Section
Computer Science & Engineering

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Section Information

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Papers

Designing Immersive Virtual Reality Simulation for Environmental Science Education

Authors: Yongjoo Cho and Kyoung Shin Park

Abstract: Recently, severe environmental changes, such as global warming, climate change and environmental pollution, have become expected, and thus environmental education is becoming essential. The purpose of environmental education is to instill awareness in students to recognize and solve environmental problems. Virtual reality provides students with a spatial and temporal experience similar to reality, and it can increase their understanding of knowledge through immersion and interaction compared to traditional learning. In previous studies, virtual reality for education has mainly focused on experience, but it is difficult to find examples for environmental education. Hence, this research proposed an immersive virtual reality simulation for environmental education based on the virtual ecosystem model. It also presented two applications developed based on this simulation. This research aims at encouraging students' active participation and motivation to solve the environmental problems while experiencing the results of interaction related to environmental factors in a virtual environment.

Deep Learning Model Transposition for Network Intrusion Detection Systems

Authors: João Figueiredo, Carlos Serrão and Ana Maria de Almeida

Abstract: Companies seek to promote a swift digitalization of their business processes and new disruptive features to gain an advantage over their competitors. This often results in a wider attack surface that may be exposed to exploitation from adversaries. As budgets are thin, one of the most popular security solutions CISOs choose to invest in is Network-based Intrusion Detection Systems (NIDS). As anomaly-based NIDS work over a baseline of normal and expected activity, one of the key areas of development is the training of deep learning classification models robust enough so that, given a different network context, the system is still capable of high rate accuracy for intrusion detection. In this study, we propose an anomaly-based NIDS using a deep learning stacked-LSTM model with a novel pre-processing technique that gives it context-free features and outperforms most related works, obtaining over 99% accuracy over the CICIDS2017 dataset. This system can also be applied to different environments without losing its accuracy due to its basis on context-free features. Moreover, using synthetic network attacks, it has been shown that this NIDS approach can detect specific categories of attacks.

Reviewing Federated Learning Aggregation Algorithms; Strategies, Contributions, Limitations and Future Perspectives

Authors: Mohammad Moshawrab, Mehdi Adda, Abdenour Bouzouane, Hussein Ibrahim and Ali Raad

Abstract: The success of machine learning (ML) techniques in the formerly difficult areas of data analysis and pattern extraction has led to their widespread incorporation into various aspects of human life. This success is due in part to the increasing computational power of computers and in part to the improved ability of ML algorithms to process large amounts of data in various forms. Despite these improvements, certain issues, such as privacy, continue to hinder the development of this field. In this context, a privacy-preserving, distributed, and collaborative machine learning technique called federated learning (FL) has emerged. The core idea of this technique is that, unlike traditional machine learning, user data is not collected on a central server. Nevertheless, models are sent to clients to be trained locally, and then only the models themselves, without associated data, are sent back to the server to combine the different locally trained models into a single global model. In this respect, the aggregation algorithms play a crucial role in the federated learning process, as they are responsible for integrating the knowledge of the participating clients, by integrating the locally trained models to train a global one. To this end, this paper explores and investigates several federated learning aggregation strategies and algorithms. At the beginning, a brief summary of federated learning is given so that the context of an aggregation algorithm within a FL system can be understood. This is followed by an explanation of aggregation strategies and a discussion of current aggregation algorithms implementations, highlighting the unique value that each brings to the knowledge. Finally, limitations and possible future directions are described to help future researchers determine the best place to begin their own investigations.

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