhood search
e	Number of best "elite" sites out of m selected sites
nep	Number of bees recruited for the best e sites
nsp	Number of bees recruited for the other (m-e) selected sites
R	Maximum iterations of Bees Algorithm
KDD	Knowledge Discovery in Databases

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CHAPTER ONE
INTRODUCTION

1.1 Optimisation Algorithms

Nature-inspired optimisation algorithms have gained considerable attention in recent years [1]. Its role is crucial and manifold in a wide number of research areas as varied as computer science, operational research, mathematics, and artificial intelligence where it is used as an optimum solution for complex problems [1][2]. A number of optimisation algorithms have been proposed to solve varied problems including real-time issues like Traveling Salesman Problem (TSP), Cutting Stock Problem, Packing Problems, Minimum Spanning Tree (MST) and timetabling problems, which are difficult to resolve in traditional way [3][4].

One of the common ways of resolving optimisation problems is the use of Swarm-based optimisation algorithms, such as Bees Algorithm (BA) [5], Ant Colony Optimisation [6], Bat Algorithm [7], Particle Swarm Optimisation [8], Firefly Algorithm [9], Cuckoo search [10] and so on. However, there is no algorithm that can single-handedly resolve all sorts of optimisation problems [1][11][12][13][14], mainly due to the massive amount of data and their applications with each introducing different types of problem that requires different algorithm to bring out solutions. This has further led to the development of various optimisation methods to resolve different optimisation problems. In order to choose the best method for a given problem, one must first identify and understand the type of the problem [15]. The challenge here is that for each problem, there are different algorithms offering the optimum result [1].

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