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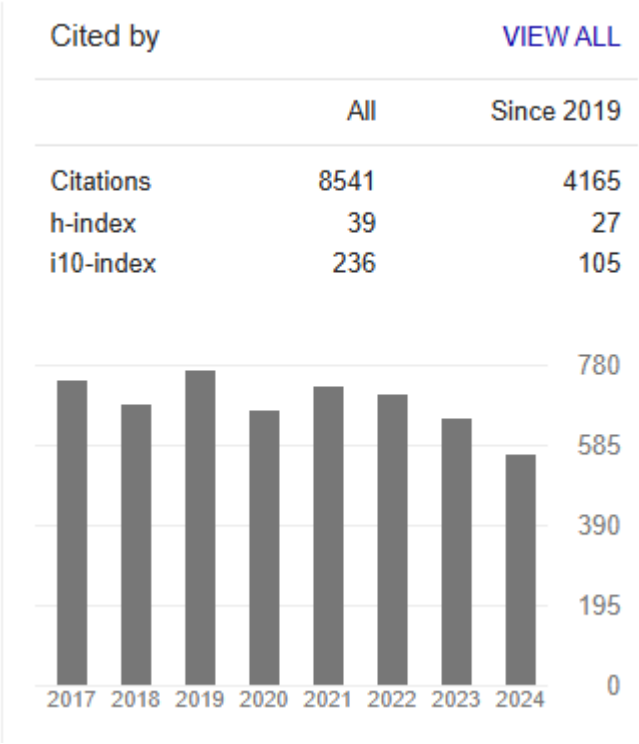

MODELING LOW-COST INERTIAL NAVIGATION SYSTEMS AND THEIR ERRORS

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ABSTRACT

Inertial Navigation Systems (INS) are critical for a wide range of applications due to their ability to provide reliable navigation information, even without external references. This paper presents a comprehensive study of the modeling of low-cost INS sensors and their inherent errors, focusing on how these errors impact the accuracy of the system's localization outputs. A MATLAB-based simulation platform was developed to analyze the effects of common sensor errors on position, velocity, and attitude over time. The experimental results show that these errors accumulate, leading to significant deviations from the true trajectory. Notably, the maximum positional error in the upward direction reached 65 meters by the end of the simulated trajectory, while the velocity error in the same direction deviated by 0.8 m/s. Initially, the estimated trajectory closely followed the reference path, but as the simulation progressed, a substantial divergence occurred, highlighting the cumulative impact of sensor errors. These findings underscore the necessity of advanced error mitigation techniques to enhance the long-term accuracy and reliability of INS in practical applications.

KEYWORDS

Low-Cost Inertial Navigation System, Sensor errors, Navigation, Modeling, Mechanization

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AN INNOVATIVE HYBRID MODEL FOR EFFECTIVE DDOS ATTACK DETECTION IN SOFTWARE DEFINED NETWORKS

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ABSTRACT

Software-Defined Networking (SDN) is a sophisticated network architecture that offers enhanced flexibility and streamlined management through a centralized controller. While these advantages allow SDNs to adapt to growing network demands, they also introduce potential security risks. Specifically, the centralized nature of SDN makes it vulnerable to network attacks, such as Distributed Denial of Service (DDoS) attacks, which can overwhelm network resources and cause widespread congestion. In this study, we propose a DDoS detection model that combines entropy-based features with Support Vector Machine (SVM) machine learning to create a hybrid approach. This model capitalizes on the strengths of both methods to improve detection accuracy. Our results, based on simulations and practical SDN implementation, show that our approach effectively and rapidly detects DDoS attacks with high precision. This paper addresses the challenge of enhancing the efficiency and accuracy of DDoS attack detection by providing a comprehensive dataset collected from both simulated and practical environments, thereby improving the detection system's performance in real-time situations.

KEYWORDS

SDN, DDoS attacks, network security, machine learning, statistical analysis method, entropy, dynamic entropy.

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ROUTING PERFORMANCES IN WIRELESS SENSOR NETWORKS: DETERMINING SHORTEST PATH ALGORITHMS EFFECTIVENESS

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ABSTRACT

Wireless Sensor Networks (WSNs) play a pivotal role in a myriad of diverse fields, ranging from crucial healthcare applications to the creation of smart cities and effective environmental monitoring systems. Within the realm of WSNs, the feature of efficient routing assumes paramount importance as it exerts a profound influence on resource utilization and the overall performance of the network. In light of their remarkable efficiency and straightforwardness, shortest-path algorithms have emerged as a prevailing choice for routing mechanisms in WSNs. Hence, the primary objective of this specialized research is to understand a comprehensive investigation into the calculating performance of sensor network routing, with a particular circle on leveraging the potential of shortest-path algorithms. This ambitious effort will involve the establishment of a rigorous evaluation framework encompassing various performance metrics, enabling a meticulous assessment of the routing performance and the efficacy of the carefully selected algorithms. The culmination of this research holds tremendous significance, as it is poised to bestow invaluable insights into the practical implementation of WSNs. To attire with a comprehensive understanding of their performance across various scenarios and metrics, the research community can make informed decisions when choosing the most appropriate routing protocols suited to particular Wireless Sensor Network (WSN) deployments. The potential results of this research promise to not only improve the network's efficiency, reliability, and lifespan safe but also to pave the way for innovative applications of Wireless Sensor Networks in critical areas of societal significance.

KEYWORDS

Wireless Sensor Networks (WSNs), Routing Protocols, Shortest -Path algorithms

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INTRUSION DETECTION MODEL USING MACHINE LEARNING ALGORITHMS ON NSL-KDD DATASET

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ABSTRACT

Big data, generated by various sources such as mobile devices, sensors, and the Internet of Things (IoT),has many characteristics such as volume, velocity, variety, variability, veracity, validity, vulnerability, volatility, visualization, and value. An Intrusion Detection System (IDS) is essential for cybersecurity to detect intrusions before or after attacks. Traditional software methods struggle to store, manage, and analyze big data, developing new techniques for effective and rapid intrusion detection in organizations and enterprises. This study introduces the IDS Random Forest (RF) model in binary and multiclass classification for intrusion detection. In this model, we used the Synthetic Minority Oversampling TEchnique (SMOTE) to address class imbalances, and the RF classifier to classify attacks using the Network Security Laboratory (NSL)-KDD dataset. In the experiment, we compared the IDS-RF model with the Support Vector Machine (SVM), k-Nearest Neighbor (k-NN), and Logistic Regression (LR) classifiers in terms of accuracy, precision, recall, f1-score, and times for training and testing. The experimental results showed that the IDS-RF model achieved high performance in binary and multiclass classification compared to others. In addition, the proposed model also achieved high accuracies for each class (Normal, DoS, Probe, U2R, or R2L) and obtained 98.69%, 99.72%, 98.93%, 95.13%, and 89%, respectively.

KEYWORDS

Intrusion Detection, Network Security Laboratory (NSL)-KDD dataset, SMOTE, Machine Learning

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FUZZY-BASED CLUSTERING OF WIRELESS SENSOR NETWORKS FOR MULTIPLE MOBILE AGENT ITINERARY PLANNING

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ABSTRACT

Mobile agent (MA) technology exhibits remarkable efficiency when integrated into Wireless Sensor Networks (WSNs) for information processing tasks. MAs reduce network overhead by executing processing code locally on nodes and selectively transmitting significant data to designated remote sensor nodes, thereby enhancing data fusion and acquisition while minimizing energy depletion. However, in large-scale networks, relying on a single MA leads to significant delays, necessitating the use of multiple MAs to operate asynchronously and minimize latency. The challenge lies in effectively grouping nodes to ensure MAs reach their intended destinations. To address this challenge, this paper introduces a novel approach, the Adaptive FCM Clustering Algorithm (AFCM), a fuzzy-based clustering algorithm designed for addressing network partitioning challenges in Multiple Mobile Agent Itinerary Planning (MIP). A systematic analysis of the existing literature examines various MIP algorithms, emphasizing their strengths and uncovering potential research gaps. AFCM is specifically developed to create disjoint and load-balanced partitions tailored for multi-mobile agent itinerary planning. A Methodical analysis with three traditional clustering algorithms is conducted. The correctness of the Adaptive Fuzzy C-Means (AFCM) algorithm is demonstrated through a detailed manual application on a wireless network comprising 15 nodes.

KEYWORDS

Clustering, Itinerary planning, Mobile agent, Routing, Wireless sensor networks.

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PRIORITIZED SCHEDULING ROUTING PROTOCOL FOR MINIMIZING PACKET DROP IN WIRELESS BODY AREA NETWORK

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ABSTRACT

The development of wireless body area networks, or WBANs, has altered people's lives through their utilization in the fields of athletics, cultural activities, fitness, including healthcare, among others. Energy conservation and ensuring the quality of offerings, however, are two of the main design difficulties for WBAN. In a WBAN, the load balancing of various packet buffers is crucial to the construction of a dependable and environmentally friendly technology. This paper proposes a prioritized scheduling-based protocol for minimizing packet drops in wireless body area networks on IEEE 802.15.6. This paper's primary goal is to reduce packet drops in the queues to increase WBAN throughput. In this instance, we take into account the data packet's importance as well as its source location to ensure that no packet is held in the designated buffer for an extended period before being sent to the connection point. PyCrypto is used to replicate the suggested approach in order to research and contrast its results with those of its competitors. According to the findings from the simulation, the suggested protocol performs more efficiently in delay, throughput, and energy consumption than the current approaches.

KEYWORDS

Routing Protocol, Wireless Body Area Network, Data Packet, Energy Consumption, Priority Scheduling

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OUTSTANDING FRAMEWORK FOR SIMULATING AND GENERATING ANCHOR TRAJECTORY IN WIRELESS SENSOR NETWORKS

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ABSTRACT

This paper proposes a framework that has the ability to animate and generate different scenarios for the mobility of a movable anchor which can follow various paths in wireless sensor networks (WSNs). When the researchers use NS-2 to simulate a single anchor-assisted localization model, they face the problem of creating the movement file of the movable anchor. The proposed framework solved this problem by allowing them to create the movement scenario regarding different trajectories. The proposed framework lets the researcher set the needed parameters for simulating various static path models, which can be displayed through the graphical user interface. The researcher can also view the mobility of the movable anchor with control of its speed and communication range. The proposed framework has been validated by comparing its results to NS-2 outputs plus comparing it against existing tools. Finally, this framework has been published on the Code Project website and downloaded by many users.

KEYWORDS

Localization, Movable anchor, Simulation, Path planning, Wireless sensor networks

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A COMPARATIVE STUDY OF COOPERATIVE AND NON-COOPERATIVE WIDEBAND SPECTRUM SENSING IN COGNITIVE RADIO NETWORKS FOR 5G APPLICATIONS

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ABSTRACT

The rapid advancements in 5G technologies have created an unprecedented need for efficient spectrum utilization to support increasing data traffic and diverse communication services. In this context, accurate and reliable spectrum sensing is essential. This study explores wideband spectrum sensing strategies, comparing non-cooperative cognitive radio (CR) techniques with cooperative methods across multiple subbands. A novel cooperative wideband spectrum sensing framework was developed, incorporating a K-outof-N fusion rule at the fusion center to make optimal decisions by selecting an appropriate K for a given number of cooperating CRs. This approach addresses noise uncertainty, a common challenge in traditional non-cooperative energy detection methods, particularly in 5G environments under Additive White Gaussian Noise (AWGN) conditions, assumed to be identically and independently distributed (i.i.d.). However, while cooperative sensing significantly improves detection in low signal-to-noise ratio (SNR) scenarios with higher false alarm rates (between 0.5 and 1), our findings reveal that it does not consistently outperform non-cooperative methods at very low false alarm rates (0.01 and 0.1) under poor SNR conditions. These findings highlight the need for further research to enhance cooperative sensing strategies for various operational environments.

KEYWORDS

Cooperative wideband spectrum sensing, non-cooperative wideband spectrum sensing, energy detection, additive white gaussian noise, hard fusion rule, Cooperative Radio.

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