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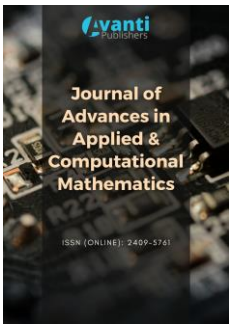

Editorial: Artificial Intelligence and Metaheuristic Optimization Methods in Engineering and Biomedical Application

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Artificial Intelligence (AI) has many facets, some of them trying to emulate human reasoning, evolving towards sophisticated and efficient numerical algorithms focused mainly on perception and action activities. AI also retrieves knowledge of the entire nature of biological organisms, their cooperation, natural evolution, and physical phenomena to develop metaheuristic algorithms that find special applications in optimizing complex non-linear models. Therefore, AI has helped to cope with systems and models when the classical and traditional gradient-based methods have reached their practical limits. We must reserve a particular comment on the recognition and classification methods found in Machine Learning (ML) and Deep Learning (DL), which have many reliable solutions to industrial and scientific tasks. Hence, ML- and DL-based methods have been proposed to solve real problems in computer vision, Genetics, Bioengineering, Robotics, Control, and automation, among others. Machine Learning (ML) is a broad set of numerical and mathematical algorithms for learning from raw data to perform recognition, model analysis, or inference tasks. Such algorithms can use parametric or non-parametric models supported by statistical and optimization formalisms. In such a context, each particular problem may require a specific solution.

This special issue is devoted to presenting high-quality papers related to the applications of Artificial Intelligence and Metaheuristic Optimization methods. The selected papers are technically sound, mathematically well-discussed, and supported by extensive experimentation.

Firstly, an overview of using adaptive dynamic programming and its application to dispatch Microgrids (MG) was carefully presented. This study was focused on an important issue of MG, the economic dispatch to ensure normal and optimal operations. The corresponding non-linear model and control theory was carefully discussed to reformulate it into an adaptive dynamic programming problem to obtain the optimal system states. An extensive set of numerical experiments validated the utility of using the ADP-based economic dispatch in the MGs.

The second proposal used an Empirical Mode Decomposition as a preprocessing step for a Bidirectional Long Short-Term Memory (BiLSTM) Network. This framework decoded individual fingers from Motor Imagery Electroencephalogram (MI-EEG) signals. This task is complex because the nature of the signals, which are non-stationary and particularly noisy, depends on the user's mental state and mood. Various finger configurations

were encoded with the proposed neural network architecture, reaching competitive recognition and classification rates.

The third contribution includes the localization, identification, and quantification of structural faults to detect structural vulnerability in buildings. The innovation in this study is the use of an artificial immunology System, which uses the biological defense paradigms, capacities, and characteristics to develop sophisticated bioinspired algorithms. Such algorithms have efficiently solved optimization algorithms in the decision-making process, which is vital in building design and maintenance.

In another close-related approach, different attention mechanisms were evaluated to improve the detection of stenosis cases using X-ray angiography images. In such a study, the authors use the Convolutional Neural Networks (CNN) to classify stenosis cases which is particularly complex considering the limited number of medical images for the training stage. Data limitations have forced scientists to use efficient alternatives such as transfer learning and attention mechanisms to boost recognition rates and enhance the network's interpretability. This last approach is analyzed and validated, being particularly efficient in detecting rare stenosis cases.

Moreover, a paper related to the semantic segmentation to extract the arterial structure in invasive coronary angiography presents an efficient algorithm to cope with one of the most important causes of death worldwide (Coronary Arteries Diseases). The proposed semantic segmentation allows extracting and classifying different arterial segments employing the robust Support Vector Machines (SVM) method. Furthermore, the proposed approach promises clinical use to improve the evaluation of stenosis and related blood vessel diseases.

In the optimization context, the design of a planetary gearbox in a wind turbine was also included in this special issue. This work applied an uncertainty design optimization using evidence theory to a model using random and internal variables. In wind turbines, the design and production of the gearbox are relevant to the final product, affecting the quality of the produced energy and operating performance. The numerical results showed that the proposed methodology allowed obtaining a reliable system fulfilling all the design parameters optimally.

Finally, A prominent application with Deep Learning is proposed in the manuscript entitled a gentle introduction to Physics Informed Neural Networks (PINN), with applications in static rod and beam problems. In this study, a mature description of Artificial Neural Networks (ANN) is contrasted with the modern Deep Learning methods with the PINN. PINN was described mathematically, and their practical applications were carefully discussed. Besides, the author has incorporated important Python modules to improve experiments' replicability. The numerical examples included solutions to engineering design problems based on partial differential equations, where complex models of solid deformable rods and beams were solved satisfactorily using PINN networks.

We invite the readers to enjoy the selected manuscripts, where the authors included many technical and methodological details for a certain advance in the state-of-the-art on artificial intelligence and metaheuristics applications.