Mathematical and Computational Applications

Editorial

Numerical and Evolutionary Optimization 2021

Marcela Quiroz-Castellanos [1], Luis Gerardo de la Fraga [2], Adriana Lara [3], Leonardo Trujillo [4] and Oliver Schütze [2,*]

[1] Centro de Investigación en Inteligencia Artificial, University of Veracruz, Xalapa 91000, Mexico
[2] Depto de Computacion, CINVESTAV-IPN, Mexico City 07360, Mexico
[3] Instituto Politécnico Nacional ESFM-IPN, Mexico City 07730, Mexico
[4] Departamento de Ingeniería en Electrónica y Eléctrica, Instituto Tecnológico de Tijuana, Calzada Tecnológico SN, Tomas Aquino, Tijuana 22414, Mexico
* Correspondence: schuetze@cs.cinvestav.mx

This Special Issue was inspired by the 9th International Workshop on Numerical and Evolutionary Optimization (NEO 2021) held—due to the COVID-19 pandemic—as an online-only event from 8 to 10 September 2021. Solving scientific and engineering problems from the real world has always been a challenge, and the complexity of these tasks has only increased in recent years as more sources of data and information are continuously developed. That is why the development of powerful search and optimization techniques is of great importance. Two well-established fields focus on this duty are (i) traditional numerical optimization techniques and (ii) bio-inspired metaheuristic methods. Both general approaches have unique strengths and weaknesses, allowing researchers to solve some challenging problems but still fail in others. The goal of the NEO workshop series is to gather people from both fields to discuss, compare, and merge these complementary perspectives. Collaborative work allows researchers to maximize strengths and minimize the weaknesses of both paradigms. NEO also intends to help researchers in these fields to understand and tackle real-world problems like pattern recognition, routing, energy, lines of production, prediction, modeling, among others.

This Special Issue consists of 11 research papers that we will shortly summarize in the following. The order of the presented papers is organized chronologically by the publication of the respective research papers in *Mathematical and Computational Applications* (MCA).

In [1], Dell'Amico and Magnani consider a pallet loading problem subject to stability requirements for which they propose a novel two-phase metaheuristic approach. Computational experiments on real-life instances are used to assess the effectiveness of the algorithm.

In [2], Arcolezi et al. use machine learning techniques to predict the ambulance response times (ART) of emergency medical services (EMS). Geo-indistinguishability was applied to sanitize each emergency location data. As shown in the results, the sanitization of the location data and the perturbation of its associated features (e.g., city, distance) had no considerable impact on predicting ARTs.

In [3], Pérez-Rodríguez proposes a new hybrid estimation of distribution algorithm (EDA) designed to tackle the quay crane scheduling problem (QCSP). The resulting hybrid algorithm uses a distance-based ranking model together with the moth–flame algorithm. Numerical results indicate that this new approach yields better performance, or at least equal in effectiveness, than the so-called pure EDAs.

In [4], Pury proposes a new indicator to determine when emergency medical services (EMS) might reach a critical condition when all service providers are busy and unable to respond to a new request. Such a scenario is crucial for EMS providers to take appropriate steps to avoid such a condition, with potentially life-altering results. The usefulness of the proposed indicator is validated using simulations, with promising results that demonstrate its applicability in real-life scenarios.

Citation: Quiroz-Castellanos, M.; de la Fraga, L.G.; Lara, A.; Trujillo, L.; Schütze, O. Numerical and Evolutionary Optimization 2021. *Math. Comput. Appl.* **2023**, *28*, 71. https://doi.org/10.3390/mca28030071

Received: 19 May 2023
Accepted: 22 May 2023
Published: 23 May 2023

In [5], Enríquez Zárate et al. study the problem of erosion in wind turbine blades, an important real-world issue regarding the efficiency and health of eolic energy generation. Determining the impact and presence of erosion, especially at the tip of the blades, is critical for proper maintenance and fault diagnosis. The work is based on the QBlade simulator to perform aerodynamic analysis and apply machine learning to predict and quantify the amount of erosion on different parts of the blade tip. The contribution is also unique because of the use of AutoML for the first time in this domain.

In [6], Cerrada et al. also study fault diagnosis in mechanical systems with AutoML, focusing on gearboxes that are widely used in industrial systems. Their work studies how different AutoML systems perform in generating machine learning pipelines to detect the severity level of different types of faults in these systems. It is shown that AutoML is competitive to the state of the art, and the authors also analyze how AutoML performs feature selection in this domain, showing that different AutoML systems tend to converge towards very similar feature subsets.

In [7], Esqueda-Elizondo et al. present a methodology based on electroencephalographic (EEG) signals for attention measurement of a 13-year-old boy diagnosed with autism spectrum disorder (ASD). The authors claim that these findings allow to develop better learning scenarios according to the person's needs, and further, that it allows to obtain quantifiable information on their progress to reinforce the perception of the teacher or therapist.

In [8], Carmona-Arroyo et al. propose a grouping genetic algorithm (GGA) to deal with the decomposition of decision variables in order to efficiently tackle large-scale optimization problems. Although the cooperative co-evolution approach is widely used to deal with unconstrained optimization problems, there are few works related to constrained problems. The authors present results on 18 constrained functions with up to 1000 decision variables. These results indicate that a GGA is an appropriate tool to optimize the variable decomposition for large-scale constrained optimization problems, outperforming the decomposition obtained by a state-of-the-art genetic algorithm.

In [9], Contreras-Luján et al. consider several machine learning (ML) models in order to improve the diagnosis of deep venous thrombosis (DVT). In particular, the authors focus on their implementation of an edge device for the development of instruments that are smart, portable, reliable, and cost-effective. It is shown on data taken from the literature that, compared to traditional methods, the best ML classifiers are effective at predicting DVT in an early and efficient manner.

In [10], Jain et al. consider ANFIS-type methods in the simulation of systems in marine environments. More precisely, the authors compare various artificial intelligence algorithms along with multivariate regression models to find the best fit model emulating effluent discharge and to determine the model with the least computational time. It is found that ANFIS-PSO performs better compared to the other considered models.

Finally, in [11], Pintér et al. address the problem to compute the conjectured sequence of the largest small n-polygons. To this end, the authors develop high-precision numerical solution estimates of the maximal areas. Results are shown for n up to 1000, with demonstrably high precision.

We warmly thank all participants at NEO 2021 as well as all authors who submitted a work to this Special Issue. We hope that this issue can be a contemporary reference regarding the field of numerical evolutionary optimization and its exciting applications.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Dell'Amico, M.; Magnani, M. Solving a real-life distributor's pallet loading problem. *Math. Comput. Appl.* **2021**, *26*, 53. [CrossRef]
2. Arcolezi, H.H.; Cerna, S.; Guyeux, C.; Couchot, J.F. Preserving geo-indistinguishability of the emergency scene to predict ambulance response time. *Math. Comput. Appl.* **2021**, *26*, 56. [CrossRef]
3. Pérez-Rodríguez, R. A hybrid estimation of distribution algorithm for the quay crane scheduling problem. *Math. Comput. Appl.* **2021**, *26*, 64. [CrossRef]

4. Pury, P.A. Time to critical condition in emergency services. *Math. Comput. Appl.* **2021**, *26*, 70. [CrossRef]
5. Enríquez Zárate, J.; Gómez López, M.D.L.Á.; Carmona Troyo, J.A.; Trujillo, L. Analysis and detection of erosion in wind turbine blades. *Math. Comput. Appl.* **2022**, *27*, 5. [CrossRef]
6. Cerrada, M.; Trujillo, L.; Hernández, D.E.; Correa Zevallos, H.A.; Macancela, J.C.; Cabrera, D.; Vinicio Sánchez, R. AutoML for feature selection and model tuning applied to fault severity diagnosis in spur gearboxes. *Math. Comput. Appl.* **2022**, *27*, 6. [CrossRef]
7. Esqueda-Elizondo, J.J.; Juárez-Ramírez, R.; López-Bonilla, O.R.; García-Guerrero, E.E.; Galindo-Aldana, G.M.; Jiménez-Beristáin, L.; Serrano-Trujillo, A.; Tlelo-Cuautle, E.; Inzunza-González, E. Attention measurement of an autism spectrum disorder user using EEG signals: A case study. *Math. Comput. Appl.* **2022**, *27*, 21. [CrossRef]
8. Carmona-Arroyo, G.; Quiroz-Castellanos, M.; Mezura-Montes, E. Variable decomposition for large-scale constrained optimization problems using a grouping genetic algorithm. *Math. Comput. Appl.* **2022**, *27*, 23. [CrossRef]
9. Contreras-Luján, E.E.; García-Guerrero, E.E.; López-Bonilla, O.R.; Tlelo-Cuautle, E.; López-Mancilla, D.; Inzunza-González, E. Evaluation of machine learning algorithms for early diagnosis of deep venous thrombosis. *Math. Comput. Appl.* **2022**, *27*, 24. [CrossRef]
10. Jain, A.; Bahreini Toussi, I.; Mohammadian, A.; Bonakdari, H.; Sartaj, M. Applications of ANFIS-type methods in simulation of systems in marine environments. *Math. Comput. Appl.* **2022**, *27*, 29. [CrossRef]
11. Pintér, J.D.; Kampas, F.J.; Castillo, I. Finding the conjectured sequence of largest small n-polygons by numerical optimization. *Math. Comput. Appl.* **2022**, *27*, 42. [CrossRef]