

African Buffalo Optimization Algorithm Based T-Way Test Suite Generation Strategy for Electronic-Payment Transactions

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Abstract. The use of meta-heuristics in Combinatorial Interaction Testing (CIT) is becoming more and more popular due to their effectiveness and efficiency over the traditional methods especially in authenticating electronic payment (e-payment) transactions. Concomitantly, over the past two decades, there has been a rise both in the development of metaheuristics and their application to diverse theoretical and practical areas including CIT in e-payments. In the implementation of t-way strategies (the t is used to represent the interaction strength), mixed results have been reported; some very exciting but, in other cases, the performance of metaheuristics has been, to say the least, below par. This mixed trend has led many researchers to explore alternate ways of improving the effectiveness and efficiency of metaheuristics in CIT, hence this study. It must be emphasized, however, that available literature indicates that no particular metaheuristic testing strategy has had consistent superior performance over the others in diverse testing environments and configurations. The need for effectiveness, therefore, necessitates the need for algorithm hybridization to deploy only the component parts of algorithms that have been proven to enhance overall search capabilities while at the same time eliminating the demerits of particular algorithms in the hybridization procedure. In this paper, therefore, a hybrid variant of the African Buffalo Optimization (ABO) algorithm is proposed for CIT. Four hybrid variants of the ABO are proposed through a deliberate improvement of the ABO with four algorithmic components. Experimental procedures indicate that the hybridization of the ABO with these algorithmic components led to faster convergence and greater effectiveness superior to the outcomes of existing techniques, thereby placing the algorithm among the best when compared with other methods/techniques.

Keywords: African Buffalo Optimization, e-payment system, T-way Testing, Software Testing, Combinatorial Problem. Optimization techniques.

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References

1. J. B. Odili and M. N. Mohmad Kahar, "Solving the Traveling Salesman's Problem Using the African Buffalo Optimization," *Computational intelligence and neuroscience*, vol. 2016, pp. 1-12, 2016.
2. J. B. Odili and M. N. Mohmad Kahar, "African Buffalo Optimization Approach to the Design of PID Controller in Automatic Voltage Regulator System," *National Conference for Postgraduate Research, Universiti Malaysia Pahang*, pp. 641-648, 2016. [3] J. Stardom, "Metaheuristics and The Search For Covering and Packing Arrays," Trent University, 2001.
3. E. Özcan, M. Mısırlı, G. Ochoa, and E. K. Burke, "A Reinforcement Learning: Great-Deluge Hyper-Heuristic," *Modeling, Analysis, and Applications in Metaheuristic Computing: Advancements and Trends: Advancements and Trends*, p. 34, 2012.
4. K. J. Nurmela, "Upper Bounds For Covering Arrays By Tabu Search," *Discrete applied mathematics*, vol. 138, pp. 143-152, 2004.
5. J. B. Odili and J. O. Fatokun, "The Mathematical Model, Implementation and the Parameter-Tuning of the African Buffalo Optimization Algorithm," in *2020 International Conference in Mathematics, Computer Engineering and Computer Science (ICMCECS)*, 2020, pp. 1-8.
6. B. S. Ahmed, K. Z. Zamli, and C. P. Lim, "Constructing A T-way Interaction Test Suite Using The Particle Swarm Optimization Approach," *International Journal of Innovative Computing, Information and Control*, vol. 8, pp. 431-452, 2012.