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Editorial: Metaheuristic Search in Medical Data Analysis

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1. Introduction

Metaheuristic algorithms are designed to explore the provided search space, try to discover the optimum solution. These algorithms are tailored tools for searching and exploiting all possible alternatives. Most of the metaheuristic algorithms are inspired from nature to mimic the natures ability to invent solution for sophisticated problems. One area that benefits from the search capabilities of metaheuristic algorithms is medical data analysis.

2. Applications of Metaheuristic Search Algorithms for Medical Data Analysis

Analyzing patient data to reveal patterns is one of the interests of data science in recent years. Moreover, determining the most significant features is also one of the most studied subjects for the development of better computer-aided classification systems. At that point, there are many studies that have been inspired by nature to present innovative search approaches for the selection of medical features. In one study, scientists implemented a metaheuristic search algorithm inspired by the hunting methods of Humpback Whales. The presented algorithmic approach reportedly reduces the dimensionality of several medical datasets with acceptable accuracy [1]. It should be noted that in another study, an enhanced version of the whale optimization algorithm is proposed for forming an optimum feature subset to detect coronavirus disease 2019 with increased classifier performance [2]

A bat behavior-inspired mechanism is also proposed for the fuzzy classification of medical data. The authors have implemented the Bat algorithm to perform with a fuzzy classifier. They have reported that the Bat algorithm optimizes membership functions effectively [3]. The Bat algorithm is also implemented in a particular study to select the best features from a breast cancer dataset to optimize the performance of a Random Forest classifier [4]. Additionally, a Bat algorithm-based approach is used to optimize the classification task of Cardiotocography [5].

Another example of animal behavior-inspired mechanisms for feature selection is Grey Wolf Optimization (GWO). This approach is based on the hierarchical leadership of wolves. In an interesting study, GWO is adopted for selecting optimum features for the classification of heart disease data [6].

The Firefly Algorithm (FFA) is another nature-mimicking algorithm inspired by the flashing patterns of fireflies [7]. In a related study, the firefly algorithm is implemented for the selection of medical feature subsets to increase the accuracy of a support vector machine-based classifier. The authors have reported that the applied algorithm enhanced the overall performance [8].

Tabu search is one of the recent metaheuristic approaches that provide an optimized search process to researchers. It is an iterative neighborhood search algorithm. This algorithm continuously updates the neighborhood status to avoid already visited points, which allows the algorithm to cope with local optima [9].

In one study, the authors have utilized tabu search to optimize the patient-to-bed assignment process [10].

The ant colony approach is also one of the optimization techniques borrowed from nature. It is one of the swarm intelligence-based metaheuristic algorithms that leverages the behaviors of artificial ants [11]. An adaptation of the algorithm is implemented in one study to extract edges in medical images. The presented results indicate that an ant colony-based mechanism may perform better than gradient-based approaches [12]

3. Conclusion

One of the factors that makes the evaluation of medical data challenging is that some of the features forming the dataset may have relatively lower significance. Therefore, selecting the optimum subset of features is critically important for the success of computer-assisted analysis. At this point, metaheuristic search algorithms are often adapted to improve success by selecting optimum features. These nature-inspired algorithms, searching the solution space for the best alternative, are promising for feature selection. It should also be noted that similar algorithms have been actively used in solving complex problems such as the segmentation of medical images, the analysis of physiological signals, or even medical resource planning. In the future, the use of metaheuristic search approaches alongside more complex classifiers, like deep learning mechanisms, will contribute to solving challenging medical problems.

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Declaration of generative AI in the writing process

While preparing this work, ChatGPT was used to refine the language usage. The author reviewed and edited the content, taking full responsibility for the publication's content.

References

[1] H. Zamani, M.-H. Nadimi-Shahraki, Feature selection based on whale optimization algorithm for diseases diagnosis, International Journal of Computer Science and Information Security 14 (9) (2016) 1243.

[2] M. H. Nadimi-Shahraki, H. Zamani, S. Mirjalili, Enhanced whale optimization algorithm for medical feature selection: A covid-19 case study, Computers in biology and medicine 148 (2022) 105858.

[3] D. Binu, M. Selvi, Bfc: Bat algorithm based fuzzy classifier for medical data classification, Journal of Medical Imaging and Health Informatics 5 (3) (2015) 599–606.

[4] S. Jeyasingh, M. Veluchamy, Modified bat algorithm for feature selection with the wisconsin diagnosis breast cancer (wdbc) dataset, Asian Pacific journal of cancer prevention: APJCP 18 (5) (2017) 1257.

[5] P. Sharma, K. Sharma, Fetal state health monitoring using novel enhanced binary bat algorithm, Computers and Electrical Engineering 101 (2022) 108035.

[6] C. Chakraborty, A. Kishor, J. J. Rodrigues, Novel enhanced-grey wolf optimization hybrid machine learning technique for biomedical data computation, Computers and Electrical Engineering 99 (2022) 107778.

[7] X.-S. Yang, X. He, Firefly algorithm: recent advances and applications, International journal of swarm intelligence 1 (1) (2013) 36–50.

[8] B. Sahmadi, D. Boughaci, R. Rahmani, N. Sissani, A modified firefly algorithm with support vector machine for medical data classification, in: Computational Intelligence and Its Applications: 6th IFIP TC 5 International Conference, CIIA 2018, Oran, Algeria, May 8-10, 2018, Proceedings 6, Springer, 2018, pp. 232–243.

[9] F. Glover, M. Laguna, R. Marti, Principles of tabu search, Approximation algorithms and metaheuristics 23 (2007) 1–12.

[10] P. Demeester, W. Souffriau, P. De Causmaecker, G. V. Berghe, A hybrid tabu search algorithm for automatically assigning patients to beds, Artificial Intelligence in Medicine 48 (1) (2010) 61–70.

[11] C. Blum, Ant colony optimization: Introduction and recent trends, Physics of Life reviews 2 (4) (2005) 353–373.

[12] A. A. Asha, S. Victor, A. Lourdusamy, Feature extraction in medical image using ant colony optimization: a study, International Journal on Computer Science and Engineering 3 (2) (2011) 714–721.