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Computing and Artificial Intelligence

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Section Information

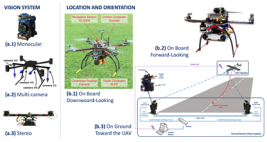
Following the great advances and global interest in the field of Computer Science, Computing and Artificial Intelligence, this section aims to collect relevant scientific contributions in the broad field of Information and Communication Technologies (ICT), with specific focus on Computing and Artificial Intelligence. The focus of papers published in this section will be on applied research within these topics, but theoretical works are also welcome, if related to possible applications. More specifically, papers dealing with the acquisition, processing, storage and transmission of information are within the scope of this section. This section aims to provide a forum for research from both academia and industry, and will be the perfect journal to disseminate your results to a global community of researchers.

Featured Papers

DOI:10.3390/app9153196

Computer Vision in Autonomous Unmanned Aerial Vehicles—A Systematic Mapping Study

Authors: Lidia María Belmonte, Rafael Morales and Antonio Fernández-Caballero

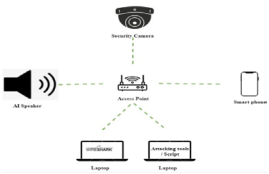


Abstract: Personal assistant robots provide novel technological solutions in order to monitor people's activities, helping them in their daily lives. In this sense, unmanned aerial vehicles (UAVs) can also bring forward a present and future model of assistant robots. To develop aerial assistants, it is necessary to address the issue of autonomous navigation based on visual cues. Indeed, navigating autonomously is still a challenge in which computer vision technologies tend to play an outstanding role. Thus, the design of vision systems and algorithms for autonomous UAV navigation and flight control has become a prominent research field in the last few years. In this paper, a systematic mapping study is carried out in order to obtain a general view of this subject. The study provides an extensive analysis of papers that address computer vision as regards the following autonomous UAV vision-based tasks: (1) navigation, (2) control, (3) tracking or guidance, and (4) sense-and-avoid. The works considered in the mapping study—a total of 144 papers from an initial set of 2081—have been classified under the four categories above. Moreover, type of UAV, features of the vision systems employed and validation procedures are also analyzed. The results obtained make it possible to draw conclusions about the research focuses, which UAV platforms are mostly used in each category, which vision systems are most frequently employed, and which types of tests are usually performed to validate the proposed solutions. The results of this systematic mapping study demonstrate the scientific community's growing interest in the development of vision-based solutions for autonomous UAVs. Moreover, they will make it possible to study the feasibility and characteristics of future UAVs taking the role of personal assistants.

DOI:10.3390/app12105015

IoT Intrusion Detection Using Machine Learning with a Novel High Performing Feature Selection Method

Authors: Khalid Albulayhi, Qasem Abu Al-Haija, Suliman A. Alsuhibany, Ananth A. Jillepalli, Mohammad Ashrafuzzaman and Frederick T. Sheldon

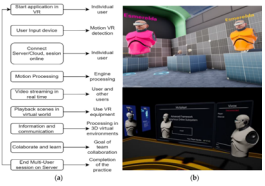


Abstract: The Internet of Things (IoT) ecosystem has experienced significant growth in data traffic and consequently high dimensionality. Intrusion Detection Systems (IDSs) are essential self-protective tools against various cyber-attacks. However, IoT IDS systems face significant challenges due to functional and physical diversity. These IoT characteristics make exploiting all features and attributes for IDS self-protection difficult and unrealistic. This paper proposes and implements a novel feature selection and extraction approach (i.e., our method) for anomaly-based IDS. The approach begins with using two entropy-based approaches (i.e., information gain (IG) and gain ratio (GR)) to select and extract relevant features in various ratios. Then, mathematical set theory (union and intersection) is used to extract the best features. The model framework is trained and tested on the IoT intrusion dataset 2020 (IoTID20) and NSL-KDD dataset using four machine learning algorithms: Bagging, Multilayer Perception, J48, and IBk. Our approach has resulted in 11 and 28 relevant features (out of 86) using the intersection and union, respectively, on IoTID20 and resulted 15 and 25 relevant features (out of 41) using the intersection and union, respectively, on NSL-KDD. We have further compared our approach with other state-of-the-art studies. The comparison reveals that our model is superior and competent, scoring a very high 99.98% classification accuracy.

DOI:10.3390/app12126258

Smart Factory Using Virtual Reality and Online Multi-User: Towards a Metaverse for Experimental Frameworks

Authors: Luis Omar Alpala, Darío J. Quiroga-Parra, Juan Carlos Torres and Diego H. Peluffo-Ordóñez

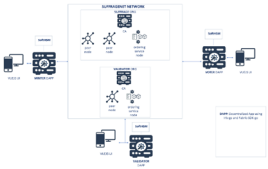


Abstract: Virtual reality (VR) has been brought closer to the general public over the past decade as it has become increasingly available for desktop and mobile platforms. As a result, consumer-grade VR may redefine how people learn by creating an engaging "hands-on" training experience. Today, VR applications leverage rich interactivity in a virtual environment without real-world consequences to optimize training programs in companies and educational institutions. Therefore, the main objective of this article was to improve the collaboration and communication practices in 3D virtual worlds with VR and metaverse focused on the educational and productive sector in smart factory. A key premise of our work is that the characteristics of the real environment can be replicated in a virtual world through digital twins, wherein new, configurable, innovative, and valuable ways of working and learning collaboratively can be created using avatar models. To do so, we present a proposal for the development of an experimental framework that constitutes a crucial first step in the process of formalizing collaboration in virtual environments through VR-powered metaverses. The VR system includes functional components, object-oriented configurations, advanced core, interfaces, and an online multi-user system. We present the study of the first application case of the framework with VR in a metaverse, focused on the smart factory, that shows the most relevant technologies of Industry 4.0. Functionality tests were carried out and evaluated with users through usability metrics that showed the satisfactory results of its potential educational and commercial use. Finally, the experimental results show that a commercial software framework for VR games can accelerate the development of experiments in the metaverse to connect users from different parts of the world in real time.

DOI:10.3390/app12020531

Electronic Voting System Using an Enterprise Blockchain

Authors: Camilo Denis González, Daniel Frias Mena, Alexi Massó Muñoz, Omar Rojas and Guillermo Sosa-Gómez



Abstract: Conventional electronic voting systems use a centralized scheme. A central administration of these systems manages the entire voting process and has partial or total control over the database and the system itself. This creates some problems, accidental or intentional, such as possible manipulation of the database and double voting. Many of these problems have been solved thanks to permissionless blockchain technologies in new voting systems; however, the classic consensus method of such blockchains requires specific computing power during each voting operation. This has a significant impact on power consumption, compromises the efficiency and increases the system latency. However, using a permissioned blockchain improves efficiency and reduces system energy consumption, mainly due to the elimination of the typical consensus protocols used by public blockchains. The use of smart contracts provides a secure mechanism to guarantee the accuracy of the voting result and make the counting procedure public and protected against fraudulent actions, and contributes to preserving the anonymity of the votes. Its adoption in electronic voting systems can help mitigate part of these problems. Therefore, this paper proposes a system that ensures high reliability by applying enterprise blockchain technology to electronic voting, securing the secret ballot. In addition, a flexible network configuration is presented, discussing how the solution addresses some of the security and reliability issues commonly faced by electronic voting system solutions.

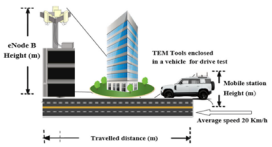
Featured Papers

DOI:10.3390/app12115713

Development of a Multilayer Perceptron Neural Network for Optimal Predictive Modeling in Urban Microcellular Radio Environments

Authors: Joseph Isabona, Agbotiname Lucky Imoize, Stephen Ojo, Olukayode Karunwi, Yongsung Kim, Cheng-Chi Lee and Chun-Ta Li

Abstract: Modern cellular communication networks are already being perturbed by large and steadily increasing mobile subscribers in high demand for better service quality. To constantly and reliably deploy and optimally manage such mobile cellular networks, the radio signal attenuation loss between the path lengths of a base transmitter and the mobile station receiver must be appropriately estimated. Although many log-distance-based linear models for path loss prediction in wireless cellular networks exist, radio frequency planning requires advanced non-linear models for more accurate predictive path loss estimation, particularly for complex microcellular environments. The precision of the conventional models on path loss prediction has been reported in several works, generally ranging from 8–12 dB in terms of Root Mean Square Error (RMSE), which is too high compared to the acceptable error limit between 0 and 6 dB. Toward this end, the need for near-precise machine learning-based path loss prediction models becomes imperative. This work develops a distinctive multi-layer perception (MLP) neural network-based path loss model with well-structured implementation network architecture, empowered with the grid search-based hyperparameter tuning method. The proposed model is designed for optimal path loss approximation between mobile station and base station. The hyperparameters examined include the neuron number, learning rate and hidden layers number. In detail, the developed MLP model prediction accuracy level using different learning and training algorithms with the tuned best values of the hyperparameters have been applied for extensive path loss experimental datasets. The experimental path loss data is acquired via a field drive test conducted over an operational 4G LTE network in an urban microcellular environment. The results were assessed using several first-order statistical performance indicators. The results show that prediction errors of the proposed MLP model compared favourably with measured data and were better than those obtained using conventional log-distance-based path loss models.



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Trends and Prospects in Multimedia
Collection Editors: Prof. Dr. Cheonshik Kim and Prof. Dr. Andrew Teoh Beng Jin

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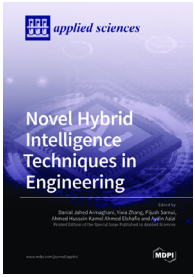
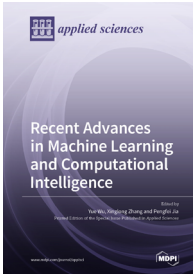
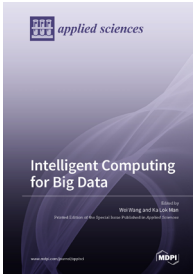


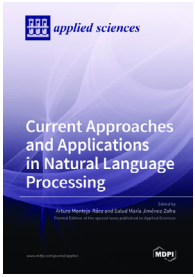
Novel Hybrid Intelligence Techniques in Engineering



Recent Advances in Machine Learning and Computational Intelligence



Intelligent Computing for Big Data



Current Approaches and Applications in Natural Language Processing