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Guest Editorial: Digital Twin Enabled Neural Networks Architecture Management for Sustainable Computing

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Abstract

Digital twin-enabled neural networks will develop innovative processes in feature selection and simulation. In addition, this methodology will have development in autonomous driving, natural language processing, healthcare, and many other fields. Recently sensors have been widely used for environment monitoring, and massive data has to be processed efficiently and effectively, which requires managed neural architectures for sustainable computing. The sustainable digital twin-empowered architectures create new biological evolution simulation algorithms and intelligent system architectures for supervised and unsupervised learning. Some of today's fundamental artificial intelligence issues, including adaptive machine learning and neuromorphic cognitive models, can be overcome by this methodology. The goals of this special issue on digital twin-enabled neural network architecture management for sustainable computing aim to pay attention to the researchers and industries towards recent advances in decision-making algorithms, neural network models and architectures for faster processing.

Keywords: Intelligent system architectures; Machine learning; Neural network modelling and simulation; Sustainable soft computing; Internet of Things (IoT).

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Overview of Submissions

This Special Issue (SI) entitled "Digital Twin Enabled Neural Networks Architecture Management for Sustainable Computing" contains a collection of selected papers discussing the state-of-the-art deep learning models, artificial intelligence techniques, and optimization algorithms for various sustainable computing applications. All the articles published in this volume are accepted for publication after a careful peer-review process to fulfil the standard quality requirements and fall within the journal's scope.

The details of the selected papers are as follows:

The first article, "Improved Particle Swarm Optimization Based Distributed Energy-Efficient Opportunistic Algorithm for Clustering and Routing in WSNs", employed various real-time applications and addressed fundamental issues, such as limited power resources and network life. Several sensor nodes in a WSN monitor the actual world and relay discovered data to base stations. The biggest issue with WSN is that the sensors have a limited lifetime and use much electricity to relay data to the base station. This paper proposes an improved PSO-based Enhanced Distributed Energy Efficient Clustering (EDEEC) algorithm to extend the network's life and reduce power consumption. Clustering is the process of forming groups of sensor nodes. The cluster aims to improve the network's scalability, energy efficiency, and other characteristics.

The second paper, "Enhanced Blockchain-based Key Generation using Butterfly Optimization Algorithm for Efficient Data Sharing in Cloud Computing", uses computational resources as a service depending on customer needs via the internet. The computing paradigm is built on data outsourcing to third-party-controlled data centres. Despite significant cloud services and application developments, various security vulnerabilities remain. This research proposes the EBBKG model for efficient data sharing in the cloud. For secure data sharing in the cloud, the approach combines BBKG with ABS. This method offers good data management that efficiently specifies the subsequent processing processes.

The third manuscript, "A Dynamic Load Balancing Architecture for Fog Computing using Tree Base Resource Arrangement and Flexible Task Prioritization", investigates the challenges in a fog-cloud system. All devices participating in fog computing must be balanced with appropriate load to improve the system's performance. The proposed method is founded

on a tree-based dynamic resources arrangement mechanism that refreshes the fog clusters created using Fuzzy C Mean (FCM) to increase the speed of resource allocation. With the help of Fuzzy rule-based load calculation and intra-cluster job allocation, the load inside the group is maintained. A novel load balancing strategy, Real-Time Flexi Forwarded Cluster Refreshing System (RTFRS), is proposed by which all the tasks can be handled efficiently within the fog cloud system.

The fourth article, "Mobile Host Intrusion Detection in Surveillance Wireless Sensor Networks with Fusion of Sensor Data", provides intrusion detection in WSNs. Many research literature papers are aimed at generating and evaluating information on intruder detection in terms of probability of detection and false alarm rates. In two modalities, the model for acoustic signal and the sensor probability model, and in this research paper, the problems of passive motive intrusion detections have been solved. The aim is to establish a three-stage hierarchy to determine if mobile intruders are present. The sensor nodes at the fundamental level have a k-mean clustering grouping.

The fifth paper, "Social Media Toxic Content Filtering System using SOIR Model", elaborates about content filtering in social media. It provides different opportunities to design practical applications to favor humanity and society. A significant amount of people consumes social media content. Thus, sometimes content promoters and influencers publish misleading and toxic content. Therefore, this paper proposes an unhealthy content filtering system using the information retrieval model SOIR to identify and remove poisonous content from social media. The Semantic query Optimization-based Information Retrieval (SOIR) uses Fuzzy C Means (FCM) clustering to produce a particular data structure.

The sixth paper, "Design and Characterization of a Low-Cost Capacitive Soil Moisture Sensor System for IoT-based Agriculture Applications", proposes a low-cost IoT-enabled handy device to measure soil water content. Four sensor probes are designed in COMSOL Multiphysics 5.4 and fabricated using PCB Technology. The designed sensor probes are calibrated to effectively measure moisture content for three different soil types (silt/sandy/clay). An electronic system has been programmed according to Optimized-Moisture-Value (OMV) algorithm to read and collect the soil moisture information.

The seventh article, "Integrated Model-Based Engineering using Deep Learning with IIoT for Industry 4.0", discovers a potential platform for developing industry 4.0 and its related applications, especially in cyber-physical systems. Such a new trend in manufacturing sectors offers further potential to optimize operations, realize business models, and reduce costs. Such accomplish may also lead to complex and complicated tasks; hence, to deal with such issues, Reference Architecture Model Industry 4.0 (RAMI 4.0) is developed to structure Industry 4.0. In this paper, the standardized framework is considered RAMI 4.0 and its integration with an IIoT software named Software Platform Embedded Systems (SPES).

The eighth manuscript, "Flash Attack Prognosis by Ensemble Supervised Learning for IoT Networks", investigates the Internet of Things (IoT) 's scope in human life's communication and information-sharing routines, similar to any technological architecture. The IoT is also not exempted from vulnerability to security issues and is even more vulnerable as the networks of IoT are built of non-smart devices. Though the few contributions endeavored to defend against the botnet's attacks on IoT, they partially or poorly performed to defend against the flash crowd or attacks by botnets on IoT networks. In this context, the method "Flash Attack Prognosis by Ensemble Supervised Learning for IoT Networks" derived in this manuscript is centric on defending the flash attacks by botnets.

The ninth paper, "Preprocessing of Aspect-based English Telugu Code Mixed Sentiment Analysis", extracts the sentiments from English-Telugu code-mixed data and its challenges. Data obtained from the Twitter API has to be in English-Telugu code-mixed language. That data is free-form text, noisy, lexicon borrowings, code-mixed, phonetic typing and misspelling data. The initial step is language identification and sentiment class labels assigned to each tweet in the dataset. The second step is the data normalization task, and the final step is classification, which can be achieved using three different methods: lexicon, machine learning, and deep learning.

The last paper, "Design and Characterization of a Low-Cost Capacitive Soil Moisture Sensor System for IoT-based Agriculture Applications", addresses the global demand for food that can be eliminated by precision farming. This research proposes a low-cost IoT-enabled handy device to measure soil water content. Four sensor probes are designed in COMSOL Multiphysics 5.4 and fabricated using PCB Technology. The designed sensor probes are calibrated to effectively measure moisture content for three different soil types (silt/sandy/clay). An electronic system has been programmed according to Optimized-Moisture-Value (OMV) algorithm to read and collect the soil moisture information.