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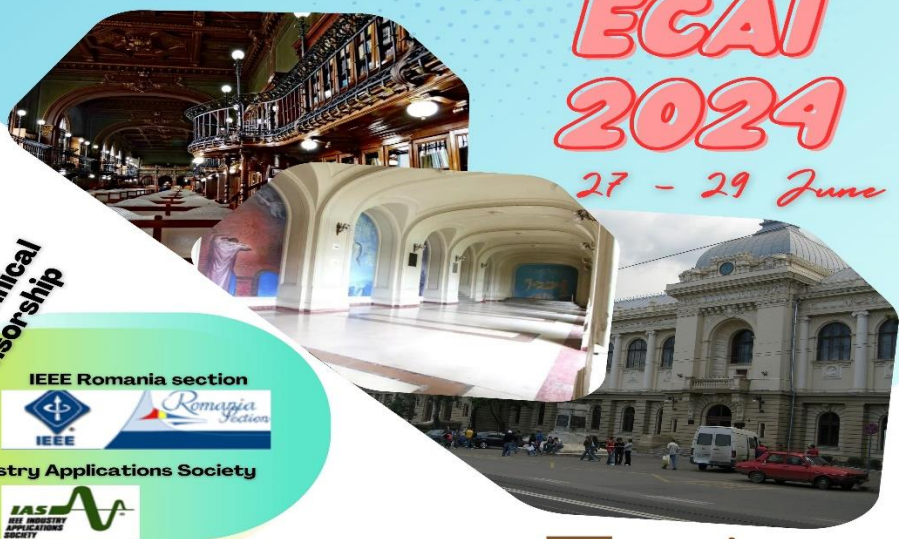

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connectivity
Consortium Block Chain
constraints-based approach
contaminated products
Content Authenticity
Content Provenance
control
Control Systems
convolutional neural network
Convolutional Neural Network
Convolutional neural network
Convolutional neural networks
convolutional neural networks
Corona-Virus Search Optimization
corrosion resistance
cover image
Cross-Site Scripting
cryptographic technologies
cryptography
Cryptography
custom parameters
cyber-attack
cyber-attacks
cyberattack
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Cybersecurity
Cybersecurity awareness
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Data Integrity
Data intensification
Data management systems
Data Mining
data security
Data warehouse (Snowflake schema)
DC-DC Converter
DC-DC converter.
deep convolutional neural networks
deep feed forward neural networks
deep learning
Deep Learning
Deep learning
deep learning framework
deep learning tracking approach
deep neural model training and validation
Deep Q Network
Deep Reinforcement Learning
Deep Transformer Neural Network
DenseNet121
Dependency preservation
Depot Charging Infrastructure
detection
Detection
Deterministic Binary Block Diagonal Sensing Matrix
Dexonline
Diagnostics
digital ecosystem
Digital Evidence
digital platform
digital signal processing
digital signature
digital strategy
digital transformation
Digital Twin
Digital Twins
Direct Normal Irradiation (DNI)
Direct torque control
Disadvantages
Distributed Energy Resources
Distribution Networks Expansion Planning
DIY prototyping
doctors
Double Tail Dynamic Comparator
Doubly Fed Induction Generator (DFIG)
Doubly Fed Induction Generator DFIG
doubly-powerd induction generator
Driver Behavior
Drowsiness Detection
Durability
DWM1001
Dynamic Comparator
dynamic window algorithm
e-mail
e-nose
e-tools
EAP
ECG Digitization
ECG noise classification
ECG Paper.
eddy currents
Edge Detection
edge detection
edge hardening
Educational Platform
EEG
efficiency
EHR
elastic deformation
Electric Distribution Networks
electric furnaces
Electric vehicle
electrical supply
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Electricity load forecasting
Electrocardiogram
Electrocardiogram signal quality
Electrocardiography
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electroencephalography

electromechanical testing
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emergent materials
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Eriophyes vitis disease
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etymology
Explainable Artificial Intelligence (XAI)
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Extra Trees Classifier
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FibrosisNet
Fiel Oriented Control FOC
FIFO
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Financial Transactions
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fire
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floating wind turbine
FLUX 2D
Flux stator ripple
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harries hawks optimization
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Incremental Conductance (IC)

indoor localization or positioning
induction heating
induction machines
Industrial Automation
Industrial Equipment
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Information security awareness
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Intrusion detection
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Malignant
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Matter
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Maximum Power Point Tracking (MPPT)
Maximum power point tracking (MPPT)
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medical diagnosis
membrane
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micro-arc oxidation
microgrid
microgrid constraint
microgrid control
microgrid parameters
Microservice
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monitoring methods
MPLS
MQTT
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Multi-Objective Optimization
Multimodal
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nanocomposite
nanocomposites
nanomaterials
nanoscale
NASICON ceramic membrane
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National Solar radiation database (NSRD)
Natural Language Processing (NLP)
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Net present value
network traffic

Network traffic monitoring
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optimization
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Parkinson's Disease
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Simulink

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Skill Assessment
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smart home
Smart Home
smart parking system
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smart system
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Transparency
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Tumor
Twingate
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Type 2 Fuzzy Logic Control (T2-FLC)
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ultrasonic
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Urban Charging Stations
urban parking
UWB (Ultra-Wideband)
Uzbekistan
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vehicle tracking
vehicular
Vibroacoustics
video matching
VIMM approach
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virtual currency
virtual instrumentation
Virtual Reality
Virtual reality
Voltage deviation
Voltage stability index
vulnerabilities
Vulnerability Detection
Wasserstein Generative Adversarial Network (WGAN)
wastewater
water quality
water quality map
weak supervised classification
wearable device
Web API

[0025] *Improvement Of An Untrained Brain-computer Interface System Combined With Target Recognition*

Jihong Xu (School of Automotive Engineering, Wuhan University of Technology), Tianran Chen (School of Automotive Engineering, Wuhan University of Technology) and Lirong Yan (School of Automotive Engineering, Wuhan University of Technology).

Abstract

In the current commonly used Steady State Visual Evoked Potential (SSVEP) paradigm, the stimuli are mostly white flashing blocks superimposed on a black background, which is monotonous and easy to cause subject fatigue with prolonged flashing stimuli. The stimulus paradigm is mostly divorced from the actual control environment, and lacks a direct connection with the control task. The mainstream classification algorithms usually analyze the data with a fixed window length, which is lack of generalizability to different subjects, and the classification performance index needs to be further improved. In this study, the SSVEP stimulus paradigm was improved by combining the YOLOv5 algorithm, which changed from the traditional black background to the actual control environment. It superimposed SSVEP stimulus blocks of different frequencies at each recognized target location. The stimulus paradigm was not stripped from the control scene, and the Filter Bank Criterion Correlation Analysis (FBCCA) algorithm was chosen to analyze it. The FBCCA algorithm was further improved by using a dynamic window strategy, which automatically adjusts the window length of each experiment according to the characteristics of each subject. This improves the versatility of the algorithm and increases the recognition accuracy and Information Transfer Rate (ITR). After the improvement, the offline experimental data were analyzed. The improved algorithm achieved an average accuracy of 87.08%, which was 17.29% higher than the original algorithm. Additionally, the average ITR was 74.28 bits/min, which was 36.51 bits/min higher than the original algorithm.

[0036] *AI and Prompt Engineering: The New Weapons of Social Engineering Attacks*

Roxana Emanuela Ambrozie (Gheorghe Asachi Technical University of Iasi), Andreea Cristina Buzatu (Gheorghe Asachi Technical University of Iasi) and Luminita Scripcariu (Gheorghe Asachi Technical University of Iasi).

Abstract

As Artificial Intelligence technologies continue to advance, their integration into social engineering tactics poses new and evolving threats to cybersecurity. This paper provides an in-depth exploration of the intersection between Artificial Intelligence and social engineering, examining the risks and challenges associated with the malicious use of Artificial Intelligence-driven techniques. The research assesses the capabilities of Artificial Intelligence of creating sophisticated and targeted social engineering attacks to exploit human vulnerabilities. The results revealed some intriguing insights into the efficacy of Artificial Intelligence-generated phishing emails compared to those composed by humans. Our motivation behind this work is to assess the impact of Artificial Intelligence used in social engineering for warfare on the Internet-connected world and recognize the attacks because, in addition to the kinetic attacks, malicious forces can employ non-kinetic attacks as well, such as cyber-attacks and social engineering attacks to disrupt critical infrastructure. In the ongoing cyberwar, the urgent recognition of phishing attempts is of utmost importance.

[0087] *Mushroom Classification using ANN, KNN, Naive Bayes, RF, SVM and the Gradient Boosting Algorithm XGBoost*

Aimen Nisa (Fatima Jinnah women University), Irum Matloob (Fatima Jinnah women University), Bushra Bashir (Fatima Jinnah Women University), Laiba Pervez (Fatima Jinnah women University) and Hafsa Razzaq (fatima Jinnah women university).

Abstract

Of the millions of different varieties of mushrooms that exist worldwide, one is edible and the other is toxic. Differ- entiating between edible and deadly mushrooms is challenging and requires knowledge. To this end, various machine learning models were employed to assess the toxicity and edibility of mush- rooms. We also developed a model for classifying mushrooms using various machine learning algorithms. The Kaggle website provided the dataset that was used for this task. The dataset consists of 8124 samples with a total of 23 features, which are divided into two categories: edible and poisonous. According to the distribution of mushrooms according to their classes, 51.8% of the dataset's mushrooms were labeled as edible while 42.8% were poisonous. Principal component analysis (PCA), data pre- processing, and exploratory data analysis (EDA) were some of the stages that were included in the project. K-Nearest Neighbours (KNN), Random Forest, Naive Bayes, Support Vector Machine (SVM) and Gradient Boosting Algorithm XGBoost were some of the ML algorithms that were applied in comparison. The ideal value of K for KNN was established through experimentation. The accuracy scores for each algorithm were determined, and the results indicated that KNN, Random Forest, and XGBoost attained the highest accuracy, with accuracies of 100%, 100%, and 99.9%, respectively. Accuracy rates for SVM and Naive Bayes were 99.5% and 92.43%, respectively. ANN also gained highest training accuracy of 100% with the 100% test accuracy.

[0090] *Necessity of Emergent Materials Development for Air Filtration to Increase Air Quality*

Omar Ahmed (Science and Materials Engineering Doctoral School National University of Science and Technology Politehnica Bucharest), Mihai Oproescu (University of Science and Technology POLITEHNICA Bucharest) and Vasile Gabriel Iana (National University of Science and Technology POLITEHNICA Bucharest).

Abstract

Air quality is a major public health issue globally. Air pollution is responsible for millions of premature deaths annually and can cause a range of health problems, including respiratory diseases. The need to develop emergent materials and new technologies to increase air quality offers a series of opportunities due to the benefits offered. The emerging materials can be used to create more efficient air filters, air quality monitoring sensors and catalysts to reduce emissions. The article summarizes the main legislative regulations for reducing pollution, as well as emerging materials with a role in increasing air purity, by reducing pollutants.

[0280] *Transfer Learning-based Framework for Automatic Vehicle Detection, Recognition and Tracking*

Tudor Barbu (Institute of Computer Science of the Romanian Academy - Iasi Branch), Silviu-Ioan Bejinariu (Institute of Computer Science of the Romanian Academy - Iasi Branch) and Ramona Luca (Institute of Computer Science of the Romanian Academy - Iasi Branch).

Abstract

A deep learning-based framework for automatic vehicle detection, classification and counting is introduced in this research work. Two convolutional neural networks (CNN) are created, trained, validated and tested for the detection and recognition tasks. First, a YOLO V2 detection network is built by modifying a MobileNet-v2 deep network and using it for the high-level feature extraction. Then, the obtained CNN model is trained and validated on a voluminous traffic video dataset. The vehicles whose bounding boxes are detected applying the trained CNN-based detector on the movie frames are then extracted using a level-set based active contour model. They are then recognized with another transfer learning network, created by modifying a GoogLeNet classification model and trained on a large vehicle dataset. Next, the detected and classified vehicles are tracked within traffic video applying a matching process using an intersection over union (IoU)–based metric and some conditions.

[0322] *A Deep Learning-Powered Web Service for Optimal Restaurant Recommendations Based on Customers Food Preferences*

Gehad Alkady (German International University (GIU)).

Abstract

The surge in food images on social media demands the advancement of effective classification algorithms for applications like restaurants recommendations, personalized health management, nutrition analysis, and dietary monitoring. Recently, food classification has witnessed substantial progress through Deep Learning driven by the availability of large-scale food datasets and enhancements in Deep Learning models. In this paper, a web service designed to assist users in identifying the optimal restaurant for their desired dish based on quality, price, and location parameters utilizing a Deep Learning (DL) engine for food image classification. The research focuses on evaluating the efficiency of several DL algorithms, namely You Only Look Once (YOLO) V8, YOLO V5, ResNet 50, ResNet 18, Inception V3, VGG 16 and MobileNet, utilizing a Jetson Nano board for training purposes (100 epochs). Food 101 dataset used in the training process while LabelImg tool is employed for annotation. The annotated version of the dataset used for training of YOLO V8 and YOLO V5. The findings reveal YOLO V8 attains a notable accuracy of 96.3%, surpassing YOLO V5, ResNet 50, ResNet 18, Inception V3, VGG 16 and MobileNet, which achieve 89.7%, 89.35%, 67.23%, 76.01%, 78%, and 57.90% accuracy, respectively. Consequently, the research advocates for the adoption of YOLO V8 as the optimal DL algorithm for the proposed web service. Future enhancements will include the integration of textual data as a feature to enhance the efficiency of the detection process. The web service will be deployed on Amazon Web Services (AWS) which opening up possibilities for expansion through the development of a mobile application accessible on platforms such as the App Store or Google Play.

[0339] *Development of a Laboratory Testbed for Cybersecurity Evaluation of Distribution Substations Using Open Source Tools*

George-Calin Seritan (Universitatea Nationala de Stiinta si Tehnologie Politehnica Bucuresti), Bogdan-Adrian Enache (Universitatea Nationala de Stiinta si Tehnologie Politehnica Bucuresti), Radu Porumb (Universitatea Nationala de Stiinta si Tehnologie Politehnica Bucuresti), Daniel Balaci (Transelectrica SA), Irina Clima (Electrica SA) and Cristinel-Bogdan Barbulescu (Electrica SA).

Abstract

This paper details the development of a laboratory testbed for cybersecurity testing of distribution substations, focusing on the GOOSE communication protocol specified by IEC 61850. The testbed uses open source tools to replicate the operational conditions of a real substation, employing Intelli- gent Electronic Devices (IEDs) with a Technology Readiness Level (TRL) of 7. This ensures high fidelity to real-world applications while maintaining a safe, isolated environment. The increasing digitization and automation of substations in- troduce new cybersecurity vulnerabilities that could disrupt power distribution, highlighting the need for robust security measures. The developed testbed provides a crucial platform for testing and improving cybersecurity defenses to protect critical infrastructure from evolving threats.

[0559] *SCAWA: Enabling Smart Card Authentication for Web Applications*

Bianca-Daniela Ionașcu (Military Technical Academy "Ferdinand I") and Iulian Aciobanitei (Military Technical Academy "Ferdinand I").

Abstract

In the evolving landscape of digital security, the integration of robust Multi-Factor Authentication (MFA) methods stands as a critical defense mechanism against unauthorized access, augmenting traditional username+password approach. In this paper, we present SCAWA, a publicly available implementation for

smart-card authentication in the context of web applications. Our proposal is based on NexU Github project implemented by Nowina Solutions, and adapted it to fit our needs. For developer convenience, we integrated our implementation into Keycloack, a popular open-source Identity-Management platform. In the paper we present solution's architecture, implementation details and achieved results. Using SCAWA, developers can seamlessly integrate smart-card logon for their web applications, by only implementing an usual OAuth 2.0 flow. Through this contribution, we aim to lower the entry barrier for implementing sophisticated and secure authentication and authorization methods. Thereby, the result of our work aims to be fostering a more secure digital environment and enabling a higher adoption rate for secure authentication methods.

[0701] *Insights into Risk Management: Leveraging Digital Twins for Ophthalmic Diagnosis*

Miruna-Elena Iliuță (University Politehnica Bucharest), Mihnea-Alexandru Moisescu (University Politehnica Bucharest), Eugen Pop (University Politehnica Bucharest) and Traian-Costin Mitulescu (Universitatea de Medicină și Farmacie CAROL DAVILA București).

Abstract

The use of Digital Twin in ophthalmology, especially in the process of identifying glaucoma and providing personalized treatment scenarios, emphasizes ensuring the integrity and confidentiality of medical data. Thus, achieving an efficient approach to risk management becomes a priority for stakeholders. Identifying, evaluating, selecting, and adopting an appropriate risk response strategy, as well as monitoring at each layer of the Digital Twin architecture, contribute to improving the quality of medical services and protecting patient data confidentiality. Ensuring reliability and security in the implementation and use of the Digital Twin in ophthalmology facilitates both the early identification of pathologies and the establishment of efficient communication between the doctor and the patient.

[0757] *Assessing Cybersecurity Awareness among The Hashemite University Students In Terms Of Computer Usage*

Ashraf Aljammal (The Hashemite University), Ahmad Qawasmeh (The Hashemite University), Salah Taamneh (The Hashemite University), Fadi Wedyan (Lewis University), Mamoon Obiedat (The Hashemite University) and Hani Bani Salameh (The Hashemite University).

Abstract

Internet usage among information technology users has expanded substantially, as have cybercrimes with potentially disastrous repercussions. Therefore, internet users have to employ the available security measures and policies during internet usage. Nowadays, University students make up a sizable portion of internet users. This study assesses the cybersecurity awareness among The Hashemite University students In terms of Computer Usage. A questionnaire survey is used to assess students' cybersecurity knowledge while using their PCs and connecting to the internet, concentrating on their behaviors and use of security measures.

[0834] *Employing the simulation platforms Flux 2D and FEMM4.2 to numerically optimize the eddy current phenomenon during the edge-hardening process*

Marius Codrean (University of Oradea), Mihaela Cornelia Novac (University of Oradea), Mihaela Codrean Mihaela Codrean (University of Oradea), Ovidiu-Constantin Novac (University of Oradea), Cornelia Emilia Gordan (University of Oradea) and Radu Sebesan (University of Oradea).

Abstract

This paper aims to develop advanced numerical methods for an in-depth examination of edge hardening process, using eddy current heating. We present a distinct procedure for heat treatment, in our attempt to achieve a particular thermal profile, defined by a higher level of heating in the tip area of the workpiece, compared to the remainder of the piece surface. In order to ensure the necessary mechanical strength, this targeted method applies selective hardening to the tip area, while maintaining the elasticity of rest of the part, so as to ensure the required mechanical strength. The fundamental objective of the work is to present advanced models for optimizing the inductor input parameters in order to achieve a differentiated and efficient heating of the workpiece tip. The precise control of the hardening process and the enhanced mechanical performance of the workpiece are two major implications of this approach.

[0890] *TIACE: A Transformer-Inspired Attentional CNN Encoder for Enhanced ECG Classification with Signal Processing*

Aryaman Rao (Delhi Technological University), Ishaan Sachar (Delhi Technological University), Vaibhav Sharma (Delhi Technological University), Ram Bhagat (Delhi Technological University) and Dinesh Kumar Vishwakarma (Delhi Technological University).

Abstract

The role of Artificial Intelligence in the healthcare industry continues to expand, with significant potential for Electrocardiography (ECG) analysis and Arrhythmia detection. Despite many quality researches on ECG classification, there has been a lack of correlation between local and global feature segments extracted from ECG signals. Moreover, there has not been many user-friendly interface, which hinders accessibility for general public. To address this challenge, we have proposed a new approach called TIACE, an acronym for Transformer-Inspired Attentional Convolutional Encoder. Our method leverages a transformer-inspired combination of 1D Convolutional Neural Networks (CNNs) and Multi-head Attention networks for enhanced ECG classification. TIACE ensures that spatial features from CNN layers and informative features from Attention layers, are combined and preserved for classification. Furthermore, we have integrated signal processing techniques to ensure quality and filtered signal for the model. Additionally, We have deployed TIACE on the Cloud using Docker containers, ensuring accessibility for remote healthcare monitoring and rapid diagnoses, a significant advancement towards real-world integration. Our method, TIACE, achieved an accuracy of 98.72% with an F1 score of 99.16% outperforming all established state-of-the-art algorithms evaluated across multiple performance metrics

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[0969] *Danube Delta Bird Sound Recognition*

Svetlana Segărceanu (R&D Department, BEIA Consult International), Maria Niculae (R&D Department, BEIA Consult International) and Theodor Pintilie (R&D Department, BEIA Consult International).

Abstract

Bird populations have recorded important changes in number and distribution since the 1970s, due mainly to land management policy and climate changes. So, bird populations monitoring and scientific research became important for environmental preservation. Automatic bird sound recognition starts receiving more attention since the mid-nineties due to technological advances and the importance of the discipline, as many bird species are often better detectable by their sounds than by vision. The underlying methodology takes advantage of similarities with speaker recognition and has evolved on the tracks of speech-based technologies. With the With the evolution of the deep learning systems, many attempts using these methods were made. The Danube Delta and its close geographical areas are home to 327 bird species and have received over time national and international recognition regarding nature protection. The paper presents the research in the field of bird sound recognition applied to some bird species specific to the Danube Delta. We have tested several settings for the Gaussian Mixture Modelling, Convolutional Neural Networks and Feed Forward Neural Networks. The experiments consider five to fifteen bird sound classes.

[1005] *IMPLEMENTATION OF DATA WAREHOUSE WITH SNOWFLAKE SCHEMA IN ELECTRIC VEHICLES REALM*

Yaqoob Al-Zuhairi (Al-Iraqia University), Ammar A. Al-Hamadani (Al-Iraqia University) and Talib M. J. Abbas (Ashur University).

Abstract

As electric vehicles (EVs) produce less pollution compared to conventional fuel-powered vehicles, governments seek to improve the use of EVs as urban transportation service to protect the environmental and economic sustainability. Therefore, it is necessary to have an optimal and sufficient charging infrastructure in order to enable the transition to EVs at a rapid pace and their widespread adoption. This will assist in providing great driving experience so that drivers are able to recharge their EVs comfortably and quickly, maximizing the return on investment and minimizing the impact on the network. Actually, this case requires the skilful application of sophisticated tools and technologies to optimize EV charging infrastructure sites. In this sense, the goal of this paper is to propose a data warehouse system in the field of electric vehicles to integrate, analyze, and utilize data from various sources to assist policymakers and administrators who benefit from analysis results in making efficient decisions for forward planning and strategies which assist in optimizing charging infrastructure, providing best services for drivers, and improving the overall efficiency and effectiveness of electric vehicle operations and development.Data warehouse (Snowflake schema), Electric vehicle, Charging station

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[1093] *Biogenic Synthesis of Zinc Oxide*

Elena Andreea Onache (University Politehnica of Bucharest) and Adriana-Gabriela Schiopu (University Politehnica Bucharest).

Abstract

Current research is focused on obtaining zinc oxide nanoparticles through environmentally friendly syntheses. The interest in developing zinc oxide is due to its applicability in electronics, optoelectronics, medicine, cosmetics, food industry, etc. Along with the increase in applicability, the need to synthesize ZnO in environmentally friendly conditions also increases. In this work, the biogenic synthesis of zinc oxide consisted of elaboration of zinc oxide by using ovoalbumin and zinc nitrate as precursors. The optimal reaction conditions are room temperature, basic pH, time and 1200Cfor degradation of ovoalbumin. Samples were analyzed by ATR-FTIR to determine when ZnO formed and completely eliminated the protein. This synthesis proves to be an easy method to obtain zinc oxide starting from natural resources.

[1115] *Efficient Water Quality Monitoring Using Unmanned Aerial Vehicles and Internet of Thing Technologies*

Pham Duc Dai (Thuyloi University), Dang Minh Quang (Nguyen Hue High School for gifted students), Nguyen Minh Hoang Giang (Nguyen Tat Thanh High School) and Le Hoa Hieu (HUS high school for gifted students).

Abstract

Climate change, human activities, and manufacturing have significantly impacted water quality. Consequently, water quality is increasingly threatened, leading to pollution in many lakes that renders them unsuitable for drinking water treatment or agricultural activities. The need for emergent and frequent monitoring of water quality is vital. Traditional methods of water quality monitoring typically involve sampling water and analyzing it in laboratories. While this approach guarantees the accuracy of water parameter assessment, it is time-consuming and incapable of capturing real-time changes in water quality. Moreover, in certain hazardous areas (e.g., toxic lakes), accessing water samples can pose risks to human safety. This paper proposes an efficient solution for water quality monitoring using unmanned aerial

vehicles (UAVs), enabling real-time and spatial water quality monitoring. The UAV is equipped with a commercial controller, IoT system, and water quality mapping tool to provide an efficient method for water quality monitoring and management.

[1147] *Managing the Challenges and Opportunities of Leadership for Organizational Success in the Age of Artificial Intelligence*

Thaya Madhavi (Mohan Babu University, Tirupati -517102, Andhra Pradesh (State), India) and Divya Bhatt (Vivekananda Global University, Jaipur, Rajashtan (State), India).

Abstract

The economy is currently experiencing a substantial and uncertain transformation propelled by recent advancements in artificial intelligence. Companies that embrace calculated risks and proactively position themselves ahead of the curve will be the ones poised to capitalize on the substantial growth and value-creation opportunities that artificial intelligence offers across nearly every industry. To achieve this, leaders must acknowledge AI's extensive potential as the all-encompassing technology of the twenty-first century. The purpose of this study is to comprehend how artificial intelligence is currently being used in leadership-related areas like hiring, training, and career development. This paper examines the advantages and disadvantages of both using and not using AI in leadership. The transformation of leadership brought about by AI is highlighted in this paper.

[1326] *Employing Comparative Study Between Frontend Frameworks. React Vs Ember Vs Svelte*

Ovidiu-Constantin Novac (University of Oradea), Mihaela Cornelia Novac (University of Oradea), Mihai Oproescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Adrian-Cristian Mlinarcic (University of Oradea), Cornelia Emilia Gordan (University of Oradea) and Camelia Maria Dindelegan (University of Oradea).

Abstract

This paper presents a comparative study of three frontend frameworks: React, Svelte and Ember. The article presents which are the differences and similarities between frameworks, how things are handled in a framework in parallel to another, and why one is more popular and used than another. This study will have as a point of reference for comparison a ToDo application written in all three languages.

[1343] *Noise-aware Atrial Fibrillation Detection for Resource-constrained Wearable Devices*

Nabasmita Phukan (Indian Institute of Technology Indore, India), M. Sabarimalai Manikandan (Indian Institute of Technology Palakkad, India) and Ram Bilas Pachori (Indian Institute of Technology Indore, India).

Abstract

Atrial fibrillation (AF) is characterized by RR intervals of unequal lengths, fibrillatory waves, and absent P-wave. AF raises the risk of ischemic stroke. So, early diagnosis is essential for detection of AF. Due to the intermittent nature of AF, early diagnosis is achieved through continuous electrocardiogram (ECG) monitoring. This research work presents a lightweight, single-stage, noise-aware AF detection method which is implemented on computing platform with limited resources of memory space and battery. With the five databases, the 5-layer convolutional neural network (CNN) with optimal hyperparameters (kernel size: 4×1, number of kernels: 8, 16, 32, 64, and 128, loss function: sparse categorical cross entropy, and optimizer: adaptive moment estimation), the single-stage, noise-aware AF detection method demonstrated an accuracy, sensitivity, and specificity of 99.89%, 99.95%, and 99.81%, respectively with model size 3.15 MB and latency of 0.30 ms for ECG segment of 5 s duration. The CNN model is deployed on Raspberry Pi 4B computing platform and detects AF with an accuracy and sensitivity of 99.67% and 99.62%,

respectively. The results obtained show feasibility for implementation of the method on wearable health monitoring devices for reduction in false alarm rates and increase in performance.

[1460] *A Brief Review of Industry 5.0: Key Technologies, Applications, and Future Perspectives*

Marius Constantin Marica (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Nicu Bizon (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Ionel Bostan (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre) and Madalin Ciprian Enescu (Political Sciences National School of Political and Administrative Studies, Bucharest, Romania).

Abstract

Industry 5.0 marks a new stage in industrial production, with a focus on close collaboration between people and smart machines. This paper presents the key technologies that define Industry 5.0, including artificial intelligence (AI), collaborative robotics, Internet of Things (IoT), Digital Twins, and advanced data analytics. At the same time, current applications of these technologies are examined, highlighting their impact on productivity and operational efficiency. The main challenges in implementing these technologies and proposed solutions to overcome them are also discussed. Finally, the paper provides an insight into emerging trends and future innovations that will shape Industry 5.0, highlighting the importance of continuous research and innovation to ensure a sustainable and efficient development of the industrial sector.

[1499] *Applications of Harris Hawks Optimization with Capacitor Shunt and Renewable Energy Source to Achieve Technical Benefits on Power Transmission Networks*

Murtadha Al-Kaabi (School building department, Rusafa 3, Ministry of Education), Ahmed Naeem Abdul Saheb (Department of Electrical Engineering, Urmia University, Urmia, Iran) and Daryoush Nazarpour (Department of Electrical Engineering, Urmia University, Urmia, Iran).

Abstract

This paper presents a new metaheuristics optimization algorithm inspired by one of the most intelligent birds, Harries Hawks, called Harris Hawks Optimization (HHO) for solving optimal power flow (OPF) problems to achieve technical benefits. Managing active and reactive power in transmission networks significantly influences their performance. To improve the performance of transmission networks, the mechanisms for determining the location of renewable energy source (RES) and capacitor shunt (CS) are most popular and important. The voltage stability index represents the indicator used to determine the optimal placement. The main goal to use this algorithm HHO is select optimal sizing of RES and CS. This paper has presented four scenarios: the initial case (only power flow calculation), optimal power flow using HHO, optimal power flow using HHO after installing CS, and optimal power flow using HHO after installing RES. In these scenarios, the three most popular objective functions (OFs) were proposed, which are the real power losses, voltage deviation, and voltage stability index of whole system. Integrating a local search scheme improves the search space's capability and enhances the exploration rate, facilitating the discovery of a global solution. IEEE 30-bus is the standard network that was applied. The numerical and simulation results demonstrate the performance of HHO in searching for global solutions and preventing local solutions. The optimal results of OFs obtained by HHO will be compared the optimal results obtained by other optimization techniques to confirm the superiority and efficiency of HHO.

[1589] *Cost Reduction of Integrated Renewable Energy Sources in Home Energy Management Systems (HEMS) using Particle Swarm Optimization*

Navid Delfekar Baghbani (Istanbul Technical University), Hooshang Zeynali (Halic University) and Arif Karabuga (Halic University).

Abstract

The purpose of this study is to optimize the 24-hour scheduling of various household appliances (schedulable appliances, entertainment appliances, and constrained appliances) to minimize the total cost of energy consumption. This approach is achieved by calculating and leveraging the lower cost of photovoltaic (PV) power supply during the day and minimizing reliance on grid power which is more expensive than PV power supply. Particle Swarm Optimization is used in this study which is inspired by the social behavior of swarm animals such as ants, bees and birds flocking. The optimization determines the optimal on/off schedule for each appliance, ensuring cost efficiency while considering the availability of renewable energy which is PV source in this case. It is different from conventional and traditional optimization methods such as gradient descent or linear programming and the comparison results are represented here.

[1653] *A Cost-Effective Corona-Virus Search Optimization Based Approach to Joint Expansion Planning of Distribution Networks with Heavy-Duty Electric Truck Dedicated Urban Charging Stations*

Hossein Shayeghi (University of Mohaghegh Ardabili), Peyman Zare (University of Mohaghegh Ardabili), Iraj Faraji Davoudkhani (University of Mohaghegh Ardabili), Nicu Bizon (The National University of Science and Technology Politehnica Bucharest, Pitești University Centre), Adam Figiel (Department of Food Chemistry and Biocatalysis, Wrocław University of Environmental and Life Sciences) and Antoni Szumny (Department of Food Chemistry and Biocatalysis, Wrocław University of Environmental and Life Sciences).

Abstract

The increasing demand for operational efficiency and redundancy in electric distribution networks necessitates continuous advancements in power distribution network expansion planning methodologies. Traditional approaches are no longer sufficient due to the integration of distributed generation resources, capacitor banks, and the proliferation of heavy-duty electric trucks. This paper presents a novel approach that integrates dedicated heavy-duty electric truck urban charging stations into modern electric distribution networks. The proposed framework employs joint expansion planning for both electric distribution networks and dedicated heavy-duty electric truck urban charging stations, encompassing constructed elements such as substation construction, circuit reinforcement, distributed generation allocation, and capacitor bank installation. To address computational complexities, the study leverages a novel meta-heuristic algorithm called corona-virus search optimization, inspired by the dynamics of the COVID-19 virus. The model's efficiency and scalability are demonstrated through evaluations using an 18-bus and a 54-bus system. The analysis reveals that depot charging of HDETs presents a more challenging scenario with higher costs. However, integrating dedicated heavy-duty electric truck urban charging stations in Scenario II leads to significant cost reductions (4.34% and 7.56% for two systems). The model's adaptability make it a valuable solution for integrating modern multi-energy electric distribution networks with dedicated charging urban infrastructure.

[1681] *An Algorithm for Automatic Analysis of the Etymology of Romanian Words*

Speranta Cecilia Bolea (Institute of Computer Science, Romanian Academy, Iasi Branch).

Abstract

The paper presents a computational method and the related software tool to determine the etymology of words (lemmas), as well as examples of results obtained for several Romanian literary texts. The problem

of etymologic analysis is almost lacking in the AI literature; hence the relevance of this paper. The results can be used in research in linguistics and computational linguistics.

[1704] *Advanced Predictive Control for Wind Turbines: Using Doubly Fed Induction Generators (DFIGs) to Improve Performance*

Farah Echiheb (LIMAS Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohammed Ben Abdellah University, Fez 30003, Morocco), Badre Bossoufi (USMBA - Fez), Ismail El Kafazi (Laboratory SMARTILAB, Moroccan School Engineering Sciences, EMSI Rabat, Morocco) and Ibrahim El Bhiri (Laboratory SMARTILAB, Moroccan School Engineering Sciences, EMSI Rabat, Morocco).

Abstract

The control of wind power is crucial for the efficient and sustainable utilization of this renewable energy source. Doubly Fed Induction Generators (DFIGs) are commonly used to harness wind energy efficiently while maintaining grid stability. Predictive control strategies have become increasingly important to improve the performance of these systems. In this context, this paper contributes to the application of deadbeat predictive control to a DFIG-based wind system. First, a comprehensive mathematical model incorporating the DFIG is presented, followed by a detailed explanation and application of the deadbeat predictive control principle to both rotor and grid side converters. The whole system is then simulated using MATLAB/Simulink software and the results are discussed. The control algorithm anticipates the future behavior of the system and adjusts the control inputs to achieve the desired performance in terms of tracking and response speed during dynamic operation. This approach has significant potential to improve the performance and reliability of DFIG wind turbines.

[1729] *Cryptography and Computational Approaches in Ensuring Data Integrity for Digital Forensic Evidence*

Renu Mahajan (Chandigarh University) and Kanika Pandit (Chandigarh University).

Abstract

The Digital evidence is derived from diverse sources like computers and their volatile and non-volatile storage, portable digital devices, network traffic, social networks, records and logs from internet service providers, websites, databases, and information systems on both global and local levels. This study focuses on assessing the effectiveness and appropriateness of different security approaches in safeguarding the integrity of digital evidence. The evaluation results in a series of suggestions that should be taken into account when choosing the appropriate algorithm to ensure the integrity of digital evidence in a broad sense. This research examines the cryptographic methods for safeguarding privacy in digital forensics and their classification them based on their support for trustworthy third parties, numerous investigators, and multi-keyword searches have been done. The Author outlines the limitations of using cryptography-based techniques in safeguarding privacy of digital forensics and propose possible remedies for these deficiencies.

[1762] *Construct a Fuzzy Rule Table with the Direct Torque Control Principle*

Nguyen Hoang Viet (ThuyLoi University).

Abstract

Direct torque control (DTC) is one of the popular induction motor control structures in industry. This control structure is simple, flexible and high performance. However, large torque ripple and poor performance in low speed regions are disadvantages of this structure. Therefore, overcoming these disadvantages of the DTC structure is always an issue of concern in the field of motor control. In order to address the drawbacks of the conventional DTC structure, this paper investigates the DTC structure employing a fuzzy controller

(FDTC). The fuzzy controller in this structure will replace the stator flux controller, torque controller, and switching table in the classic DTC structure. The paper proposes fuzzy rules are built based on the principle of direct torque control and are derived from the DTC table in 12 sectors. This ensures the stability and robustness of the FDTC control structure. Simulation results on Matlab/Simulink show that the fuzzy rules suggested in this paper, when combined with the FDTC structure, perform exceptionally well and the torque ripple and stator flux ripple are significantly reduced compared to the traditional DTC structure.

[1867] *Robust Electric Motor Fault Classification with Extra Trees Classifier on Comprehensive Dataset*

Syed Safdar Hussain (National University of Sciences and Technology, NUST Islamabad, Pakistan) and Syed Sajjad Haider Zaidi (National University of Sciences and Technology, NUST Islamabad, Pakistan).

Abstract

This paper presents a comparative study on the efficacy of machine learning algorithms in enhancing fault diagnosis in electric motors. Through detailed experimentation and analysis, our research highlights the superior performance of the Extra Trees Classifier in accurately classifying various motor faults. With an impressive accuracy rate of 84%, the Extra Trees Classifier emerges as the top performer among the algorithms tested. Additionally, the Random Forest Classifier demonstrates considerable effectiveness with an accuracy of 82%. These findings underscore the potential of machine learning techniques to significantly improve fault diagnosis and prognostication in industrial machinery. Notably, the analysis showcases the successful classification of diverse fault types, including Normal, Horizontal Misalignment, Imbalance, and various other fault conditions. Moreover, our study emphasizes the importance of ongoing research and development efforts to further refine these algorithms and address any remaining challenges in fault diagnosis within motor systems.

[1910] *Predicting Detection Range of Maritime Sensors: a Meteorological Data-Driven Approach*

Alexandru Pohontu (Politechnica University of Bucharest), Andra-Teodora Nedelcu (Romanian Naval Academy "Mircea cel Batran" Constanta, Romania), Nicolae-Silviu Popa (Politechnica University of Bucharest) and Constantin Vertan (Politehnica University of Bucharest).

Abstract

Modern maritime surveillance systems integrate various RF sensors to construct regional awareness pictures. Such sensors include the Automatic Identification System, coastal and over-the-horizon radars, or passive signal analysis systems. However, these technologies exhibit inherent limitations due to variable propagation conditions. This paper introduces a novel data-driven approach that combines both meteorological and AIS detection range datasets. Standard and recurrent neural networks were implemented to predict detection ranges for AIS maritime receivers. By leveraging 72 hours of data, the models forecast the AIS discovery performance for the subsequent 24 hours with an accuracy of almost 89%. The proposed methodology offers benefits such as detecting AIS spoofing, jamming, and hidden activities, thus enabling efficient resource allocation and optimizing data acquisition strategies. This research establishes an innovative AI-driven analysis for predicting maritime sensor detection ranges, contributing to enhanced maritime security and operational effectiveness.

[1929] *Kinematics Skill Modeling of Cardiac Catheterization via Deep Learning Method*

Seyedfarzad Famouri (Mechanical Eng. Department Concordia University Montreal, Canada), Pedram Fekri (Mechanical Eng. Department Concordia University Montreal, Canada) and Javad Dargahi (Mechanical Eng. Department Concordia University Montreal, Canada).

Abstract

According to advances in robotic surgery, the importance of data-driven techniques that incorporate deep learning methods is expanding quickly, with a focus on objective surgical skill evaluation. Unlike traditional evaluation where surgeons' skills are evaluated in the real surgery room, capturing users' motion kinematics can be used as input for an AI model to assess their skills. For this study, a simulated mechanical setup has been provided for the trainees, focusing on cardiac catheterization procedures. This setup allows users to engage in hands-on practice while simultaneously capturing their hand movements for further evaluation. Trainees have the opportunity to engage in extensive practice on a mechanical setup as a pre-operation procedure, enabling them to develop a deeper familiarity and understanding. The task is to pass the tip of a commercial catheter through curves and level intersections on a plastic transparent blood vessel phantom. The objective is to guide the catheter's tip from the vessel entry point to the designated ablation target. By conducting various experiments involving both novices and experts, a deep recurrent neural network was employed to extract a skill model by solving a binary classification task. The trained model demonstrated a remarkable 92.3% accuracy in effectively discerning between the maneuvers performed by novices and experts, indicating the successful implementation of the proposed methodology.

[1941] *Automation solution of an electric furnace for personalized thermal treatments*

Stelian Ilie (Mira Technologies Group), George Iulian Marin (National University of Science and Technology POLITEHNICA Bucharest), Vasile-Gabriel Iana (National University of Science and Technology POLITEHNICA Bucharest), Mihai Oproescu (National University of Science and Technology POLITEHNICA Bucharest), Ioan Lita (National University of Science and Technology POLITEHNICA Bucharest) and Adriana-Gabriela Schiopu (National University of Science and Technology POLITEHNICA Bucharest).

Abstract

There are a variety types of heat treatment furnaces available, each with its own advantages and disadvantages. Choosing the right type of furnace, depends on a number of factors, such as: the type of material to be treated, the temperature and the duration of the heat treatment required. In this paper, a laboratory solution for automation an electric heat treatment furnace is presented. The proposed solution offers the possibility to configure operating parameters: temperature and time. The novelty of the proposed solution is represented by the possibility of implementing (with minimal costs and structural changes) a digital control on any type of electric heat treatment furnace. By using two temperature sensors, we want to obtain a better temperature monitoring, eliminating the effects caused by the malfunction of one of the sensors. At the same time, the digital temperature control, with a resolution of 0.25ºC, results in an electricity saving compared to the classic bimetal sensor control.

[2009] *Fractional-order third-order sliding mode control to improve the characteristics of multi-rotor wind power systems*

Sara Kadi (Power equipments Characterization and Diagnosis Laboratory (USTHB) Algiers, Algeria), Habib Benbouhenni (Department of Electrical & Electronics Engineering, Nisantasi University, 34481742 Istanbul, Turkey) and Nicu Bizon (Faculty of Electronics Communication and Computers, University POLITEHNICA Bucharest, 110040 Pitesti, Romania.).

Abstract

The energy system that relies on wind turbines contains many disadvantages, the most prominent of which are energy ripples and the quality of the current. The latter is used to produce a doubly-powerd induction generator (DPIG). To overcome these problems, it is proposed in this work to use fractional-order third order sliding mode control as a suitable solution due to its durability and outstanding performance. Ease of implementation and simplicity are the most prominent features of this proposed control. In this proposed strategy, internal loops are not used, as the power estimation is used to calculate the power error. The

Matlab software has been used to validate the designed control for multi-rotor wind power (MRWP) systems. The performance of the proposed control is compared with traditional power control of the 1.5 MW DPIG under the reference tracking and variation of parameters. The fractional-order third-order sliding mode control compared with the traditional power control and the numerical and graphical results show the superior robustness of the fractional-order third-order sliding mode control.

[2072] *Genetic Algorithm Approach for Smart Industrial Multi-Objective Production Planning*

António Mestre (Muvu Technologies), Dinis Faustino (Muvu Technologies), Bruno Silva (Muvu Technologies) and Jorge Cruz (NOVA School of Science and Technology).

Abstract

The fourth industrial revolution has ushered in a transformative era for the industrial sector, marked by the integration of advanced technologies that increase production efficiency and quality. Among these innovations is Smart Scheduling, which aims to optimize production processes while minimizing costs and meeting manufacturing requirements. This article explores the development and application of a Hybrid Genetic Algorithm, optimized by Tabu Search, to meet the complex challenge of multi-objective industrial production planning. The proposed framework introduces a Genetic Algorithm designed for intelligent, multi-objective industrial production planning, demonstrating its effectiveness in generating high-quality planning. It significantly reduces production times while maintaining quality and business needs, as validated in a real-world case study. The algorithm improves on traditional planning methods by dynamically adapting to manufacturing priorities. It also describes potential future adaptations to a wider range of industrial contexts and sectors. This research highlights the fundamental role of genetic algorithms in advancing smart manufacturing, offering a scalable and adaptable solution to the challenges of Industry 4.0.

[2105] *Trading with Deep Reinforcement Learning Agents: A Case of Gold, GBPUSD and EURUSD*

Daniel Ruiru (Strathmore University).

Abstract

Trading in the financial markets is driven by both fundamental and technical analysis. These methods have however been shown to have limitations owing to the inefficiency of the markets attributed to human behavior and psychology. Algorithm led methods have been highlighted as a suitable alternative which for years has banked on simple heuristics and rules. Deep Reinforcement Learning presents the next frontier in these automated methods owing to its ability to develop agents that can master any given environment like financial markets. In this paper, these agents are tested by trading three financial instruments. While developing these agents, simple prediction models are first implemented using a variety of deep learning algorithms. Sequence to sequence models outperform all other algorithms in the prediction of the three instruments. As for the agents, their performance is not consistent across the three instruments but Gold is traded with better results that is, better profit and loss measures. In the end, the paper recommends the use of better trade management heuristics to determine quality of trades taken and the refinement of the action space to incorporate risk management strategies.

[2128] *An application about server communication: Using the Command pattern on Web API requests*

Daniel Damyanov (Department of Information Technologies, University of Veliko Tarnovo) and Zlatko Varbanov (Department of Information Technologies, University of Veliko Tarnovo).

Abstract

In modern applications, performing a large number of activities and exchange of information, the architectural approach of microservices is increasingly required. If we make a more detailed analysis of them, they are nothing more than standalone applications that are synchronized in their communication between them, they are interchangeable in certain situations, and they are also divided by functionality. In addition to microservices, the so-called monolithic applications also work with the reception and processing of requests, which architecturally translates into an even greater concentration of functionality in one place and this leads to difficulties in their maintenance. In modern microservice architectures, different methods of communication are often used: microservices often communicate via HTTP with RESTful API design. URLs are used to detect and access microservices. Message Brokers: the use of communications brokers such as RabbitMQ or Apache Kafka provides an effective way of asynchronous communication. Whether we are talking about monolithic or microservice applications, it always comes the moment with the growing code, complex service structure and maintenance. In the current development, we focus on the implementation of a new service in a microservice architecture. The goal of the development is to create an application architecture using design patterns and optimization solutions that lead to fast and efficient operations of the business layer, which remains stable in its performance even with a large amount of data to process.

[2140] *Detection of Vehicles and Travelers in Public Transport System Using Bluetooth and Wi-Fi*

Marius Minea (Telematics and Electronics for Transport Dept., National University of Science and Technology Politehnica Bucharest), Bogdan George Popescu (Telematics and Electronics for Transport Dept., National University of Science and Technology Politehnica Bucharest), Roberto-Mario Borș (Telematics and Electronics for Transport Dept., National University of Science and Technology Politehnica Bucharest), Andreea-Alexandra Țicu (Telematics and Electronics for Transport Dept., National University of Science and Technology Politehnica Bucharest) and Paul-Dan Stoichici (Telematics and Electronics for Transport Dept., National University of Science and Technology Politehnica Bucharest).

Abstract

This paper is aimed on research regarding the assessment of Bluetooth and Wi-Fi technologies for detecting travelers in public transport systems and vehicles. The use of these technologies is much more environmentally friendly and less expensive than the conventional solutions. The study has focused on the usability of these two technologies, considering accuracy of detection, range, and electromagnetic compatibility. Results of conducted field experiments are presented, along with possible future developments.

[2168] *Security Analysis and Architecture of a Blazor-Based Web Application*

Radu-Adrian Calomfirescu (Universitatea Tehnica din Cluj-Napoca), Cristian Dan (Universitatea Tehnica din Cluj-Napoca), Florin-Cosmin Iacobut (Universitatea Tehnica din Cluj-Napoca), Bogdan Gabriel Drăghici (Universitatea Tehnica din Cluj-Napoca) and Ovidiu Petru Stan (Technical University of ClujNapoca, Department of Automation).

Abstract

As technology advances, the ingenuity of security attacks and vulnerability exploits increases. These attacks target mainly web applications and strive to access and obtain user information for malicious use. A secure user login and registration interface was used to protect these data. This paper presents the architecture and security analysis of a web application developed using Blazor, AuthAPI, and RabbitMQ middleware. The application employs Blazor for the front end, AuthAPI for user authentication, and a Fake API to demonstrate secure message processing with RabbitMQ. A comprehensive security evaluation was conducted using SQLMap, Snyk, and OWASP ZAP to identify and mitigate potential vulnerabilities. The findings confirm the robustness of the implemented security measures and suggest areas for further enhancement.

[2274] ***Equivalent electrical circuit design of a magnetorheological rotary brake***

Grazia Lo Sciuto (Department of Mechatronics Silesian University of Technology, Gliwice, Poland), Paweł Kowol (Department of Mechatronics Silesian University of Technology, Gliwice, Poland) and Giacomo Capizzi (Department of Electrical, Electronics and Informatics Engineering University of Catania, Catania, Italy).

Abstract

In this paper is proposed the equivalent electrical circuit that describes the input/output behavior of the designed and manufactured Magnetorheological Fluid rotary brake system. The input is represented by a current and the outputs are respectively the force and the magnetic field. The transfer function estimation was computed by means of orthonormal rational basis functions starting from the frequency response measurements carried out in laboratory during the testing and characterization of the designed prototype. Finally, the circuit synthesis was performed using the well-known method of Cauer.

[2298] ***Improving Breast Cancer detection with upsampling and resizing algorithms in image processing***

Atakan Göçer (Computer Engineering Department,Bursa Technical University) and Mustafa Özgür Cingiz (Computer Engineering Department,Bursa Technical University).

Abstract

Our study focuses on the detection of breast cancer using medical image analysis. The researchers explore the effectiveness of various oversampling methods in improving the performance of deep learning models for breast cancer detection. The dataset used in the study has a severe class imbalance with a disproportionate number of cancerous and non-cancerous examples. Six oversampling methods are evaluated in this study. Each oversampling method is applied to the dataset, and the augmented data is used to train deep learning models. The performance of each oversampling method is evaluated using metrics such as accuracy, precision, recall, and F1-score. The results demonstrate that oversampling methods significantly enhance the performance of deep learning models for breast cancer detection. SVM-SMOTE and ADASYN consistently outperform other methods, achieving the highest F1 scores on both ResNet-50 and AlexNet architectures. The findings also suggest that the choice of oversampling method has a substantial impact on model performance, emphasizing the importance of selecting an appropriate oversampling technique for imbalanced data. Overall, this study highlights the significance of addressing class imbalance in medical image analysis and provides valuable insights into the effectiveness of different oversampling methods in improving the performance of deep learning models for breast cancer detection.

[2310] ***Evaluating Email Traffic Patterns in Active MPLS Networks: A Comparative Analysis***

Cristian Stanescu (Valahia University of Targoviste), Predusca Gabriel (University Valahia of Targoviste), Liana Denisa Circiumarescu (Valahia University of Targoviste), Nicoleta Angelescu (Valahia University of Targoviste) and Dan Constantin Puchianu (Valahia University of Targoviste).

Abstract

After a network breakdown, modern networks offer partial data recovery. Multiprotocol Label Switching (MPLS) incorporates methods for quick troubleshooting and secure link management. This paper investigates a current issue affecting email traffic in MPLS networks using Active Label Switch Routers and quality of service guarantees. To underscore the effectiveness of active LSRs, we conducted a comparison between two types of networks: one with all LSRs active and the other with a mixed network configuration.

[2375] ***Access Control Based on Self-Sovereign Identity***

Stefania Loredana Nita ("Ferdinand I" Military Technical Academy), Marius Iulian Mihailescu (SPIRU HARET University), Valentina Marascu (National Institute for Laser, Plasma and Radiation Physics) and Marius Rogobete (Harman International Romania).

Abstract

In the rapidly growing interest in digital identity management, there is an important shift toward adopting verifiable credentials, often based on blockchain technology. This transition highlights a growing interest in the concept of Self-Sovereign Identity (SSI), a paradigm that empowers individuals with control over their own digital identities through the use of verifiable credentials. This paper introduces a novel access control framework that leverages the principles of Self-Sovereign Identity to significantly enhance the security of system access based on the users' credentials. By integrating the decentralized and user-centric nature of SSI, our proposed framework aims to address existing vulnerabilities in traditional access control systems. It provides a robust, scalable, and controlled mechanism that ensures higher levels of trust and security in digital interactions. This approach aligns with the broader digital identity trends favoring transparency, user autonomy, and trust.

[2433] *Mixed-Based Approach for an Intelligent e-Commerce Recommender System*

Shaidah Jusoh (School of Electrical Engineering and Artificial Intelligence) and Ger-Qin Ng (School of Computing and Data Science).

Abstract

Content-based recommender systems and collaborative filtering recommender systems might be useful in recommending items that might be preferred by users based on their preferences from the past, these systems rely on users' preferences, items' ratings, and items' descriptions. Thus, these systems might be less useful for items for which users' preferences and ratings cannot be easily collected. On the other hand, a constraint-based recommender system can suggest items that fulfil users' requirements (or constraints) by relying on users' requirements and knowledge about the domain of the items for giving a recommendation. In the case where, no item can be found, the system will proceed with the constraints of a relaxation phase to search for possible modifications in the constraints, give advice to the user, and enable them to edit their requirements to obtain more results. In this study, we propose a new approach called a mixed-based approach. The approach is based on an integration of soft and hard relaxation-based approaches. The proposed approach is implemented as a notebook recommender system. We conducted experiments on the proposed approach using collected data from e-commerce websites. The results also show that the proposed mixed-based approach is able to control constraints, and gives better performance in giving recommendations to users.

[2514] *About Controlling the Autonomous Car Movement on the Road*

Andrei-Marius Mazilu ("Gheorghe Asachi" Technical University of Iasi), Ion Bogdan ("Gheorghe Asachi" Technical University of Iasi) and Luminita Scripcariu ("Gheorghe Asachi" Technical University of Iasi).

Abstract

The autonomous movement of a car in a structured environment is possible based on a map, with the location of the vehicle by GPS and a destination specified by a user or by the vehicle management system [1]. LIDAR sensors are essential for autonomous vehicles to detect other vehicles or obstacles on the road. Controlling the movement of self-driving vehicles is an important aspect of the development of intelligent transportation systems (ITS), for people and goods safety [2], [3]. The estimation of distances is very similar to the perception of distances through binocular vision in humans and using artificial intelligence (AI) techniques can optimize it [4]. In this paper, we simulate controlling the movement of an autonomous

vehicle on a lane of the road using MATLAB program. We discuss the results for different time values when obstacles occurs in front of the vehicle.

[2536] *Design and Simulation of Data Acquisition system using Ethernet for Zynq 7000 SoC FPGA*

Prajwal Angadi (Visvesvaraya Technological University.), Satwika S (Visvesvaraya Technological University.), Shreya E (Visvesvaraya Technological University.) and Dr Jamuna S (Visvesvaraya Technological University.).

Abstract

Data Acquisition system using Ethernet for Zynq 7000 SoC FPGA, In autonomous vehicles, data transmission is essential for being reliable and for the efficient operation of the vehicle. In this project we are trying to implement the 10G Ethernet MAC for the data transmission. The Advanced Driver Assistance System (ADAS) in autonomous vehicles now uses CAN networks, which are not very reliable in today's faster environment. The Ethernet is much faster than the CAN. Therefore, Ethernet is the protocol we're employing to achieve this fast data transmission. Analog data is transformed into digital data and stored in FIFO in this data acquisition system. Ethernet is used to transfer the data that is stored for analysis and visualization. The simulation is the primary emphasis of this project. This simulation's output is organized according to the IEEE 802.3 Ethernet standard. This Ethernet output will be of use in ADAS system for increasing the rate of transmission and reliability.

[2591] *Smart Parking System Using IoT*

Hiba A. Abu-Alsaad (Mustansiriyah University) and Rana Riad K. Al-Taie (Mustansiriyah University).

Abstract

Sometimes parking practices lead to inefficiency and confusion, for example traffic congestion, drivers searching for vacant spaces, and insufficient revenue management for parking operators. Here the role of smart parking systems is highlighted in overcoming these challenges by providing live updates about the presence of unoccupied parking spots, improving the use of all parking spaces, and completing a convenient payment process. This paper introduces a parking system that incorporates cloud technology for seamless integration (Internet of Things IoT). Proposed system involves deploying an IoT module on-site to monitor and indicate the system offers up-to-date information on the presence of each parking space, and it also offers a mobile application for end users to conveniently check parking space availability and make reservations as needed. The paper also provides an overview of the system architecture at a high level. Furthermore, the paper includes a use that demonstrates the operational functionality of the model being proposed. This use case serves as evidence to validate the accuracy and effectiveness of the system. Overall, this research contributes to addressing issues like traffic congestion, restricted parking options, and roadway safety through the implementation of IoT technology in a parking system that is integrated with cloud technology. This system strives to improve the utilization of parking spaces and elevate the parking experience by providing real time data and convenient booking choices.

[2598] *Detection, Prevention, and Monitoring Techniques for Industrial Equipment – a brief review*

Ion-Stelian Gherghina (Politechnica University of Bucharest) and Nicu Bizon (Politechnica University of Bucharest).

Abstract

Within the modern industry, the analysis and critical evaluation of existing techniques for the detection, prevention, and monitoring of industrial equipment are essential aspects for improving performance and operational efficiency. This study investigates innovative methods designed to enhance the reliability and

accuracy of defect detection, with the main goal of optimizing maintenance programs and preventing failures within production processes. The analysis will focus on a diverse range of techniques, including methods based on signal acquisition and analysis, artificial intelligence, audio analyses, and image processing, as well as vibration analyses and other relevant techniques. Through comparison and critical evaluation of these techniques, this paper aims to provide a deep understanding of the advantages and limitations of each approach, as well as the context in which they are applicable in industrial practice. Through this study, a series of methods and technologies are pursued that contribute to the strengthening of knowledge in the field of monitoring industrial equipment and identifying future directions for research and development, aimed at the continuous improvement of performance and reliability.

[2673] *The Digital Platform – new opportunities and implementation strategy*

Petya Popova (Tsenov Academy of Economics), Popov Veselin (Tsenov Academy of Economics), Marinova Kremena (Tsenov Academy of Economics), Petrova Mariana (Tsenov Academy of Economics) and Krasimir Shishmanov (Tsenov Academy of Economics).

Abstract

In terms of the digital transformation of the business, the success of the organization largely depends on the integration and construction of a digital ecosystem and digital platform, which are key structures of the digital economy. The focus of the study is on the digital platform as the main technical tool for the formation of conditions for the creation of new products and services by participants in the ecosystem. The article aims to define the positive aspects of digital platforms and to provide recommendations and good practices for their integration into the activities of companies. The study also addresses some gaps in the scientific literature regarding the digital platform ecosystem. The main method of research is the systematic review of the scientific literature on the subject. By applying a structural approach and critical analysis of publications on the topic, conclusions and summaries are made about the potential of the ecosystem approach for business development, the new opportunities they receive from the use of digital platforms, and possible risks and threats that they face. An attempt has been made to identify key steps and tools for the successful implementation of the strategy for the integration of the digital platform, considering the requirements of the dynamic business environment. The research is directed to those companies that are planning a transition to an ecosystem model of development and construction or inclusion in a digital platform. The author's future research is related to the study of the potential of the second component of the digital ecosystem - the application programming interface.

[2686] *CNN based Heart Rate Classification Using ECG Signal Without R-peak Detection for Rhythm-Aware Health and Emotion Monitoring*

Jomole Varghese Vadakkan (Indian Institute of Technology Palakkad), M. Sabarimalai Manikandan (Indian Institute of Technology Palakkad) and Linga Reddy Cenkeramaddi (University of Agder).

Abstract

Heart rate (HR) is an important vital sign in health and wellness monitoring to identify various kinds of cardiac arrhythmias, such as sick sinus syndrome with slow heart rates (bradyarrhythmias) and atrial fibrillation with fast heart rates (tachyarrhythmias). Therefore, in this paper, we present a one-dimensional convolutional neural network (CNN) based heart rate classification (HRC) method using the electrocardiogram (ECG) waveform without R-peak detection with the major objective of development of heart rhythm-aware health and emotion monitoring systems. The proposed CNN-ECG-based HRC method consists of two major stages: preprocessing and CNN architecture for directly classifying the ECG signal into normal rate ECG, slow rate ECG, and fast rate ECG signal without the use of R-peak detection. The trained CNN model is obtained using the ECG signals (normal, slow, and fast heart rates) taken from the MIT-BIH arrhythmia database. On different kinds of untrained ECG signal databases, the CNN-based method achieves an overall accuracy of 89.18%, 92.74%, and 88.98% for Apnea-ECG (APNEA-ECG)

database, MIT-BIH polysomnographic (MIT-BIH SLP) database and MIT-BIH atrial fibrillation (MIT-BIH AFib) database, respectively. Evaluation results show that the deep ECG waveform-based HRC method achieved promising results for the ECG signals having similar ECG morphological patterns within 10 second ECG signals.

[2734] *Modified ResNet-50 for Training the Neural Network in Pothole Detection using Deep Learning in Matlab*

Marius-Emanuel Obreja (Technical University Gheorghe Asachi Iasi, Faculty of Electronics, Telecommunications and Information Technology) and Dan-Marius Dobrea (Technical University Gheorghe Asachi Iasi, Faculty of Electronics, Telecommunications and Information Technology).

Abstract

The detection of potholes in asphalt has been a concern in the field of deep learning to identify patterns with the best possible accuracy. In the smart city concept, autonomous cars are used more and more to take traffic images and transmit them to a specialized center, which processes and distributes the information to all drivers in real time. In this study, we modified the structure of the standard ResNet-50 model of a convolutional neural network (CNN) architecture used to train deep neural networks. Using a data set previously taken from the traffic with images categorized into 2 classes: with pits and without pits, to be used in training using the Matlab Deep Network Designer. Using different training epochs, we verified and synthesized the validation accuracy for different training epochs with the aim of identifying an improvement in performance compared to the classical residual neural network model with 50 deep layers processed in Matlab.

[2746] *Enhancing Driver Safety through A Data Collection Platform*

Mihaela Gavrila (Gheorghe Asachi Technical University Iași, România), Madalina-Giorgiana Murariu (Gheorghe Asachi Technical University Iași, România), Eduard Mihailescu (Gheorghe Asachi Technical University Iași, România), Daniela Tarniceriu (Gheorghe Asachi Technical University Iași, România) and Delia-Elena Barbuta (Gheorghe Asachi Technical University Iași, România).

Abstract

This paper introduces an innovative Data Collection Platform (DC Platform) developed to enhance driver safety by enabling effective aggregation detection data. Designed to interface with external data detection systems, the DC Platform provide advanced functionalities for efficient management and synchronization of data alongside geospatial information of monitored drivers. Based on the collected data the developed Platform enables the application of analytical tools to assess and predict risk patterns related to impaired parameters driving. Developed CD Platform was implemented through two different approaches: one hosted in a traditional host-based web server and the second one deployed in virtual environment in Docker containers. The platform's support for real-time data integration facilitates targeted and timely interventions, which may contribute to a reduction in the incidence of -related traffic accidents.

[2829] *Experiences in PCB manufacturing with ultra low-cost and home-made CNC machine*

Bernardo Yaser León Ávila (Transilvania University of Brașov), Carlos Alberto García Vázquez (Transilvania University of Brașov), Osmel Pérez Baluja (Transilvania University of Brașov), Daniel Tudor Cotfas (Transilvania University of Brașov), Luis Alberto Quintero Domínguez (University of Sancti Spiritus José Martí Pérez) and Petru Adrian Cotfas (Transilvania University of Brașov).

Abstract

In the domain of PCB (Printed Circuit Board) manufacturing, accessibility and affordability are pivotal, especially for individuals and institutions with very limited economical resources. The emergence of ultra-low-cost and homemade CNC (Computer Numerical Control) machines offers a promising solution to address these concerns. However, the abundance of online resources often presents purported solutions fraught with practical challenges. This paper delves into firsthand experiences in utilizing such technologies, navigating the delicate balance between cost-effectiveness and functionality in the prototyping process. By examining the inherent obstacles, it aims to offer valuable insights for those seeking to achieve PCB manufacturing goals with minimal resources.

[2885] *A Study of Intelligent Parking: Urban Efficiency Through Advanced Automated Systems Based ON Green Energy Management*

Alexandra-Valentina Chiliment (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Florina-Gabriela Tiron (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Andreea-Gabriela Voicu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Florentina Magda Enescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Sebastian-Alexandru Drăgușin (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Nicu Bizon (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre) and Maria-Simona Răboacă (National University of Science and Technology POLITEHNICA Bucharest,).

Abstract

Solving the problems related to the availability of parking spaces in urban areas requires a smart and sustainable approach. We propose the implementation of a smart system that provides real-time information about parking availability and optimizes traffic management. Our system is based on two main components: solar panels and IoT sensors. Solar panels will generate green energy to power various equipment in parking lots, thus helping to reduce costs and increase sustainability. IoT (Internet of Things) sensors will collect information about the occupancy of parking spaces and transmit this data to our online platform. The platform will provide drivers with information about parking spots through a website, making it easy to quickly find a parking space. In addition, our system is made with advanced traffic management algorithms, which will optimize the flow of vehicles in parking lots and reduce the waiting time of customers. By efficiently integrating solar panels and IoT sensors, we are proposing an innovative solution for efficient parking management in urban areas, helping to reduce traffic congestion and increase user experience.

[2891] *UWB Indoor Localization: Accuracy Evaluation in a Controlled Environment*

Tiberius-George Sorescu ("Gheorghe Asachi" Technical University, Iasi), Andreea-Valentina Militaru ("Gheorghe Asachi" Technical University, Iasi), Vlad-Mihai Chiriac ("Gheorghe Asachi" Technical University, Iasi), Ciprian-Romeo Comsa ("Gheorghe Asachi" Technical University, Iasi) and Iolanda-Elena Alecsandrescu ("Gheorghe Asachi" Technical University, Iasi).

Abstract

This paper presents a comprehensive study on the precision of Ultra-Wideband (UWB) technology for indoor positioning in controlled environments. In this study, we evaluate the positioning accuracy of Decawave DWM1001 sensors based on the IEEE 802.15.4 standard within two different spatial configurations: a 3x3 meter area and a 3x12 meter area. Our method involved deploying a network of four anchors and one tag in these two setups and conducting a series of empirical measurements to assess the technology's performance. Our findings demonstrate the high accuracy of UWB localiza- tion, particularly in smaller spaces. However, our experiments uncovered challenges in larger areas, where environmental factors play a significant role in influencing the accuracy and reliability of positioning measurements, compared to the high accuracy promised by the UWB technology positioning and shown by our simulations

in ideal conditions. We experimented a high level of accuracy in the smaller 3x3 meter area, with an average error of 6.950 cm at a 1-meter height. The larger 3x12 meter area exhibited increased error rates, with an average error of 9.339 cm at the same height.

[2910] *ECG Paper Records Digitization for Generation of 1-D ECG Signal and Analysis of Heart Disease*

Jomole Varghese Vadakkan (Indian Institute of Technology Palakkad), M. Sabarimalai Manikandan (Indian Institute of Technology Palakkad) and Linga Reddy Cenkeramaddi (University of Agder).

Abstract

The electrocardiogram (ECG) signal is a critical diagnostic tool for analyzing cardiovascular diseases. Accurate and early diagnosis of heart disease is vital for effective treatment and management. Thus, an automatic algorithm is necessary to analyze the ECG signals plotted on paper, which can be achieved by converting the ECG paper records into digital formats. In this paper, we present an automatic algorithm to digitize the ECG signals recorded on paper and transform them into 1-D ECG signals suitable for detailed analysis. The proposed method comprises preprocessing, edge detection, ECG lead segmentation, and time-series ECG signal generation. The algorithm was tested using ECG images and validated by comparing the digitized results with the actual records from the standard MIT-BIH Arrhythmia (MIT-BIHA) database. The proposed algorithm achieved a Pearson correlation coefficients of 0.93 and 0.94 for the leads 1 and 2 of MIT-BIHA records, respectively.

[2976] *A Proposed Framework for Transparency of Supply Chain using Blockchain and IoT*

Paul Cioloca (Military Technical Academy ''Ferdinand I''), Emil Bureacă (Military Technical Academy ''Ferdinand I''), Alexandru Aloman (Special Telecommunications Service) and Iulian Aciobanitei (Military Technical Academy "Ferdinand I").

Abstract

In the global supply chain, ensuring the integrity and safety of sensitive products, such as vaccines, is paramount. This paper introduces a concrete and novel framework for product provenance and supply chain monitoring that leverages Internet of Things (IoT) sensors and blockchain technology to address these challenges. The proposed framework employs IoT sensors to continuously monitor and record in an efficient manner the keeping conditions of products during transit and storage. The blockchain solution implied is an Ethereum-based open-source client, our framework making use of smart contracts. Targeted measurements are temperature and humidity levels, but the framework is not limited to those. These data, along with comprehensive product provenance information, are securely and transparently logged on a public blockchain, enabling end-to-end traceability and verifiability. Furthermore, any third-party application is able to access this information for all stakeholders, including end users, who can verify the authenticity and handling conditions of their products in a trustful manner. Although integrating IoT and blockchain technologies pose significant challenges, our proposed framework finds a good balance between the two. Our initial evaluation demonstrates the framework's effectiveness in providing a trustworthy record-keeping and accessible monitoring for supply chain in the current digital era.

[3012] *Security in the context of smart cities*

Andreea Buzatu (GH Asachi), Vlad Mihai Chiriac (GH Asachi) and Daniela Tarniceriu (GH Asachi).

Abstract

This article presents an overview of security considerations in the context of smart cities, highlighting key areas of connectivity of IoT devices in a smart city, vulnerabilities and strategies for risk mitigation. It

explores possible vulnerabilities associated with interconnected IoT devices, the potential impact of cyberattacks on essential services, and the importance of implementing robust security measures to mitigate risks.

[3039] *A Smart UAV System to Assess the Health of a Vineyard*

Dobrea Dan Marius ("Gh. Asachi" Technical University) and Dobrea Monica Claudia ("Gh. Asachi" Technical University).

Abstract

This paper presents the hardware and software components of a system designed to autonomously detect the vine's health state through the analysis of vine leaves texture, shape, and color. The detection component uses a deep neural network and its execution is supported by an i.MX 8M Plus processor. Based on the NXP HoverGames drone, that flies over the vineyard, the detection system can analyze, in real-time, the health state of the different sections of the vineyard. The system, referred to in this paper as agriHoverGames, obtained an average 84.7% classification performance when classifying leaves into three classes (i.e., healthy leaves and leaves affected by two distinct diseases). Although this project was initially implemented to identify two vine diseases, it actually provides a mobile platform capable of identifying any other type of disease as long as this one manifests through specific changes (in texture, shape, color, or size) in the fruits, flowers, or leaves of a plant or fruit tree and, more, these ones can be identified through the video information.

[3086] *Sustainability for Estimating Global Energy Efficiency of Data Centers*

Scott Ehiri (Montclair State University) and Stefan Robila (Montclair State University).

Abstract

The modern digital landscape has turned data centers into one of the most important technologies to date. They are now tasked with handling very intensive workloads and also are responsible for processing a large amount of data. This, in turn, has led to an important aspect to consider as technology evolves at the pace it is now, that is energy efficiency. Data centers now support more than just business critical workloads and applications; they are now the bridge between different technologies like IoT devices, cloud computing and artificial intelligence. Such technologies function at the highest level and require more and more data processing and storage, leading to more power being consumed. In this paper we investigate how global estimates of energy consumption of the data centers could continue to be improved as the center's components continue to evolve. A model to predict just how much energy will be consumed in order to process and store all of the data needed to perform various tasks is discussed. Components like networking equipment such as switches play an important role in the efficiency of the data center, another component that is vital to all operations in a data center is the hardware architecture, for example the chip used in the switches. These combined paint a picture of how much energy and power will be needed to power data centers and the equipment inside of them.

[3269] *Sparse Attention Graph Gated Recurrent Unit for Spatiotemporal Behind-The-Meter Load and PV Disaggregation*

Mahdi Khodayar (University of Tulsa), Ali Farajzadeh Bavil (University of Tulsa) and Mohsen Saffari (University of Tulsa).

Abstract

The increasing adoption of rooftop photovoltaic (PV) power generation systems in residential areas necessitates accurate monitoring and disaggregation of behind-the-meter (BTM) load and PV power.

Despite recent advancements, existing BTM disaggregation approaches suffer from three major drawbacks: neglecting task-relevant spatiotemporal features, overfitting, and lack of a sparse neural architecture which leads to high sample complexity. This paper addresses them by introducing a deep sparse attention graph recurrent framework. This framework conceptualizes a set of neighboring residential units as a graph where the nodes are the net load values of the units and the edges show the mutual information (MI) of these measurements. We develop an Attention Gated Recurrent Unit (AGRU) to capture enhanced temporal characteristics of the net load. We employ a novel low-rank Dictionary Learning (DL) method to discern spatiotemporal features of these measurements and further utilize a Rectified Linear Unit (ReLU) neural network that incorporates an MI-based dropout to provide a sparse model for the estimation of the BTM load and PV. Experimental results validate the effectiveness of our proposed model, exhibiting superior performance on the Ausgrid dataset in BTM load and PV power estimation compared to state-of-the-art methods.

[3416] *The Chemical Stability of Nasicon Solid Electrolyte for Seawater Batteries*

Mihaela Iordache (National Research and Development Institute for Cryogenics and Isotopic Technologies—ICSI Rm. Valcea), Anisoara Oubraham (National Research and Development Institute for Cryogenics and Isotopic Technologies—ICSI Rm. Valcea), Simona Borta (National Research and Development Institute for Cryogenics and Isotopic Technologies—ICSI Rm. Valcea) and Adriana Marinoiu (National Research and Development Institute for Cryogenics and Isotopic Technologies—ICSI Rm. Valcea).

Abstract

Due to the alternative availability of renewable energy sources, rechargeable batteries were inevitably considered as key intermediaries for their sharing. The main purpose of energy storage systems (ESS) is to store renewable energy and use it with high energy efficiency on demand. Currently, lithium-ion battery (LIB) technology is a mature battery technology that holds a major position in the ESS market due to its high energy density, long cycle ability and energy competitive, cost. However, their long-term sustainable use may be limited due to the significant increase in prices of Li-containing raw materials, due to the increasing demand for LIBs in electric vehicles and large-scale ESSs, and due to their limited geographical distribution. Rechargeable seawater batteries (SWBs) are considered sustainable alternatives to Li-ion batteries due to the use of an unlimited and free source of Na-ion active materials. The purpose of this work is to test an electrochemical cell, of a hybrid battery, which contains a NASICON ceramic membrane as a solid electrolyte. Charge/discharge testing was performed at constant current of different values, using Pt/C as catalyst and seawater as catholyte. Also, the possible applications of batteries activated with seawater in the marine sector, were presented.

[3419] *Empirical Wavelet Transform in Epilepsy Diagnosis: A Multi-Features Approach to EEG Focal and Generalized Signal Classification*

Madalina-Giorgiana Murariu (Faculty of Electronics, Telecommunications and Information Technology, “Gheorghe Asachi” Technical University), Mihaela Gavrila (Faculty of Electronics, Telecommunications and Information Technology, “Gheorghe Asachi” Technical University) and Daniela Tarniceriu (Faculty of Electronics, Telecommunications and Information Technology, “Gheorghe Asachi” Technical University).

Abstract

The diagnosis of epilepsy has increasingly relied on automated algorithms that detect the type of epilepsy with high precision. The objective of this paper is to accurately discriminate between focal and generalized EEG epileptic signals collected in two states: awake and sleep. This study developed and implemented a method based on Empirical Wavelet Transform (EWT) for detecting and classifying EEG signals related with epilepsy. Characteristics such as skewness, kurtosis, median, and the fluctuation index are computed after decomposing each EEG signal into five components by EWT. These derived features are then utilized in classifying EEG signals using the K-Nearest Neighbors (KNN), Naïve Bayes (NB), and Support Vector Machine

(SVM) classifiers. The findings of this study demonstrate a maximum classification rate of 90.27% for data collected in awake state and 83.81% for data collected during sleep, achieved with KNN classifier in both situations. The results have been clinically validated, emphasizing the efficacy of integrating advanced statistical measures and automatic techniques to enhance the diagnostic processes in epilepsy care.

[3560] *EARLY DETECTION OF PARKINSON'S DISEASE USING MACHINE AND DEEP LEARNING MODELS*

Afreen Sorathiya (Dwarkadas J. Sanghvi College of Engineering), Jinal Mehta (Dwarkadas J. Sanghvi College of Engineering), Hetangi Rathod (Dwarkadas J. Sanghvi College of Engineering) and Nilesh Marathe (Dwarkadas J. Sanghvi College of Engineering).

Abstract

Parkinson's disease (PD) presents significant challenges in early detection, often relying on subjective clinical assessments and costly imaging procedures, leading to low accuracy rates, especially in detecting PD at its early stages. This research investigates the transformative potential of machine learning and deep learning algorithms in PD detection and diagnosis. Leveraging a diverse dataset comprising vocal fundamental frequency measurements, nonlinear dynamical complexity measures, and image data, we explore various ML/DL models. Our findings reveal promising accuracies across different models, with DenseNet121 achieving a maximum accuracy of 96.67% for image data and hybrid architectures like 1D CNNGRU achieving 94.87% accuracy for vocal data. Furthermore, the study identifies key limitations and challenges associated with each model, emphasizing the need for continued refinement and innovation. This research contributes to advancing PD diagnosis, offering potential improvements in patient outcomes and paving the way for more accessible and effective diagnostic solutions.

[3614] *A Comprehensive Assessment of LoRaWAN and NB-IoT Performance Metrics Under Varied Payload Data Sizes*

Kanar Alaa Al-Sammak (National University of Science and Technology Politehnica Bucharest (UNSTPB)), Sama Hussein Al-Gburi (National University of Science and Technology Politehnica Bucharest (UNSTPB)), George Suciu (National University of Science and Technology Politehnica Bucharest (UNSTPB)), Cristina Marghescu (National University of Science and Technology Politehnica Bucharest (UNSTPB)), Abedulqader Gailan Abdulqader (Ministry of Education) and Ana Maria Drăgulinescu (National University of Science and Technology Politehnica Bucharest (UNSTPB)).

Abstract

The notion of Internet of Things (IoT) has revolutionized whole industries, simply because it has provided constant connectivity between devices that hitherto existed in isolation. This has made Low Power Wide Area Networks (LPWAN) the network of choice when it comes to implementing an IoT, because they guarantee long-range communication and low power consumption. Great emphasis has been put on LoRaWAN and NB-IoT among the LPWAN technologies. This paper presents a comprehensive assessment of the performance metrics of LoRaWAN and NB-IoT under varied payload data sizes. The findings are substantially notable in two methods: LoRaWAN and NB-IoT. In comparing NB-IoT with LoRaWAN, it is evident that it has an overall trend to more problems in the transmission with an increase in the size of the payload. Albeit with higher bit error rates than LoRaWAN, NB-IoT generally is more susceptible to the risk of suffering from communication-related issues. This implies that LoRaWAN will always be in a position to achieve faster speeds of connectivity as compared to NB-IoT because its transmission time is smaller. LoRaWAN is always good for the whole time in terms of energy efficiency compared to NB-IoT; it uses less energy with different sizes of payload. Furthermore, LoRaWAN provides constant resource use, whereas with NB-IoT, a lesser amount of resource is used to transmit the same amount of data.

[3649] *Laboratory rat tracking methods in biomedical experiments*

Florin Rotaru (Institute of Computer Science Iasi), Hariton Costin (Institute of Computer Science of the Romanian Academy, Iasi Branch), Silviu Ioan Bejinariu (Institute of Computer Science, Romanian Academy, Iasi Branch), Mihaela Luca (ROMANIAN ACADEMY, IASI, COMPUTER SCIENCE INSTITUTE, IIT), Ramona Luca (Institute of Computer Science, Academia Română, Filiala Iași), Cristina Diana Nita (Institute of Computer Science, Romanian Academy Iasi Branch), Bogdan-Ionel Tamba (Advanced Research and Development Center for Experimental Medicine "Prof. Ostin C. Mungiu" – CEMEX, Iasi, Romania), Andrei Szilagyi (Advanced Research and Development Center for Experimental Medicine "Prof. Ostin C. Mungiu" – CEMEX, Iasi, Romania) and Gabriela-Dumitrita Stanciu (Advanced Research and Development Center for Experimental Medicine "Prof. Ostin C. Mungiu" – CEMEX, Iasi, Romania).

Abstract

Presented are two video analysis methods for tracking laboratory rats in three biomedical scenarios. In the first scenario, rat moves freely in a rectangular box, necessitating computation of the number of visits and visit duration in specific box areas. To assess the recognition of novel objects in the second scenario two toys are placed on the diagonal of the box, requiring tracking of visits and visit durations for each toy. The third scenario involves a Y-maze environment, with calculation of visits and visit durations for each branch. Initially, a tracking method using a voting procedure was proposed for the first scenario. The method combines results from binarized body detection and identification of the main cluster in the difference image of two consecutive frames. Subsequently, a deep learning-based body localization technique was applied across all three scenarios.

[3687] *A Comparative Study of Holistic Expansion Planning using Osprey Optimization Algorithm for Modern Electric Distribution Networks*

Hossein Shayeghi (Energy Management Research Center, University of Mohaghegh Ardabili), Peyman Zare (Energy Management Research Center, University of Mohaghegh Ardabili), Iraj Faraji (Energy Management Research Center, University of Mohaghegh Ardabili) and Nicu Bizon (The National University of Science and Technology Politehnica Bucharest, Pitești University Centre).

Abstract

The growing complexity and evolving requirements of Modern Electric Distribution Networks (MEDNs) necessitate a paradigm shift in Expansion Planning (EP) methodologies. Conventional Expansion Planning (CEP) approaches primarily focused on Substation Construction/ Reinforcement (SCR) and Circuits Expansion/Reinforcement (CER) often fall short in addressing the challenges of MAEDNs . This pioneering study introduces a novel Holistic Expansion Planning (HEP) framework moving beyond CEP, marking a significant advancement in EP for MAEDNs. The proposed HEP framework integrates SCR, CER, Capacitor Banks (CBs), Voltage Regulators (VRs), and Distributed Generators (DGs) into a unified optimization process. This comprehensive approach leverages the power of the Osprey Optimization Algorithm (OOA), inspired by the hunting behavior of ospreys, to efficiently solve the non-linear optimization problem associated with optimal EP strategies. The OOA's unique capabilities contribute to the innovative nature of the HEP framework. The HEP aims to minimize total costs while optimizing EP strategies for EDNs. It considers both installation costs of SCR, CER, CBs, VRs, and DGs, along with operational costs associated with power losses. The effectiveness of HEP is rigorously evaluated through a series of case studies conducted on a 24-bus system. The results demonstrate the superiority of HEP compared to conventional SCR and CER approaches. HEP consistently identifies more cost-effective and efficient EP strategies while achieving improved voltage regulation and reduced power losses. This groundbreaking approach to HEP empowers engineers to identify optimal EP strategies for MEDNs that meet system requirements, optimize resource allocation, and enhance overall network performance. HEP paves the way for a more efficient and sustainable future for MEDNs .

[3790] *Performance Comparison of Malware Classification Algorithms Using WEKA Tool*

Maria-Mădălina Andronache (National University of Science and Technology Politehnica Bucharest), Alexandru Vulpe (National University of Science and Technology Politehnica Bucharest) and Corneliu Burileanu (National University of Science and Technology Politehnica Bucharest).

Abstract

Monitoring a computer network and protecting the resources within it is a topic of great interest for a wide range of applications such as those used in the military, finance, healthcare, and many others. Also, in addition to effective monitoring, a continuous development of cyber security tools is also necessary because attacks are becoming more frequent and attackers are also developing more and more mechanisms to steal information and affect services which, at first glance, would be of extremely low interest to anyone. Therefore, a system that constantly monitors and detects intrusions into a computer network is an increasingly common requirement in most institutions and companies. This system can be realized using both hardware and software resources and solutions. Within the work, a classification of pre-tagged network traffic will be performed to detect malware applications. The experiments will comprise two distinct approaches: a binary classification approach, to simply distinguish between normal and malicious traffic, and a multi-class classification approach, to detect different types of malicious traffic. Afterwards, a comparison will be realized, in terms of efficiency and accuracy, between the Machine Learning algorithms used in the experiments.

[3827] *Experimental Setup for Automatic Position Control of an Adjustable Cantilever Under External Load*

Stefan Mocanu (Technical University of Civil Engineering of Bucharest), Cristian Stefan Dumitriu (Technical University of Civil Engineering Bucharest) and Alina Barbulescu (Transilvania University of Brașov).

Abstract

This paper presents an experimental stand designed to demonstrate the influence of the elastic deformation of a metallic cantilever under an external loading force. An automatic position-adjusting system of the cantilever was built and configured to compensate for the elastic deformation computed into the automation management software using the known material resistance theories. The stand can help estimate the position errors due to the mechanical and constructive tolerances of the equipment it is built on.

[3832] *ECG Quality Detection and Noise Classification for Wearable Cardiac Health Monitoring Devices*

Achinta Mondal (Department of Electrical Engineering, Indian Institute of Technology Indore), M. Sabarimalai Manikandan (Department of Electrical Engineering, Indian Institute of Technology Palakkad) and Ram Bilas Pachori (Department of Electrical Engineering, Indian Institute of Technology Indore).

Abstract

Electrocardiogram (ECG) signals are continuously acquired from the body surface and analyzed or transmitted with the help of wearable devices for continuous cardiac health monitoring under resting, ambulatory and exercise conditions. An automatic checking quality of ECG signals has become most essential to reduce false alarms and improve trustworthiness of automatic ECG diagnosis. Further identifying type of ECG noise sources can also improve noise removal effectiveness with selection of noise-specific denoising approach with reduced computational load. In this paper, we present convolutional neural network (CNN) based ECG quality detection and classification method by exploring optimal hyperparameters to achieve lightweight CNN model with acceptable performance in classifying noises into

electrode movement artifacts, muscle artifacts, and random noises. The proposed CNN based method achieve an accuracy of 94.87% in detecting quality of ECG signals and achieve a sensitivity of above 98% in identifying three types of noises with 2 convolutional layers and 3 dense layers with best activation function of exponential linear unit. The proposed method had model size of 1409 kB and computational time of 71.62 ms for processing 5 seconds ECG signal. The proposed CNN based ECG quality checking and noise type identification has great potential in automated cardiovascular disease diagnosis with reduced false alarms by discarding severely corrupted signals and enabling noise-specific ECG denoising in achieving better noise reduction capabilities by selecting noise specific signal processing techniques.

[3980] *Deep Learning Modeling and Increasing Interpretability of Lung Nodule Classification with Improved Accuracy*

Juliana Li (The Harker School).

Abstract

A major step in lung cancer diagnosis is the classification of nodule malignancy, but in early stages, benign and malignant nodules appear very similar, leading to frequent misdiagnoses. This study developed a novel multimodal image-based CNN (MIB-CNN) model architecture to classify pulmonary nodules as either benign or malignant, performing multimodal learning on only computed tomography (CT) images, without the need for other clinical data like genomic tests. MIB-CNN takes in CT images of nodules, convolutionally extracts chosen semantic features from the images to obtain numeric data, and integrates it with the image data using a novel method, improving model performance and uncovering the mechanisms of the “black box” of this deep learning task. The results showed that the MIB-CNN model achieved 0.94 AUC on the LIDC-IDRI dataset compared to 0.90 AUC with a basic image CNN, and 0.91 specificity in comparison to 0.86 specificity of the basic model, indicating a significant decrease in the number of false positives. This study also identifies the primary causes of inaccurate predictions: small airways and other thoracic organs cause noise in the image data and decrease visibility of small nodules. Furthermore, the premise of MIB-CNN is not limited to this lung nodule malignancy classification task, as this methodology can be applied to other medical image-based deep learning tasks to overcome the challenge of limited multimodal data availability.

[3999] *Applications Of Artificial Intelligence In Firefighting Management Systems: A Bibliometric Review*

Robert Bostinaru (Politehnica University of Bucharest), Nicu Bizon (Politehnica University of Bucharest), Sebastian Dragusin (Politehnica University of Bucharest) and Florentina Magda Enescu (Politehnica University of Bucharest).

Abstract

In the works, the last generation technologies in the field of Smart fire management systems are debated. Paper presents fire prevention and control technologies in areas such as: forestry areas, cities, buildings and in transport. The processed data are extracted from databases such as Google, WOS and Scopus. The paper presents the advantages and disadvantages of the technologies used in fire prevention and control, projects and architectures. The work also analyzes, using the Prisma Smart fire management systems method, the summary of graphs revealed in the field of interest. The conclusions of the work are that it is a vast and intensively researched field in continuous expansion and remodeling in trend with the latest technologies.The work is composed of three chapters, so chapter 1 presents the analyzed technologies, chapter 2 presents the Prisma analysis and chapter 3 presents the conclusions.

[4075] *Blockchain in Personal Document Archiving Services*

Florentina Magda Enescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Cosmin-George Nicolăescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Valeriu Manuel Ionescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre) and Nicu Bizon (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre).

Abstract

In this article, blockchain technology is proposed for use in the personal document archiving process. This area is less covered in the literature/specialist applications in the field. The aim was to obtain benefits in terms of security, privacy and accessibility of personal data. The architecture of such a system is debated/justified to determine the justification of the importance of applying this research to the implementation of a: digital identity platform; personal health management system; digital portfolio of education and qualifications; financial identity management system; archiving of legal documents; blockchain for wills and estate planning; intellectual property management system; platforms for managing insurance documents; professional career management system; platforms for travel and immigration documents; And so on

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[4159] *Design and Performance Evaluation of Two-Degree-Of-Freedom PID Control for a Modified Boost Converter*

Hossein Shayeghi (University of Mohaghegh Ardabili), Samaneh Salmalian (University of Mohaghegh Ardabili), Reza Mohajery (University of Mohaghegh Ardabili) and Nicu Bizon (The National University of Science and Technology Politehnica Bucharest, Pitești University Centre).

Abstract

In light of the current energy crisis and the environmental damage that fossil fuels have wrought, the generation of electrical power from renewable sources like photovoltaics is emerging as a viable alternative to traditional approaches. Due to the photovoltaic system's low and changeable output voltage, utilizing DC-DC converters with high voltage and great efficiency is recommended. As a result of these converters' nonlinear features, the device becomes highly sensitive to modifications in the circuit since the output voltage varies frequently. Consequently, the nonlinear structure and rapid dynamics of these converters add to the complexity of their control process. In this paper, a two-degree-of-freedom proportional-integral- derivative (2DOF PID) controller is utilized as an enhanced method for controlling an extended high step-up DC-DC converter. Moreover, employing the marine predators' algorithm (MPA) allows the controller parameters to be implemented optimally. This system controls the voltage at the output in accordance with variations in both the input and the load. The proposed controller coefficients are designed to minimize the time-domain performance indices of the closed-loop system, with the ISTAE index acting as the objective function. Finally, the efficacy of the suggested controller has been demonstrated via comparisons with the commonly used PID controller.

[4196] *Efficient Approximate Adders for Fast Arithmetic in Energy-Saving Applications*

Avireni Srinivasulu (Mohan Babu University, Tirupati -517102, Andhra Pradesh (State), India), Dasamandam Venkata Supriya (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Chapati Raghavendra Reddy (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Chapati Venkata Srikanth Reddy (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Chelikam Bhavya (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Musala Sarada (Vignan's Foundation for Science, Technology and Research (Deemed to be University), Guntur, India), Appasani Bhargav (Kalinga Institute of Industrial Technology, Bhubaneswar, 751024, India) and Cristian Ravariu (Politehnica University of Bucharest, Splaiul Independentei 313, Sect.6, 060042, Bucharest, Romania).

Abstract

The proposed circuits are robust for designing energy-efficient full adders, crucial in approximate computing to enhance circuit efficiency. Full adders serve as essential components in arithmetic circuits, crucial for diverse computational devices. Circuits utilizing Metal Oxide Semiconductor Field Effect Transistor (MOSFET) technology are crucial in digital signal processing applications due to their significant role. The Cadence Virtuoso software is utilized to evaluate new approximate adders designed for 45nm CMOS processing with different supply voltages. The assessment focuses on metrics such as power delay product, power consumption, and transistor count.

[4223] *Autoencoder-Based Image Steganography With Least Significant Bit Replacement*

Mariam Ibrahim (Department of Mechatronics Engineering German Jordanian University Amman, Jordan), Ruba Elhafiz (Department of Mechatronics Engineering German Jordanian University Amman, Jordan) and Haneen Okasha (Department of Biomedical Engineering German Jordanian University Amman, Jordan).

Abstract

Information confidentiality is critical to the progress of sustainable smart cities. Cover images are commonly used in classic image steganography to safely hide/conceal hidden information or images. This paper proposes a new autoencoder (AE) neural network-based image steganography algorithm. With AE, the model employs the Least Significant Bit (LSB) Replacement technique, embedding a secondary image within the LSB of the pixel values in the cover image. During the extraction phase, the decoder uses the learned features to reconstruct both the original cover image and the stego secondary image, allowing for the covert integration of a whole image within the AE framework. The model was trained and evaluated using the MNIST and CIFAR-10 datasets. The suggested method's effectiveness was measured using three performance assessment metrics: mean square error, peak signal-to-noise ratio, and structural similarity index. The best results were 0.0018, 47.89, and 0.96, respectively, which are promising and outperforming the findings of the most significant bits technique. The model was successful in concealing the secret, as seen by several similarities between the cover and stego images.

[4238] *Device For Securing IoT In The Wireless Environment*

Dumitrache Cezar-Gabriel (Interdisciplinary Doctoral School, University of Pitești), Gavriloaia Gheorghe (Interdisciplinary Doctoral School, University of Pitești), Predusca Gabriel (Valahia University of Targoviste Targoviste, Romania) and Gavriloaia Mariuca-Roxana (Universitatea Titu Maiorescu Bucuresti).

Abstract

The security of IoT devices has become imperative given their exponential proliferation worldwide. This underscores the critical need for ensuring their security, especially considering their connectivity through diverse types of networks. This paper introduces a device I have designed for encrypting data in wireless networks. I will illustrate a scenario commonly encountered in organizations. Our aim was to create a cost-effective solution for encrypting data in Wi-Fi environments, taking into consideration the prevailing cyber security landscape in 2024.

[4389] *Implementation of an Automated Pick and Place System for Didactic Study of Industry 4.0*

Marius Constantin Marica (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Nicu Bizon (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Ionel Bostan (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre) and Florentina Magda Enescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre).

Abstract

Industry 4.0 represents a significant evolution in the field of automation and production, imposing the need to develop advanced educational platforms to train the next generation of engineers and researchers. In this article, is present an innovative didactic platform for the study of Industry 4.0, focused on the implementation of an automated pick and place system. Our platform integrates advanced hardware and software components, including pneumatic cylinders, vacuum grippers, IO-Link sensors, IO-Link master and IO-Link solenoid valve group, HMI (Human-Machine Interface) and control buttons. These components are interconnected to create a modular and flexible system that is easy to use for educational and research purposes. The article will detail the architecture and operation of the system, as well as the software development process, including the programming languages and environments used. It will also discuss the implemented communication protocols (Profinet, OPC UA, MQTT) and the possibility of activating a web server for interfacing with other systems. The results obtained demonstrate the efficiency and applicability of our platform in the educational environment, providing students and researchers with an interactive and practical environment for understanding and applying Industry 4.0 concepts. This platform is a valuable resource for training future generations of automation and advanced technology specialists.

[4414] *Constraints and Adjustable Parameters in Microgrids for Cost and CO2 Emission Reduction*

Mohammed Amine Houmadi (LIMAS Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohammed Ben Abdellah University, Fez 30003, Morocco), Hala Alami Aroussi (LGEM Laboratory, Higher School of Technology, Mohamed First University, Oujda 60000, Morocco), Mohammed Karim (usmba) and Badre Bossoufi (USMBA - Fez).

Abstract

Microgrids offer a promising solution to the mounting challenges of surging energy demand and environmental issues. This article explores the crucial role of microgrids in addressing contemporary energy needs while mitigating pollution risks. Microgrid operations are intricately influenced by constraints falling into two fundamental categories: those intrinsic to the microgrid and those imposed by the external environment. These constraints, stemming from component limitations, environmental factors, and grid connections, exert significant influence over the microgrid's operational capabilities. Particularly important is the three-tiered control framework, comprising primary, secondary, and energy management controls, ensuring optimal microgrid function by regulating power quality, frequency, and voltage within defined parameters. The energy management control, the third tier, deserves thorough examination, revealing the art of fine-tuning microgrid components and integrating them seamlessly with their environment to streamline energy flow and ensure uninterrupted operation. In essence, this article scrutinizes the intricate interplay between microgrid constraints and energy management parameters, underscoring how subtle adjustments to these parameters are instrumental in achieving the twin goals of cost reduction and CO2 emission minimization, thereby molding a more sustainable and environmentally conscious energy landscape.

[4541] *A Data Augmentation Approach using WGAN with Grey Wolf Optimizer (GWO) to Improve Deep CNN Weak Supervised Classification of Hyperspectral Images*

Liviu Rujan (National University of Science and Technology POLITEHNICA of Bucharest) and Victor-Emil Neagoe (National University of Science and Technology POLITEHNICA of Bucharest).

Abstract

This paper proposes a new approach to improve weak supervised classification of deep CNN architectures based on data augmentation by integrating Grey Wolf Optimizer (GWO) with Wasserstein Generative Adversarial Network (WGAN). The model is applied for hyperspectral image classification. We have chosen

a weak supervised CNN classifier, where only 5% of hyperspectral training data is authentic, the remaining 95% ones being virtually generated using the model GWO-WGAN. The performance of the proposed model is evaluated using Indian Pines, Pavia University, and Salinas hyperspectral image datasets.

[4581] *Implementation of a Speech Recognition System using Convolutional Neural Networks*

Sebastian-Alexandru Drăgușin (National University of Science and Technology Politehnica Bucharest Romania), Nicu Bizon (National University of Science and Technology Politehnica Bucharest), Robert-Nicolae Boștinaru (National University of Science and Technology Politehnica Bucharest) and Denisa Toma (National University of Science and Technology Politehnica Bucharest).

Abstract

This paper addresses the problem of ASR (Automatic Speech Recognition), a key field for the development of HCI (Human-Computer Interaction) technologies and for applications in voice assistant and machine translation. The proposed methodology uses CNN (Convolutional Neural Networks) to classify voice signals, extracting essential features such as spectrogram, ZCR (Zero Crossing Rate), spectral centroid, spectral role and MFCCs (Mel-frequency cepstral coefficients). A filter bank was also implemented to improve signal processing. To evaluate the performance of the system, comparisons of the accuracy of the results obtained by different processing methods were realized. In addition, a hardware implementation of the system was developed, using the Simulink graphical programming environment and a Raspberry Pi microcontroller, thus demonstrating the feasibility and efficiency of the system in a practical context. The results obtained indicate that the use of CNNs, together with specific characteristics, offers superior accuracy in speech recognition compared to traditional methods. The implementation on the Raspberry Pi confirms the possibility of using this system in applications, opening new perspectives for the development of affordable and efficient solutions in automatic speech recognition.

[4618] *Photoplethysmography Signal Quality Assessment Using Neighbour Edge Restricted Horizontal Visibility Graph and Machine Learning Classifiers*

Zahir Khan (Indian Institute of Technology Palakkad), M. Sabarimalai Manikandan (Indian Institute of Technology Palakkad) and Mufti Mahmud (Nottingham Trent University).

Abstract

Photoplethysmography (PPG) signals are vital for monitoring pulse rate, blood pressure, and more, but they are prone to motion artefacts and noise, leading to unreliable data. Assessing PPG signal quality is crucial for reliable healthcare and accurate medical diagnoses. By transferring the PPG time domain signal to a Horizontal Visibility Graph (HVG) network and combining extracted features from HVG with machine learning algorithms, we can classify the PPG signal into clean (or high quality) and noisy. We have proposed a new version of HVG called Neighbour Edge Restricted Horizontal Visibility Graph (NERHVG) by invoking some extra conditions for joining edges in HVG for PPG signal quality assessment (SQA). We have used the average degree (AD) of graphs extracted from HVG, and NERHVG algorithms as features in 3 different machine learning classifiers such as Random Forest (RF), Gaussian Naive Bayes (GNB), Decision Tree (DT) to classify 4 standard untrained PPG datasets (DS). The classifier models DT, RF, GNB associated with graph feature AD of HVG, NERHVG algorithms are named as: DT-HVG, DT-NERHVG, RF-HVG, RF-HVG, RF-NERHVG, GNB-HVG and GNB-NERHVG. After all the performance of HVG and NERHVG algorithms using AD feature are compared over the mentioned classifier models. It is observed that the NERHVG algorithm outperformed the HVG algorithm with the AD feature in all 4 datasets with a maximum achieved accuracy of: 99.09%, 95.03%, 96.56% and 84.63% using the GNB classifier model.

[4747] *Application of machine learning algorithms for monitoring of spoilage of cow's milk using the cheap gas sensor*

Kristian Dokic (Faculty of Tourism and Rural Development), Bojan Radisic (Faculty of Tourism and Rural Development) and Hrvoje Kukina (Lipik development and tourism agency LIRA d.o.o.).

Abstract

Cow's milk is very sensitive to spoilage processes that could negatively affect its quality. Several methods have been developed for the analysis of milk spoilage, and in recent times solutions using e-nose are more and more common. This paper analyzes the possibility of using the Bosch BME688 (BioMedical Engineering) sensor, which can detect different gases by analyzing their different electronic signatures. Samples of fresh, pasteurized and UHT (Ultra High Temperature) sterilized milk, which were at room temperature (22°C) during the 4-day experiment, were tested. The obtained data for every day were used to train nine models based on different classification algorithms (K Nearest Neighbor, Logistic Regression, Support Vector Machine, Naive Bayes, Decision Tree, Random Forest, Gradient Boosted Trees, Probabilistic Neural Network) with the aim of distinguishing the type of milk with known time after opening, i.e. milking. The focus of the research was on the analysis of classification algorithms that can be used for the classification of milk with regard to the standing time at room temperature. The manufacturers of the sensor itself enabled the use of neural networks exclusively in the BME AI-Studio program, which is used for configuration and training of the model, and their decision is correct in most cases.

[4764] *Ladder Logic implementation for Romanian railway interlockings*

Florin Bădău (National University of Science and Technology POLITEHNICA Bucharest), Valentin Iordache (National University of Science and Technology POLITEHNICA Bucharest), Valentin Alexandru Stan (National University of Science and Technology POLITEHNICA Bucharest) and Angel Ciprian Cormoș (National University of Science and Technology POLITEHNICA Bucharest).

Abstract

Interlockings are critical systems for the railway network that ensure the safety of train operations. While previous generations of interlockings used hardware logic to implement safety functions, electronic interlockings employ different techniques and architectures to comply with strict reliability and redundancy standards. Ladder logic has been used for decades for industrial automation, which has witnessed a transition from relay-based to PLC-based systems. This paper proposes a standard for translating relay interlocking schematics into ladder programmes. The proposed model is evaluated against physical relay interlocking.

[5049] *Streamlining Healthcare: An Efficient Health Records Management System*

Shradha Bora (Vishwakarma Institute of Technology, Pune), Manasi Mhatre (Vishwakarma Institute of Technology, Pune), Satyam Mhetre (Vishwakarma Institute of Technology, Pune), Owee Mirajkar (Vishwakarma institute of technology, Pune), Chinmay Metha (Vishwakarma Institute of Technology, Pune) and Vivek Methade (Vishwakarma Institute of Technology, Pune).

Abstract

The healthcare practitioners, especially in India, traditionally rely on manual paper logbooks for maintaining patients' records. Our study underscores the crucial need of transitioning from manual to digital patient health records management. Also in emergency conditions, accessing all the patient's health records becomes challenging since the paper records might be stored in various locations, making it uncertain that all the necessary files are readily available. Additionally, the risk of losing paper records further highlights the vulnerability of traditional record-keeping methods. When consulting different doctors, it is essential

to have an easy track on patients' health records. To address these challenges, we have developed DrFilEz, a web application to streamline and enhance the management of medical records. Our system will enable doctors to store and consolidate health records on a single platform and allow credentialed doctors to access patients' health information seamlessly. On our platform, different doctors and patients can connect to seek advice and share medical knowledge. After completion of our web application, all the functions were tested, and its performance was evaluated. Overall, the evaluation's findings were according to expectations.

[5211] *An Inference Performance Evaluation of TensorFlow and PyTorch on GPU Platform Using Image Super-Resolution Workloads*

Jihao Tian (Chongqing Normal University) and Yan Wei (Chongqing Normal University).

Abstract

Since a growing number of parameters in deep learning model occurred, the overhead of inference performance is comparable to training, which promotes to various deep learning frameworks continually optimized for providing better inference performance. As one of the prevalent model tasks in recent years, super-resolution plays an essential role in the development of computer vision. Our study aimed to evaluate the inference performances between two most popular frameworks, TensorFlow and PyTorch. We selected eight representative super-resolution models in deep learning and calculated three metrics, inference latency, Peak Signal-to-Noise Ratio (PSNR), and Structural Similarity Index Measure(SSIM). For enhancing the reproducibility of our experiments, Open neural network exchange (ONNX) was introduced to convert trained models between TensorFlow and PyTorch. We also conducted experiments on both local and cloud platforms to ensure the reliable results. The results on local platform showed that the overall inference latency differences between two frameworks were up to 4%, and the differences in PSNR and SSIM were within 1%. However, noticeable differences persisted between the two frameworks in separate eight models and four datasets. The results of local platform were reproduced on cloud platform. Our findings can provide proposals for end-users when choosing frameworks between TensorFlow and PyTorch.

[5213] *Optimal Wind Farm Site Selection Using MCDM Approaches: A Combination of the VIMM Weighting Method and TOPSIS Ranking Algorithm*

Ouiame El Fadli (LSMI Laboratory, Department of Electrical Engineering, ENSAM, Moulay Ismail University Meknes,Morocco), Mourad Yessef (LIMAS Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fes, Morocco) and Ahmed Lagrioui (LSMI Laboratory, Department of Electrical Engineering, ENSAM, Moulay Ismail University Meknes,Morocco).

Abstract

Wind turbines are currently one of the world's most commonly employed renewable energy generation technologies. The selection of an optimal wind farm site might be challenging considering the variety of site possibilities in the same region. Using the second scenario of a novel subjective and goal-oriented weighting technique called the Vital-Immaterial and Mediocre MCDM Method, this study presents an optimal wind farm site selection methodology, considering three main objectives: biological conservation, safety during production, and durability, which are weighted by a pair-wise comparison based on the opinion of decision-makers. Moreover, this paper gathers eight criteria, including earthquakes and seismic activity. This study also examines four wind farm site possibilities using the TOPSIS MCDM approach. This investigation found identical ranking outcomes between the TOPSIS and COPRAS ranking methods.

[5295] *The Impact of Artificial Intelligence in Recruitment and Selection Processes in IT Companies*

Thaya Madhavi (Mohan Babu University, Tirupati -517102, Andhra Pradesh (State), India) and Avulakunta Kaveri (Mohan Babu University).

Abstract

The research explores the hiring and selection processes of Information Technology (IT) firms in Hyderabad, with a focus on state-of-the-art technologies such as Artificial Intelligence (AI), chat platforms, social media, and virtual reality. It seeks to comprehend the strategies employed in talent acquisition amidst Hyderabad's ascent as an IT center. Artificial Intelligence has notably expedited candidate identification and screening, while chat boards and social media platforms facilitate community-building and engagement with potential hires. Virtual Reality adds an immersive dimension to recruitment experiences. Employing a quantitative survey methodology, the study aims to assess the impact of these technologies on talent acquisition within Hyderabad's IT industry. The findings aspire to offer valuable insights for strategic decision-making in the competitive IT arena. Emphasizing the importance of recruitment processes in acquiring skilled personnel, the research examines prevalent practices and challenges encountered by IT companies in Hyderabad. It concludes that effective recruitment practices are widespread in the region. Furthermore, the study sheds light on how leading IT enterprises leverage AI, Chabot's, Social Media, and Virtual Reality to revamp their recruitment and selection approaches, evaluating the drivers, obstacles, and efficacy of these technologies in attracting top talent and enhancing the candidate experience amidst Hyderabad's evolving IT landscape.

[5345] *A model for horizontal community collaboration between government departments, agencies and organizations providing seamless Local and Area Public Interest Services*

Dorin Vasile Deac Suteu (UPB), Aurel Mihail Titu (Lucian Blaga University Sibiu), Alina Bianca Pop (UTCN) and Marius Ioan Toderici (UPB).

Abstract

Horizontal models of community collaboration involve the creation of partnerships and cooperation between various government departments, agencies and organizations that provide public services at the local and area level. This collaborative strategy strives to improve efficiency, reduce silos, and ensure seamless service delivery. A model of horizontal collaboration among government departments, agencies and organizations ensures seamless public services for local and area interests. Implementing this entire paradigm requires dedication, effective communication, and a shared understanding of the benefits of collaboration. Regular reviews and revisions based on lessons learned will help ensure the longevity and effectiveness of this horizontal community cooperation approach

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[5509] *Fuel economy and overall efficiency optimization of a Fuel Cell Electric Vehicle in a European Extra-Urban Drive Cycle (EUDC)*

Ioan Sorin Sorlei (Doctoral School of Electronics, Telecommunications & Information Technology, UPB).

Abstract

The overall performance of a Fuel Cell Electric Vehicle (FCEV) depends in particular on the overall fuel consumption during a load cycle (eg NEDC, EUDC, WLTP, FTP, etc.). This reveals the importance of fuel economy strategies in defining the system performance. The fuel economy strategy will use the fuel and air flows to efficiently operate the fuel cell system (FCS), based on the Load-Following (LFW) control and the Global Extremum Seeking (GES) algorithm. The load following control will ensure the charging sustained mode for the Energy Storage System (ESS), improving their lifetime. The objective of this research paper is to analyze the performance of an FCEV and to implement an energy management strategy for fuel economy in a European Extra-Urban Drive Cycle (EUDC) with the aim of extending the lifetime of the ESS and maximizing of the vehicle's overall efficiency.

[5537] ***Finite Control Set MPC versus multi-loop PR control for a three-phase four-leg inverter as grid disturbances generator : a Comparative Analysis***

Katria Kamiantako Nzimbakani (Université Libre de Bruxelles), Angelo Kuti Lusala (Université de Kinshasa) and Johan Gyselinck (Université Libre de Bruxelles).

Abstract

This study presents a comparative study between the Finite Control Set Model Predictive Control (FCS-MPC) and the multi-loop control strategy based on a Proportional Resonant (PR) Controller for a three-phase four-leg inverter to generate various grid disturbances under various load conditions. It is shown that MPC has a better transient response in all cases of grid disturbances. Regarding the steady-state performances, the output voltage has a lower THD when using MPC, especially for inductive loads, while the relative error on the output voltage is relatively the same for both control schemes.

[5596] ***System for monitoring the performance of occupational safety and health in enterprises***

Brîndușa-Elena Nițan (Computer Science and Engeneering Department National University of Science and Technology POLITEHNICA Bucharest) and Mariana Mocanu (Computer Science and Engeneering Department National University of Science and Technology POLITEHNICA Bucharest).

Abstract

The Occupational Health and Safety field generally concerned with the physical and mental safety and well-being of employees at the workplace itself. In order to help with proper integration, especially in micro and small enterprises, as they are the majority, the European Union has created a complex legislative framework with clear and detailed directives and developed various e-tools. Thus, in the first part of the paper some of the e-tools, their functionalities and categories of applicability are highlighted. In the second part the proposed prototype system is described, together with a detailed highlighting of the performance metrics, from the OSH point of view, which are the main elements in calculating the performance of a company's employees, of the equipment in use or of the company itself.

[5749] ***A Blockchain-based Framework for Content Provenance and Authenticity***

Emil Bureaca (Military Technical Academy "Ferdinand I") and Iulian Aciobanitei (Military Technical Academy "Ferdinand I").

Abstract

In the current social and technological context, the proliferation of content creation led to easy spreading of misinformation and fake content. This poses an important threat to individuals and even countries or democracy itself. This paper presents a novel proposal for ensuring content provenance and authenticity by leveraging blockchain technology. Besides blockchain, we make use of digital signatures and signature preservation services, integrated through standard interfaces. The proposed framework is designed to accommodate various content formats: text, image and video. After a comparison with similar solution, we also detail a discussion analysing limitations, opportunities and advantages or our approach. To sum up, the proposed framework outlined in this paper offers a robust and standard-compliant mechanism to ensure the provenance and authenticity of digital content, thereby addressing the pressing challenge of disinformation.

[6116] ***Feedback Linearization Control and Current Control Mode for Boost Converter***

Nguyen Hoang Viet (Thuyloi University), Pham Hong Duong (Thuyloi University) and Nguyen Tien Duc (Thuyloi University).

Abstract

Linear control techniques have proven effective in controlling DC/DC converters, such as the Boost converter. This approach relies on averaged small signal models and can be implemented using either voltage mode control or current mode control structures. However, linear controllers are often greatly affected by changes in load and model parameters because they are designed based on a small signal model that is established by the linearization method. Consequently, to control DC/DC converters, it is required to study nonlinear control strategies. Feedback linearization control is one of the popular nonlinear control techniques and it has been widely used in the field of power electronics control. This paper suggests a technique for designing a current mode control structure for a boost converter. The internal current loop controller is designed using the feedback linearization control method, and the voltage outer loop controller is designed using the affine parameterization approach. The simulation results on Matlab/Simulink show that the boost converter in the current control mode using the proposed design technique has a good dynamic response and is less affected by fluctuations in the load and parameters model.

[6123] *Contributions on the application of IDEF 0 modelling for collaborative design of information systems integration for local and area service process management*

Aurel Mihail Titu (Lucian Blaga University of Sibiu), Dorin Vasile Deac Suteu (UPB), Marius Toderici (UPB) and Alina Bianca Pop (UTCN).

Abstract

This paper discusses the use of a set of modeling concepts used in the field of systems and software engineering known as IDEF, which stands for "Integration Definition". Specifically, IDEF0 is used for the purpose of representing the many activities, actions, and choices that occur within an organization. Applying IDEF0 modeling to collaborative design in the context of integrating local and area service process management information systems can provide stakeholders with the ability to visually represent and understand the processes that are involved in integrating local and area service process management information systems. Benefits include the use of a clear visualisation helps to improve communication between stakeholders, which in turn helps to build a shared understanding of the collaborative design process. In conclusion, the use of IDEF0 modelling in collaborative design for information systems integration brings clarity, efficiency and strategic alignment to the process. It provides companies with a structured framework that enables them to traverse the complexities of managing local and area service processes. In addition, it encourages collaboration between stakeholders and optimises integration efforts to achieve better results.

[6141] *An Overview of New Trends in Electric Machine for HEV*

Badre Bossoufi (USMBA - Fez), Mohammed Chiboub (USMBA), Houda El Alami (USMBA), Chakib El Bekkali (USMBA), Mohammed El Mahfoud (USMBA) and Mohammed Karim (USMBA).

Abstract

This paper provides an overview of emerging trends in electric machine technology for hybrid electric vehicles (HEVs) and presents a comparative study of different machine configurations. The paper begins by examining the propulsion system requirements for HEVs and the different configurations, including series, parallel, and dual-mode HEVs. The requirements for motor characteristics in an electric vehicle propulsion system are then described, including efficiency, torque, speed range, power density, and reliability. The paper then looks at a comparative study of induction and synchronous machines. For induction machines, the design and advantages are discussed, as well as their limitations and techniques for improving performance, such as vector control and multiphase drives. Synchronous machines, including surface permanent magnet (SPM), internal permanent magnet (IPM), and insert and spoke (BLDC) motors, are also

reviewed, highlighting their advantages, disadvantages, and design considerations. New trends are highlighted by presenting permanent magnet hybrid motors as a promising solution for hybrid electric vehicles. Finally, a comparative analysis of these types of electric machines provides a better understanding of their suitability for different vehicle applications. Power density, efficiency, controllability, reliability, torque characteristics, and cost-effectiveness are among the factors taken into account in the assessment. In particular, the study highlights the importance of adapting the choice of electric motor to the specific needs and design priorities of hybrid electric vehicles. Overall, this paper provides valuable information on the latest trends and advances in electric machine technology for hybrid electric vehicles.

[6166] *Short Review on Micro-Arc Oxidation Layers on Aluminum Alloys*

Maria-Ionela Popescu (National University of Science and Technology Politehnica Bucharest Romania), Maria Magdalena Dicu (National University of Science and Technology Politehnica Bucharest,) and Daniela Mioara Ioniță (National University Politehnica Bucharest,).

Abstract

Micro-arc oxidation (MAO) coatings have several advantages for example: expanded surface zone, important process mechanical properties, optical properties, biomedical gadgets, or aviation components. MAO can be applied for surface treatment which can be used to obtain useful coatings on metals and alloys. The process consists in applying a high voltage electrical trigger to the substrate. This makes a plasma that connected with the surface of the substrate, making a thick coating. MAO coatings are commonly composed of a blend of oxides, hydroxides, and other compounds. Coating structure is affected by several components, tallying voltage, current characteristic, electrolyte composition and planning time. MAO coatings can be used to create surfaces with wear resistance and optical properties such as anti-reflective properties, while also being anti-corrosion and self-cleaning. This makes MAO a promising innovation for a huge range of applications. Our article presents the experimental studies involving MAO with different electrolytes at certain parameters. The obtained layers present very good corrosion properties were obtained on aluminum metals but also on their alloys that can also be applied in the automotive industry.

[6170] *Analysis of YouTube video comments with NLP methods*

Mironela Pirnau (Faculty of Informatics, "Titu Maiorescu" University), Iustin Priescu (Faculty of Informatics, "Titu Maiorescu" University), Catalina Mihaela Priescu (Faculty of Automatic Control and Computer Science, National University of Science and Technology POLITEHNICA Bucharest), Claudiu Pirnau (Faculty of Industrial Engineering and Robotics, National University of Science and Technology POLITEHNICA Bucharest) and Liviu Daniel Ghiculescu (Faculty of Industrial Engineering and Robotics, National University of Science and Technology POLITEHNICA Bucharest).

Abstract

This study proposes methods that can be used to examine and interpret comments that users have made after watching videos on YouTube on a particular topic. YouTube tutorials are very popular among young people. They have become an important pillar in informal education, thus contributing to the rapid acquisition of skills and knowledge. Under these circumstances, we were interested in analyzing the YouTube videos comments, knowing that the platform has a continuous increase in popularity, which is also due to the oportunities of sharing them. Since ChatGPT-themed YouTube videos have seen a significant surge in popularity since 2022, we were interested to analise some videos that approache the topics of "ChatGPT, AI clone, AI robot and Deep Learning."

[6195] *Exploring the Intricacies of the Architectural Framework Underlying the Internet of Things Ecosystem*

Maria Ioana Oproiu (National University of Science and Technology POLITEHNICA Bucharest), Marian Ileana (National University of Science and Technology POLITEHNICA Bucharest, Pitesti University Center) and Constantin Viorel Marian (National University of Science and Technology POLITEHNICA Bucharest).

Abstract

In recent years, the Internet of Things (IoT) has significantly impacted the digital economy. This article provides a comprehensive examination and thorough analysis of the architectural framework that supports the IoT ecosystem, tracing its evolution from a complex and fragmented system to a network of interconnected devices with limitless potential. This study explores the various applications of IoT across different sectors, including manufacturing, smart enterprises, city management, healthcare, agriculture, and transportation. It highlights the significant impact of IoT on enhancing efficiency, safety, sustainability, accessibility, and overall quality of life. Although IoT presents promising opportunities, there are persistent challenges, particularly in the areas of distributed processing, data analysis, interoperability, security, and privacy. These challenges demand innovative solutions and efforts across industries and academia. This article aims to provide insights into the ongoing transformative journey driven by IoT technologies, by examining their benefits and drawbacks. The article emphasizes the potential for unprecedented interconnectedness, innovation, and societal advancement on a global scale. The focus is on the use of the IoT solution developed in Python 3 and the server implementation on the Kali Linux operating system.

[6259] *Comparative study of experimental data and numerical simulations using 2D FLUX for hardening the teeth edges in a portable inductor gear*

Mihaela Cornelia Novac (University of Oradea), Marius Codrean (University of Oradea), Ovidiu-Constantin Novac (University of Oradea), Mihaela Codrean (University of Oradea), Ioan Mircea Gordan (University of Oradea) and Teofil Ovidiu Gal (University of Oradea).

Abstract

The aim of this paper is to model the semi-finished gear wheel tip using a coil and the resources provided by the FLUX 2D program. In this case, the inductor was assumed to be supplied with a voltage at its terminals, using a coil for modeling. The problem is axisymmetric. Important information about the process of surface heating by induction was obtained through the cooperative analysis of numerical simulations with Flux 2D and experimental data in edge hardening. These data were applied to a semi-finished gear wheel, with the treatment focusing on the tip of the ferromagnetic steel gear wheel. The information was helpful in the design of such equipment.

[6332] *Robust Methodology to Extract the Electricity Consumption Patterns of End-Users Using Data Mining Techniques*

Răzvan Livadariu (Faculty of Electrical Engineering, Energetics and Applied Informatics “Gheorghe Asachi” Technical University of Iasi), Gheorghe Grigoras (The "Gheorghe Asachi Technical University from Iasi), Florina Scarlatache (Faculty of Electrical Engineering, Energetics and Applied Informatics “Gheorghe Asachi” Technical University of Iasi) and Bogdan Constantin Neagu (Gheorghe Asachi Technical University).

Abstract

In the paper, a Data Mining-based methodology to identify electricity consumption patterns that characterize the behaviour of end users in the low voltage active electric network of distribution network operators is proposed. It involves retrieving consumption data (active and reactive power profiles) from smart meters (at the central level, for example, house) and local sensors to collect information about household appliances and equipment to identify usage habits and preferences of end users. The methodology discovers the electricity consumption patterns and trends associated with each end user using data mining techniques based on clustering algorithms regardless of whether they are part of the

end-users' category. The proposed methodology used the data uploaded from the Pecan Street database sampled at 1 minute, ultimately identifying the consumption patterns of all equipment and appliances monitored at the level of end users. The patterns obtained will be integrated in the next stage where the energy consumption will be subject to an optimization process to reduce electricity bills for the end users.

[6363] *Assessing performance of long-range ZigBee for road infrastructure communications*

Valentin Iordache (National University of Science and Technology POLITEHNICA Bucharest), Marius Minea (National University of Science and Technology POLITEHNICA Bucharest), Andrei Razvan Gheorghiu (National University of Science and Technology POLITEHNICA Bucharest), Florin Badau (National University of Science and Technology POLITEHNICA Bucharest), Victor Stoica (National University of Science and Technology POLITEHNICA Bucharest) and Valentin Alexandru Stan (National University of Science and Technology POLITEHNICA Bucharest).

Abstract

The rapid advancement of Intelligent Transport Systems necessitates reliable and efficient communication between Vehicles and Infrastructure (V2I). ZigBee technology, known for its low power consumption and robust mesh networking capabilities, is a promising solution for such applications. This paper presents an empirical evaluation of long-range ZigBee communication in an interurban environment. This study examines how distance and antenna type affect communication performance for vehicle-to-infrastructure (V2I) systems. There were two main tests conducted on a straight, obstacle-free road. The first test, a radio range test, measured Received Signal Strength Indicator (RSSI) values to assess signal strength over different distances. The second test, a throughput test, evaluated communication reliability by measuring the average transfer ratio test and the number of successfully transmitted packets. The tests determined the maximum operational range of the communication modules, the overall performance of the technology, and the most suitable antenna type for V2I applications.

[6375] *Enhancing photovoltaic performance using artificial intelligence methods based on Fuzzy Logic*

Abdelkarim Ballouti (ENSA Tetouan), Mohamed Chouiekh (Faculty of Science Ain Chock, Hassan II University), Hatim Ameziane (National School of Applied Sciences Sultan Moulay Slimane University Khouribga), Alia Zakriti (ENSA Tetouan) and Youness Elmourabit (ENSA Tetouan).

Abstract

Maximum power point tracking (MPPT) methods for photovoltaic (PV) systems have evolved from traditional techniques such as incremental conductivity (IC) to more advanced artificial intelligence-based methods such as fuzzy logic controllers (FLC). This study systematically compares the efficiency of two MPPT methods, IC and FLC, under different temperature and solar irradiation conditions. The FLC dynamically adjusts the DC-DC converter's duty cycle to ensure accurate MPP tracking, while the IC uses traditional techniques to adjust the system operating point. Analysis in MATLAB/Simulink shows that FLCs consistently outperform ICs in energy efficiency, achieving efficiencies as high as 98% under certain illumination conditions. The results highlight the importance of fuzzy logic-based methods for optimizing photovoltaic system performance, especially in the context of climate fluctuations. This approach provides a fast, oscillation-free response and improves the overall efficiency of MPP tracking in dynamic photovoltaic environments.

[6453] *Designing of a new Medical Diagnostic System based on Blockchain and Artificial Intelligence technologies*

Cosmin-George Nicolăescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Florentina Magda Enescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre) and Nicu Bizon (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre).

Abstract

Research allows the integration of the most advanced technologies in the process of diagnosis and treatment of patients, such as Artificial Intelligence and Blockchain. The proposed platform is not only limited to providing an accurate diagnosis, but also allows a comparison to be made between the diagnosis, treatment plan and drug therapy prescribed to other patients with similar symptoms, existing in the database. The patient can choose the medical center and the doctor who will consult and diagnose him. As conclusions regarding the efficiency of this proposed system, the following are noted: the security of patient data, the accuracy of diagnosis and the benefits of using chat, which contribute to reducing the waiting time and improving the efficiency of the system, both for patients and for the staff of the medical center. The proposed platform allows a health system accessible to patients, to their requirements and obviously the transformation of the existing medical system.

[6520] *Comprehensive Analysis Of Cyber-Attack Techniques And Vulnerabilities In Communication Channels Of Embedded Systems*

Sebastian-Alexandru Drăgușin (National University of Science and Technology Politehnica Bucharest), Nicu Bizon (National University of Science and Technology Politehnica Bucharest) and Robert-Nicolae Boștinaru (National University of Science and Technology Politehnica Bucharest).

Abstract

The paper presents an exhaustive analysis of security in embedded systems, with a focus on identifying and managing vulnerabilities in communication channels. The introductory chapter highlights the importance of a comprehensive analysis of these vulnerabilities, highlighting the basics of cryptography used in these systems. The paper explores the basic principles of cryptography and its role in securing communications, detailing specific cryptographic technologies and protocols. It also analyses potential weaknesses in communication channels in depth, providing concrete examples of vulnerabilities and approaches to detect them through machine learning. An enlightening chapter of the paper presents the various attack methods used to compromise security in embedded systems, including case studies of notorious attacks and ways to protect against them. Finally, the paper draws the conclusions obtained and indicates directions for further research in the field.

[6584] *Automated Recognition of Structures in Scanning Electron Microscopy Images Using Specialized Algorithms in MATLAB and Python: An Overview*

Valentina Marascu (Scientific Research Center in Mathematics, “Spiru Haret” University, Bucharest, Romania), Marius Iulian Mihailescu (Scientific Research Center in Mathematics and Informatics, “Spiru Haret” University, Bucharest, Romania), Stefania Loredana Nita (Department of Computers and Cybersecurity “Ferdinand I” Military Technical Academy Bucharest, Romania) and Marius Rogobete (Harman International, Bucharest, Romania).

Abstract

Applied physics serves as the bridge connecting theoretical principles with their practical implementations in everyday situations. Informatics plays a crucial role in this subject because of its comprehensive and intricate capacity to simulate and forecast physical phenomena. This research highlights the indispensability of computer-based tools for analyzing the Scanning Electron Images of the obtained materials, particularly materials synthesized by plasma. Herein, the conducted research highlights the

advantages of image processing via Matlab and Python algorithms, and frameworks, in order to analyze the synthesized structures. Furthermore, the gathered materials offer fresh perspectives on physical processes by employing image processing techniques. Optimization approaches were used and future directions were identified.

[6602] *A hybrid approach for maximum power point tracker on PV systems.*

Ely Ondo Ekogha (Tshwane University of Technology) and Pius Adewale Owolawi (Tshwane University of Technology).

Abstract

As the usage of photovoltaic is emerging to palliate the degradation of the atmosphere and the natural environment. Photovoltaic (PV) systems appear to be the key for green energy production for households and industrial sectors. However, due to the dynamic change of load for a PV system or the variations of weather conditions, most PV systems are equipped with a maximum power point tracker (MPPT) to operate at their optimum capabilities. However, the efficiency of the MPPT controller varies from the techniques and algorithms used thus affecting the operations of the PV system. This paper proposes a hybrid technique based on Artificial neural network (ANN) combines with perturbation and observation (P&O) or incremental conductance (IC) algorithms using MATLAB Simulink for tracking the ideal maximum power point under uniform and sudden change of weather conditions. A comparison is depicted with conventional techniques, the findings suggest that the hybrid ANN-IC technique has an improved accuracy of 98% and response time 0,154 seconds to MPP under uniform weather. The model presents a fast-tracking response under rapidly changing conditions for a convergence time of 1,013 us.

[6831] *Economic Dispatch Using Harris Hawks Optimization with Renewable Energy Source and Capacitor Shunt*

Murtadha Al-Kaabi (Ministry of Education), Ahmed Naeem Abdul Saheb (Department of Electrical Engineering, Urmia University, Urmia, Iran) and Daryoush Nazarpour (Department of Electrical Engineering, Urmia University, Urmia, Iran).

Abstract

In this article, Harris Hawks Optimization (HHO) is the optimization technique that was proposed to solve economic dispatch (ED) problems. This optimization technique was inspired by one of the most intelligent birds, Harries Hawks. Managing active and reactive power in transmission networks significantly influences their performance. To improve the performance of transmission networks, the mechanisms for determining the location of renewable energy sources (RES) and capacitor shunts (CS) are the most popular and important. Voltage stability index represents the indicator used to select the optimal placement. The optimal sizing of RES and CS has been performed using the HHO algorithm. This paper has presented four scenarios: the initial case (only power flow), optimal power flow using HHO, optimal power flow using HHO after installing CS source, and optimal power flow after installing RES. In these scenarios, two of the most popular objective functions (OFs) was proposed, which are the total fuel cost of generators and emissions issued by fossil fuels to achieve economic and environmental benefits. Integrating a local search scheme improves the search space's capability and enhances the exploration rate, facilitating the discovery of a global solution. To prove the efficiency of HHO performances, the IEEE 30-bus is the standard network that has been applied. The numerical results and simulation confirmed the performance of HHO in searching for global solutions and preventing local solutions. The comparison among the results obtained by HHO and meta-heuristic optimization techniques confirmed the superiority and efficiency of HHO algorithm.

[6836] *Driver Behavior Assessment with Different ML Models Using EEG and Physiological Data - A Comparative Study*

Sama Hussein Al-Gburi (National University of Science and Technology Politehnica Bucharest (UNSTPB)), Kanar Alaa Al-Sammak (National University of Science and Technology Politehnica Bucharest (UNSTPB)), Khattab M. Ali Alheeti (University of Anbar), George Suciu (National University of Science and Technology Politehnica Bucharest (UNSTPB) and BEIA Consult International) and Abedulqader Gailan Abdulqader (Ministry of Education).

Abstract

Ensuring road safety is becoming more and more significant for researchers and for all the society. One of the main issues in this area considers driver drowsiness. Therefore, the focus of this paper is the comprehensive analysis and comparison of four distinct machine learning models: Logistic Regression, Random Forest, Support Vector Machine (SVM), and Gradient Boosting. The ultimate goal is to gain insights into the intricate factors that shape driver behavior. When assessing the effectiveness of each model, four key metrics are taken into account: precision, recall, F1 score, and accuracy. In this study, we used a "TRYOUT" dataset. The study yielded several significant findings regarding the performance of the machine learning models employed. Remarkably, the accuracy scores for all models were notably high, falling within a range of 0.8651 to 0.9999. Among all the models, the Random Forest model stood out as the most effective, displaying an impressive accuracy score of 0.9999 on the merged data. The SVM model, while not as proficient as the Random Forest, still managed a respectable performance, particularly on the MPM39 dataset where it achieved an accuracy of 75.06%. The Logistic Regression model demonstrated its strength on the CVD08 dataset, although its performance was comparatively weaker on the other datasets. Lastly, the Gradient Boosting model demonstrated consistent competency across all datasets, underscoring its reliability in a range of circumstances.

[7014] *Enhancing 3D Printing Infill Quality through Advanced Machine Learning*

Alexander Wang (MaClay School), An-Tsun Wei (Florida State University), Hui Wang (Florida State University) and Hongmei Chi (Florida A&M University).

Abstract

Abstract: As 3D printing technology revolutionizes manufacturing processes, the quest for improving print quality remains paramount. This research paper explores novel avenues for enhancing infill quality in 3D printing by applying advanced machine-learning techniques. Traditional infill patterns often face structural integrity and overall print performance challenges. Leveraging machine learning algorithms, we propose a comprehensive approach to optimize infill patterns based on critical parameters such as printing speed, Acceleration, and material utilization. This study underscores the transformative potential of artificial intelligence in the realm of 3D printing, paving the way for more innovative and sustainable manufacturing practices. The research establishes algorithms to support quality control for optimizing 3D printing parameters, predicting mechanical performance, and evaluating 3D-printed products. We allow the end-user and practitioner to reduce the calibration (ramp-up) time for obtaining the part with good infill quality and improve the productivity of part production.

[7040] *Membrane electrode assemblies fabrication by ultrasonic – spray technique*

Elena Marin (National Research and Development Institute for Cryogenic and Isotopic Technologies – ICSI Rm. Valcea), Anisoara Oubraham (National Research and Development Institute for Cryogenic and Isotopic Technologies – ICSI Rm. Valcea) and Adriana Marinoiu (National Research and Development Institute for Cryogenic and Isotopic Technologies – ICSI Rm. Valcea).

Abstract

The following discusses the method and advantages of ultrasonic deposition of carbon-based platinum ink solution onto catalytic membranes in the manufacture of fuel cells. Ultrasonic spray coating is a unique spraying technology, which is a spraying method based on ultrasonic spray nozzles technology. The sprayed material is first in a liquid state, and the liquid can be a solution, a sol, a suspension, etc. The liquid ultrasonic coating is first atomized into fine particles by an ultrasonic atomization device, and then evenly coated on the surface of the substrate by a certain amount of carrier gas, thereby forming a coating or film. Catalytic ink is a mixture of catalyst powder, water, solvent and ionomer, in suspension form.

[7053] *Hydrogen Production and Storage Methods: Recent Trends and Technologies*

Doğan Çelik (Electrical and Electronic Engineering, Van Yuzuncu Yıl University, Van, Turkey).

Abstract

Hydrogen is an emerging technology that offers a sustainable energy pathway for the transportation industry and buildings. It can help reduce environmental pollution and climate change. In this context, this paper investigates hydrogen production and storage methods to calculate carbon emissions (CEs) of an electrical energy system and assess the environmental benefits of carbon reduction. An analytical model for carbon emission flow (CEF) in the electricity network is addressed to evaluate the carbon emission. The case study results are presented to evaluate CO2 emissions and average emission intensity concerning hydrogen production. This paper provides a thorough investigation of the hydrogen energy landscape with future implications. By emphasizing this unique focus, it is envisaged that the literature will be enriched and the understanding of hydrogen as a promising energy source will gradually increase.

[7073] *Cybersecurity of Online Financial Systems using Machine Learning Techniques*

Sorin-Ionuț Mihali (Military Technical Academy "Ferdinand I") and Ștefania-Loredana Niță (Military Technical Academy "Ferdinand I").

Abstract

With the rapid expansion of online financial systems, ensuring their security against fraud has become essential. This work focuses on using machine learning techniques to improve the cybersecurity of these systems. The proposed solution includes an architecture that integrates various components such as Java Server, Web Customer, Mobile Customer, Python Server and data storage mechanisms. The fraud detection algorithm, the characteristics of the dataset and the evaluation metrics used in the implementation of the solution are presented. The system gives priority to security measures, such as encryption, authentication, authorization and safe communication protocols. The results demonstrate the efficiency of the system, by improving the rate of fraud detection. Future directions involve additional customization based on the user's behavior, real-time data analysis, but also a logging system based on the characteristics of the mobile device.

[7077] *Low Power High Speed Inverter Based Differential Input Dynamic Comparator*

Venkata Nandini Thella (Vignan's Foundation for Science, Technology and Research (Deemed to be University)), Bhavya Sri Singaraju (Vignan's Foundation for Science, Technology and Research (Deemed to be University)), Jagadeesh Rali (Vignan's Foundation for Science, Technology and Research (Deemed to be University)), Rakshitha Raghavarapurapu (Vignan's Foundation for Science, Technology and Research (Deemed to be University)), Posani Vijayalakshmi (Vignan's Foundation for Science, Technology and Research (Deemed to be University)) and Avireni Srinivasulu (Mohan Babu University, Tirupati -517102, Andhra Pradesh (State), India).

Abstract

High-speed, High-resolution ADCs are increasingly used in communication applications, where the need for dynamic comparator arises. This paper proposes a low power high speed inverter based differential input cascode cross-coupled dynamic comparator. By using the inverter based differential input concept to the existing cascode architecture low power consumption was achieved. Due to increased transconductance the design works at low voltages too. The proposed design and existing designs are simulated in 45nm technology, illustrating that the proposed comparator has a significant benefit in power consumption. It produces a low power of 15.89 pW.

[7209] *Constraints on Planar and Planar Interdigital Capacitors used in Sensors*

Horia-Nicolai Teodorescu (TU Iasi).

Abstract

Based on geometric considerations, we derive an approximate relation between the capacitance of a planar capacitor and the maximal frequency operation according to the basic formula of planar capacitors in electrostatics. The reciprocal formula results for maximal capacitance of a planar capacitor at a given frequency, for operation under the same electrostatic hypothesis. The formulae involve the square root of the ratio of the dielectric thickness to the relative dielectric constant, and a shape factor. Similar conditions are derived from geometric and EMI considerations. The results are extended to interdigital capacitors. Design considerations and limitations of the use of comb capacitive sensors in flexible circuits and in wearable devices are exposed. The main concern is the driving signal frequency and the electromagnetic interference (EMI). The discussion avoids the use of Smith charts, where the value of the inductance is required.

[7357] *Parabolic Trough Plant Performance In Morocco For Techno-economic Evaluation: A Case Study Of Noor 1*

Aabla Yahya (Higher National School of Arts and Crafts (ENSAM), University of Moulay Ismail,Meknes, Morroco.), Mourad Yessef (LIMAS Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fes, Morocco.), El Ghali Bennouna (Green Energy Park (UM6P/IRESEN), Benguerir, Morocco.), Ahmed Lagrioui (Higher National School of Arts and Crafts (ENSAM), University of Moulay Ismail,Meknes, Morroco.) and Noureddine Boutammachte (Higher National School of Arts and Crafts (ENSAM), University of Moulay Ismail,Meknes, Morroco.).

Abstract

Noor 1 is a parabolic trough concentrating solar power (CSP) plant in Morocco, about 10 km to the north-east of Ouarzazate. It concerns the first and largest cylindrical-parabolic mirror complex in Africa. With a nominal capacity of 160 Mwe, the plant covers 480 hectares of solar field. Masen is operating the project, which cost over 7,000 million MAD, while Acwa Power, a Saudi group, owns and operates it on a BOOT basis. Comparative analysis reveals that Noor 1 costs 1.62 dirhams per kWh. Although officially placed at the end of 2015, the plant's commercial operation date is January 26, 2016. In this study two configurations are employed for the simulations, leveraging the System Advisor Model tool to assess each model's performance. A critical review of these configurations was conducted by comparing the input-output correlations against actual data reported from the Noor 1 plant. This review process allows evaluation of the accuracy and reliability of each model, ensuring the simulated outputs closely match real-world operational data. This correlation analysis provided insights into the models' robustness, facilitating informed adjustments and optimizations for accurate techno-economic evaluations.

[7430] *RLIDT: A Novel Reinforcement Learning-Infused Deep Transformer Model for Multivariate Electricity Load Forecasting*

Seyed Mohammad Jafar Jalali (Edith Cowan University), Fateme Fahiman (University of Melbourne) and Mahdi Khodayar (University of Tulsa).

Abstract

Electricity load forecasting plays a crucial role in the management of electricity power grids, enhancing operational efficiency, ensuring network reliability, facilitating infrastructure planning, and promoting energy sustainability. As the complexity of energy consumption patterns increases, traditional forecasting techniques struggle to accommodate the intricate and nonlinear temporal dynamics characteristics present within the data. This paper introduces a novel hybrid model called RLIDT that merges reinforcement learning (RL) with the deep transformer architecture to address the complicated challenges associated with load forecasting effectively. The integration of RL for hyperparameter optimization within the transformer framework not only utilizes their respective advantages but also provides a dynamic, adaptive model that exhibits versatility, robustness, and enhanced predictive accuracy through continuous learning. The experimental investigations conducted on real-world datasets have clearly demonstrated the remarkable advantage of the proposed RLIDT model when compared to traditional methods.

[7442] *Cryptographic Services Based on Cellular Automata in Image Encryption*

George Cosmin Stanica (National University of Science and Technology POLITEHNICA Bucharest, Pitesti University Centre), Stefan Octavian Stanica (National University of Science and Technology POLITEHNICA Bucharest, Pitesti University Centre) and Petre Anghelescu (National University of Science and Technology POLITEHNICA Bucharest, Pitesti University Centre).

Abstract

Image encryption is vital for safeguarding sensitive visual data as it moves over different networks or gets stored in digital formats. Recently, cellular automata (CA) have emerged as promising tools for this task, thanks to their capability to produce intricate and chaotic patterns. This study introduces an encryption algorithm based on cellular automata rules 90 and 150. These rules are chosen for their distinct attributes in creating pseudo-random sequences, which serve for scrambling the pixel values of the input image. Experiments carried out on the results, including comparing histograms between the original and encrypted images, along with statistical analyses, illustrate the effectiveness and efficiency of the proposed encryption approach in ensuring security.

[7501] *Analytical concepts of causal inference and intensification of data prioritizing meta-heuristic approach*

Zdzislaw Polkowski (Jan Wyzykowski University, Polkowice, Poland), Jyoti Prakash Mishra (Gandhi Institute for Education and Technology, Bhubaneswar, Odisha, India) and Sambit Kumar Mishra (Gandhi Institute for Education and Technology, Bhubaneswar, Odisha, India).

Abstract

In general data science is the prioritization on large size data provisioning multidisciplinary approach towards extraction of meaningful insights in general as well as business applications. In this context, general purpose programming languages have already been thought of in which the basic importance has been provisioned towards code readability with transparency. As the direct involvement may be on multiple programming paradigms, the interpreters associated with the conceptualized programming environment can be provisioned with many operating systems. Somehow due to structured programming approach, the linkages can be associated towards functional programming as well as aspect oriented and logic programming. In many situations, it has been observed that the dynamic implementation can be initiated provisioning specified sequenced references in memory management. Accordingly, the programming languages associated with the features of binding methods can be properly sequenced during program

execution. As per maximum extensibilities of some specific programming languages, the programmable interfaces towards existing applications can enhance the feasibilities with the existing applications. In practical situation, analysis of the huge amount of heterogeneous data implementing learning principles is possible to focus on meaningful intelligent applications to maximize the outcomes from each and every stage of application. As it is understood that modeling data with predictive analysis is quite feasible using intelligent agents as well as meta-heuristic approaches, accordingly in this work,the meta-heuristic technique has been prioritized to focus on causal inference with intensification data.

[7536] *Design of Comparator and Binary Amplitude Shift Keying Modulator using CCCII*

Syed Zahiruddin (K.S.R.M.College of Engineering, Kadapa, A.P, India), Papisetty Sai Prasad (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Sidhavarapu Sri Yaswitha (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Regatipalli Kamal Teja (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Ramavath Ravindra Naik (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Sampangi Jayachandra (Mohan Babu University (Erstwhile Sree Vidyanikethan Engineering College), Tirupati, India), Musala Sarada (Vignan University (VFSTR Deemed to be University)), Bhargav Appasani (Kalinga Institute of Industrial Technology, Bhubaneswar), Cristian Ravariu (University Politehnica of Bucharest, Bucharest, Romania) and Avireni Srinivasulu (Mohan Babu University, Tirupati -517102, Andhra Pradesh (State), India).

Abstract

A novel circuit for the design of Second Generation Current Controlled Conveyor (CCCII) based Comparator and Binary Amplitude Shift Keying (BASK) modulator are proposed. Comparators find applications in almost every field related to the electronics and BASK find applications in the areas of wireless communications, RFID systems, Infrared (IR) remote controls, Digital Audio Broadcasting, Data Communication over Power Lines, Testing and Prototyping, Control Systems and Industrial Automation. The two topologies are designed using single CCCII and is tested using Cadence Virtuoso simulator tool with 45nm technology files and found satisfactory. Delay and power dissipation are also calculated for the proposed topologies

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[8182] *Architecture Model for the Verification and Identification of Inappropriate Products by the Consumer - supported by IoT, Blockchain and AI*

Florentina Magda Enescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Cosmin-George Nicolăescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Nicu Bizon (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Valeriu Manuel Ionescu (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre), Constantin Marius Marica (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre) and Robert-Nicolae Boștinaru (National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre).

Abstract

This study presents a realistic and comprehensive framework for creating food traceability and safety from producer to consumer and adds to the expanding body of knowledge on Internet of Things, blockchain and Artificial Intelligence applications. More than ever recently, quality controls of various foods have been carried out. These revealed a series of problems from the point of view of their contamination with a larger than normal amount of harmful elements for the body. The lack of possibility and quick information of the consumer who wants to purchase a certain product was found. This research aims to offer the consumer, through the use of an application, the opportunity to find out about the origin, composition and method of obtaining each product before it is purchased. When obtaining these performances, the new technologies such as the Internet of Things, Blockchain and Artificial Intelligence appear, to be tested in certain research areas, and then to be used on a large scale. The combined use of the Internet of Things,

Blockchain and Artificial Intelligence have contributed to the realization of a new architecture and the respective creation of a new operating platform in commercial spaces that offer special products to consumers. The proposed platform is not only useful for the consumer, but also for the authentic producers and all the intermediaries that intervene in the circuit of the products from the producer to the consumer.

[8271] *Impact of Neuro/placebo-feedback on The Performance of Attention: Subjective and Objective Considerations*

Bingzhao Zhang (School of Automotive Engineering, Wuhan University of Technology), Tianran Chen (School of Automotive Engineering, Wuhan University of Technology) and Lirong Yan (School of Automotive Engineering, Wuhan University of Technology).

Abstract

Neurofeedback training (NFT), as a method of self-regulating brain activity, may be beneficial in improving subjective and objective attentional performance or attentional network efficiency. In this pilot study, we investigated how sensorimotor (SMR)/theta NFT or placebo-feedback training (PFT) can improve the attentional performance and the electrical activity of the brain. An experimental program of attention training based on the Electroencephalogram (EEG) neurofeedback method, 5 sessions of neurofeedback training, and a total of 5 weeks was designed. We use response time of attention network test (ANT) and completion time of Schulte grids to measure objective attentional performance, and three attention scales to measure subjective attentional performance. The results showed that subjects in the NFT group had a significant improvement in SMR/theta and SMR power, but not theta power. Whereas PFT did not improve these three rhythms Subjective attention scores improved in the NFT and PFT groups, with significant decreases in response time for both Schulte's square and ANT. The NFT group showed a statistically significant improvement in executive control network whereas PFT did not. NFT could be seen as a useful non-invasive, non-pharmacological tool to strengthen the executive control network, enabling people to improve cognitive flexibility.

[8398] *Enhancing Interpretability, Reliability and Trustworthiness: Applications of Explainable Artificial Intelligence in Medical Imaging, Financial Markets, and Sentiment Analysis*

Afreen Sorathiya (Dwarkadas J. Sanghvi College of Engineering), Jinal Mehta (Dwarkadas J. Sanghvi College of Engineering), Vineet Chotaliya (Dwarkadas J. Sanghvi College of Engineering) and Dr. Kriti Srivastava (Dwarkadas J. Sanghvi College of Engineering).

Abstract

In today's technological era, as AI systems become more integral to critical decision-making, the importance of Explainable Artificial Intelligence (XAI) has become more pronounced. It addresses the challenge of understanding complex machine learning and deep learning models, ensuring transparency, interpretability, and accountability. This research paper provides a comprehensive analysis of XAI, focusing on its significance, methodologies, challenges, and future prospects. Theoretical foundations of XAI are elucidated, clarifying key concepts such as interpretability, transparency, and accountability. We differentiate between model-agnostic and model-specific XAI methods, outlining their strengths and limitations. A range of recent XAI techniques, including Local Interpretable Model-agnostic Explanations (LIME), SHapley Additive exPlanations (SHAP), and Gradient-weighted Class Activation Mapping (Grad-CAM), are scrutinized. Through case studies in Healthcare (Pneumonia Classification), Finance (Stock Price Prediction), and Entertainment (Sentiment Analysis), we demonstrate how XAI enhances the understandability and trustworthiness of AI systems. Additionally, a comparative study of all three methods on all three case studies has been conducted, and the results are compared. Challenges such as scalability issues and ethical considerations, including biases and fairness, are discussed. Looking ahead, we offer

insights into future XAI research trajectories, aiming to foster public trust and shape a future where AI systems are both intelligent and comprehensible.

[8512] *Unveiling Veracity: An Integrated Semi-Supervised Algorithm for Fake News Detection*

Aman Malik (BITS Hyderabad), Dayal Kumar Behera (KIIT University, Bhubaeswar), Amulya Ratna Swain (KIIT University, Bhubaeswar) and Jhalak Hota (KIIT University, Bhubaeswar).

Abstract

In recent years, the pervasive dissemination of misinformation and deliberately falsified content, commonly referred to as "fake news," has become a critical challenge in the realm of information dissemination. With the exponential growth of digital media and online platforms, the ease and speed at which misleading information can be generated and spread have increased substantially. Addressing the formidable task of detecting fake news has thus become an imperative within the field of information technology. The supervised model gives promising results. However, the availability of labelled data is critical in the realm of fake news detection. Leveraging unlabeled data alongside labelled data is an effective approach, but it requires careful handling. This paper explores the application of Semi-Supervised Learning for fake news detection by integrating Label Propagation and various ML models as base classifiers. By leveraging both labelled and unlabeled data, Label Propagation with CatBoost Classifier seeks to overcome traditional limitations, offering a promising avenue for bolstering the reliability of automated systems in distinguishing between authentic and deceptive information in the vast landscape of digital content.

[8615] *Analysis of Vulnerabilities in Communication Channels using an Integrated Approach based on Machine Learning and Statistical Methods*

Sebastian-Alexandru Drăguşin (National University of Science and Technology Politehnica Bucharest), Nicu Bizon (National University of Science and Technology Politehnica Bucharest), Robert-Nicolae Boştinaru (National University of Science and Technology Politehnica Bucharest), Florentina-Magda Enescu (National University of Science and Technology Politehnica Bucharest), Rodica-Mihaela Teodorescu (National University of Science and Technology Politehnica Bucharest) and Corina Săvulescu (National University of Science and Technology Politehnica Bucharest).

Abstract

This paper investigates potential weaknesses in embedded systems communication channels, with a focus on identifying and analyzing specific vulnerabilities. The problem of securing communication in embedded systems is critical due to the increasing reliance on these systems in various industries, from automotive to healthcare, where breaches can lead to significant safety and security risks. To address this issue, the study employs a multi-faceted approach using machine learning and statistical methods for vulnerability detection. Machine learning techniques, such as supervised learning algorithms, were utilized to identify patterns indicative of potential security breaches. Additionally, Markov Chains were applied to model and analyze the probabilistic behavior of communication sequences, identifying anomalies that could signify vulnerabilities. A practical application was developed using virtual instrumentation in LabVIEW, providing a user-friendly interface for real-time vulnerability detection and analysis. The results demonstrate that the combined use of machine learning and statistical methods significantly improves the accuracy and efficiency of detecting vulnerabilities in embedded systems communication channels. This research highlights the importance of integrated security measures and presents a robust framework for enhancing the security of embedded systems.

[8877] *IoT Cyber Attacks Detection - Survey*

Alaa Abdul Al Muhsen Hussain Al Zubaidi (University of Bucharest).

Abstract

The increased dominance of Internet of Things (IoT) devices has paved the way of improved connectivity and comfort. Since IoT and other technology types are mostly using the Internet as the connectivity medium, the new challenges of cyber security have also emerged. This review paper highlights the significance of Intrusion Detection Systems (IDS) by focusing on those implementations that secure IoT devices and related networks. The paper describes how the IDS have evolved over time and have become a sophisticated tool of securing the network traffic and computer applications. The paper describes the unique challenges of the IoT environment and its distinct features that add additional complexities in building and using IDS. The paper presents a comprehensive and comparative analysis of the techniques of intrusion detection. Different datasets and evaluation metrics have also been discussed and how the edge computing can optimize the system bandwidth and data routing. The paper highlights how the machine learning techniques and the concepts of artificial intelligence have assisted in developing effective IDS and how these technologies can provide an effective threat defense mechanism by implementing anomaly detection and deep learning techniques.

[8904] ***Short Review on Current Trends in the Nanomaterials Elaboration***

Elena Andreea Onache (University Politehnica of Bucharest).

Abstract

Nanomaterials have become important materials used in various fields due to their small size (<50 nm). Since the 1990s, nanotechnology has become a widespread term as it has various industrial applications. Nanomaterials research is a rapidly evolving field with new discoveries and applications emerging all the time. Currently, nanoparticles are indispensable for many industries such as pharmaceuticals, electrical, automotive, nautical. The article aims to present the current trend in nanomaterials elaboration. Every type of method highlights the technological parameters and advantages.

[8921] ***Using Dual Type 2 Fuzzy Logic Technique to Increase Performance of the Wind Turbine System***

Sara Kadi (Power equipments Characterization and Diagnosis Laboratory (USTHB) Algiers, Algeria), Habib Benbouhenni (Department of Electrical & Electronics Engineering, Nisantasi University, 34481742 Istanbul, Turkey) and Nicu Bizon (Faculty of Electronics Communication and Computers, University POLITEHNICA Bucharest, 110040 Pitesti, Romania.).

Abstract

This paper outlines a Maximum Power Point Tracking (MPPT) method based on the Tip Speed Ratio (TSR) of a singular wind turbine system, operated by a doubly fed induction generator (DFIG). The conventional MPPT approach using a proportional-integral (PI) controller faces multiple challenges, including those related to maintaining the system's stability and performance during steady state. To realize a more efficient variable-speed wind turbine system, MPPT strategies rooted in Artificial Intelligence, namely Type 1 and Type 2 Fuzzy logic control (T1-FLC and T2-FLC respectively). The proposed MPPT techniques' effectiveness is validated using numerical simulations executed via Matlab software. The derived results demonstrate the efficacy of our proposed MPPT strategies, with a notable preference for T2-FLC over T1-FLC and the traditional PI control.

[8997] ***Effective Sparse Reconstruction Algorithms for Compressed ECG Sensing with Deterministic Binary Block Diagonal Sensing Matrix***

Jayarani Medakal Anirudhan (Indian Institute of Technology, Palakkad, India), Sabarimalai Manikandan M (Indian Institute of Technology Palakkad, India) and Subrahmanyam Mula (Indian Institute of Technology Palakkad, India).

Abstract

For low-power, energy-efficient wearable edge health devices and health monitoring systems, compressed sensing (CS) achieves significant advances by sampling at sub-Nyquist rates for sparse signals such as electrocardiograms (ECG). The paper attempts to explore the best sparse reconstruction algorithm, along with a sparsifying matrix composed of a discrete cosine (C) and a discrete sine (S) basis [C S] and a deterministic binary block diagonal (DBBD) sensing matrix. The six different sparse reconstruction algorithms used for the recovery of CS ECG are orthogonal matching pursuit (OMP), approximate message passing (AMP), L1- minimization (L1-min), compressive sampling matching pursuit (CoSaMP), iterative hard thresholding (IHT), and iterative soft thresholding (IST). The ECG signals from 48 records of the MIT-BIH arrhythmia database (mitdb) were tested for CS reconstruction at compression ratios (CR) of 2.4, 3, 4, 4.8, 6 and 8. Further results showed that the combination of the OMP algorithm, the DBBD sensing matrix, and the basis [C S] surpassed the performance of other recovery algorithms in terms of lower average percentage root mean square difference (PRD). This combination achieved a lowest average PRD of 1.04 for the mitdb record 213, at a CR of 2.4. Although L1-min exhibits competitive performance with OMP in terms of PRD, OMP is computationally simpler than L1-min with a shorter recovery time.

[9007] *Securing the Internet of Medical Things: AI-Based Intrusion Detection*

Mariam Ibrahim (Department of Mechatronics Engineering German Jordanian University Amman, Jordan), Ruba Elhafiz (Department of Mechatronics Engineering German Jordanian University Amman, Jordan), Haneen Okasha (Department of Biomedical Engineering German Jordanian University Amman, Jordan) and Abdallah Al-Wadi (Department of Mechatronics Engineering German Jordanian University Amman, Jordan).

Abstract

Recent advancements in the Internet of Medical Things (IoMT) have had an influence on traditional medical treatment and developed data communications in the Smart Healthcare scenario. Unfortunately, this has created a fruitful ground for adversaries. As a consequence, classic intrusion detection (ID) schemes as well as innovative detection strategies for IoMT applications have been implemented. Examining the call sequences made by the system processes is one way for determining a typical system behavior. In this paper, an ID system built on Multinomial Naive Bayes was developed. The suggested ID model performed well considering accuracy, detection rate, and false alarm rate.

[9040] *Parameters optimization to minimize the power dissipation of FiNFET 7 nm*

Abdelaziz Lazzaz (Laboratoire des Sciences de la Matière Condensée (LSMC), Université d'Oran 1), Khaled Bousbahi (ESGEE d'Oran) and Mustapha Ghamnia (Laboratoire des Sciences de la Matière Condensée (LSMC), Université d'Oran 1).

Abstract

FinFET device represents one of the options to settle and to overcome the Short Schannel Effect (SCE). In this paper, a layout based FinFET design approach have been presented at 7 nm node technology using Spice model. The electrical performance and characteristics of both N and P device has been studied to realize the CMOS circuits such as CMOS NOT gate, CMOS NOR and CMOS NAND. An impact parameters of load capacitance (CL), supply voltage (VDD) and gate width (Wgate) has been study on the total power to have optimal CMOS circuit. The simulation results show that the minimum total power can reach with Wgate=16 nm and VDD=0.65 V for CMOS NOR gate. The optimal load capacitance is 0.5 fF for CMOS NOT Gate.

[9074] *Cloud and AI Fusion: Revolutionizing Electronic Evidence Admissibility in the Digital Age*

Kanika Pandit (Chandigarh University) and Renu Mahajan (Chandigarh University).

Abstract

The combination of artificial intelligence (AI) and cloud computing has resulted in significant alterations to the admissibility rules for electronic evidence in modern legal situations. Due to cloud-based services, data processing, storage, and access have completely changed, presenting both new opportunities and challenges for the area of electronic evidence. New standards are needed as cloud platforms become more widespread in order to handle issues with data integrity, chain of custody, and authentication in a virtualized and decentralized context. The swift advancement of computer technology and Internet technology in our nation coincides with a growing prevalence of computer network crime. This paper addresses how artificial intelligence and cloud computing are combined and how it affects the admissibility of electronic evidence.

[9092] *Artificial Neural Network Models For Time Series Smoothing And Holt Trend Analysis*

Kazeem Bankole (Georgia Southern University), Felix Hamza-Lup (Georgia Southern University) and Ionut Iacob (Georgia Southern University).

Abstract

We show how to create Artificial Neural Network based models for performing time series exponential-like smoothing and the well-known Holt time series analysis. Our work fares well compared to the well known Holt time series analysis and prediction method, while avoiding the burden of searching for the parameters of the model. We present the theoretical justification of the connection between the two models and experimental results showing the similarities of these models.

[9136] *Complex System for Monitoring Environmental Factors at the Galata Platform in the Black Sea*

Cristian Beceanu (Beia Consult international), Madalin Silion (Beia Consult international), George Suciu (Beia Consult International), Lucian Luminaroiu (Beia Consult International), Stefan Stefanescu (BEIA CONSULT INTERNATIONAL), Cornelia Alexandru (Beia Consult International), Maria-Laura Rosu (Beia Consult International), Ioana Taranu (Beia Consult International), Lucian Necula (Beia Consult Internațional S.R.L), Mariana Panaitescu (Constanta Maritime University), Fane-Viorel Panaitescu (Constanta Maritime University Faculty of Naval Electromechanics), Andrei-Alexandru Scupi (Constanta Maritime University Faculty of Naval Electromechanics), Ionut Voicu (Constanta Maritime University) and Gabriel Raicu (Constanta Maritime University Faculty of Navigation and Maritime Transport).

Abstract

Offshore wind represents a highly efficient, environmentally friendly, and scalable source of power. In the offshore area, wind turbines are usually anchored on the seabed at less than 50 meters depth. However, floating offshore wind technology is anticipated to revolutionize energy production in deeper ocean areas. Within the Black Sea FLoating Offshore Wind (BLOW) project, the main goal is to analyze the efficiency of capturing the wind potential in the Black Sea basin. It aims to achieve this by showcasing an innovative and cost-effective floating unit tailored for low-to medium-wind speed conditions in the Black Sea. The project's pilot initiative seeks to enhance regional energy security while improving the cost-effectiveness of wind energy. This is proposed through the integration of turbines and floats into a semi-submersible structure with a pyramid design. Additionally, the project will feature advanced elements such as an innovative mooring system, subsea monitoring with predictive maintenance, a digital twin for operational optimization, and grid integration control techniques. The BLOW project aims to implement a pilot project

involving a 5 MW wind turbine in the Black Sea. The transition to sustainable energy in the region will be accelerated by stimulating synergies with the oil and gas sector, as well as developing cross-border policy. The energy cost price level estimated by BLOW varies between 87 EUR/MWh and 50 EUR/MWh (until 2028 and after 2030). The impact on environmental factors will be reduced by at least 40% through the innovative construction.

[9227] *Monitoring, control and optimization of wastewater treatment plants: a brief review*

Popescu Gheorghe (National University of Science and Technology Politehnica Bucharest) and Bizon Nicu (National University of Science and Technology Politehnica Bucharest).

Abstract

Wastewater treatment processes are essential components in ensuring water quality and protecting the environment. In order to obtain effective results in these installations, the monitoring, control and optimization of process-specific parameters in wastewater treatment plants are very important. In this context, this paper presents an analysis of the different methods used to monitor, control and optimize process-specific parameters in wastewater treatment plants. These methods include classical rule-based control, methods based on mathematical models and simulations, evolutionary algorithms, machine learning techniques and artificial intelligence. Each method is examined in terms of advantages, limitations and areas of application, providing a comprehensive view of the available solutions. In addition, aspects related to the practical implementation of these methods in real wastewater treatment plants are discussed, as well as future trends in their research and development. Appreciation and proper application of these methods can contribute significantly to the efficiency and sustainability of wastewater treatment processes, with a positive impact on the environment and the community as a whole. The importance of wastewater treatment and the role of optimization algorithms in improving the efficiency of these biological wastewater treatment processes in sewage treatment plants is very high today. The discharge of mechano-biologically purified wastewater into natural outfalls manifests itself on various levels, from affecting human health to complex problems of an ecological, technical and economic nature. Thus, as a new contribution to the literature, this study aims to review and analyze the history, current issues, and future directions of control of specific process parameters in wastewater treatment plants in the context of sustainable development. The study carried out in this paper will certainly lead researchers and industry partners towards the development of process optimization in sewage treatment plants.

[9251] *Online Laboratory Access Control With Zero Trust Approach: Twingate Use Case*

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Abstract

As educational institutions increasingly integrate remote (online) laboratories into their systems, the need for secure and efficient access to lab resources becomes paramount. While traditional Virtual Private Networks (VPNs) have historically served as the primary solution for remote access, they are not without limitations. In this paper, we explore how zero-trust networking access solutions (ZTNA) effectively address these limitations. We examine the advantages of ZTNA-based solutions compared to traditional VPNs, discuss the underlying principles of zero-trust, and illustrate a practical application of ZTNA in educational online labs through the utilization of Twingate, a novel ZTNA-based commercial solution.

[9363] *Flexible system architecture used to collect and store signals acquired by IoT devices*

Dan-Catalin Noje (University of Oradea), Ovidiu-Gheorghe Moldovan (University of Oradea), Ovidiu-Constantin Novac (University of Oradea), Mihaela Cornelia Novac (University of Oradea) and Radu-Catalin Tarca (University of Oradea).

Abstract

Part of the effort to develop predictive maintenance systems, especially when Digital Twins are used as part of this effort, special attention is paid to the data acquisition using IoT devices, data that uses as inputs for the predictive algorithms. Usually when a new IoT device is connected to a data management system, several configurations and sometimes even code changes should be made, which increase the implementation costs and the implementation duration. The goal of this paper is to propose an architecture for a data management system that permits to connect a new IoT device to it such that the configurations to be made automatically on demand and to allow the IoT device to push the acquired data without any other intervention.

[9526] *Development, Implementation and Testing of the Application for Measuring and Controlling the Concentration of Oxygen in Molten Lead*

Denisa Toma (RATEN ICN Pitesti), Nicu Bizon (National University of Science and Technology Politehnica Bucharest) and Alexandru Ionut Nitu (RATEN ICN Pitesti).

Abstract

Nuclear research, worldwide, is oriented towards the realization of a new generation of nuclear systems with improved performance. The technological challenges for Generation IV systems led to the definition of a framework plan composed of four directions: durability, economy, safety and reliability, and resistance against proliferation and physical protection. Generation IV systems come with a precise and practical response to the demand for clean and safe nuclear energy in modern society, fully satisfying the requirements of sustainable development. Regarding generation IV reactors, the European Union's option is to develop liquid metal (sodium or lead) or gas-cooled systems. The choice of lead as a coolant adds to operational safety given the high boiling point of lead (1745oC). However, under certain high-temperature conditions, lead has a corrosive effect on structural materials. That is why the choice of structural materials for the manufacture of reactor components is very important, and it is also very important to control the purity of lead by monitoring the concentration of dissolved oxygen. Therefore, the development of oxygen control methods and techniques is one of the critical issues for nuclear systems using liquid heavy metals as a coolant. The development and implementation of software for the acquisition of the parameters of interest for the mechanical test tests in the liquid lead environment requires a period in which the developer evaluates the necessary equipment that must be used and analyzes the way of integrating them into the installation so that everything function correctly when the software is finished, and the user can work as simply as possible with the graphic interface provided by the programmer. This paper presents the development of an application for measuring and controlling the concentration of dissolved oxygen in the liquid lead environment and also the way to implement this application in the command and data acquisition software of the mechanical testing machine in the liquid lead environment. After the implementation of the application, some preliminary tests were carried out, the results of which are presented in this paper.

[9635] *Vibroacoustic Diagnostics of Electronic Parking Brake System*

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Abstract

This article reports the new approach in the diagnostics of Electronic Parking Brake (EPB) Module, the electromechanic part that is used as literally electronic brake and in a hill-holder system. Each module contains the gear system, that consists of 4 rotating elements: pinion gear, worm gearbox, electric motor, and spur gear that can suffer the damage during its operation. In order to precisely define the defective element, we focus on its diagnostics with piezoelectric sensors, i.e. Micro Fiber Composite (MFC). Each of mounted piezoelectric sensors on the EPB's housing is sensitive to the vibrations during its operation. Recorded voltage time-series are used for the quantitative estimation of the module's condition with help of several statistical indicators. Such approach allows to state, which of elements generates high amplitudes and should be replaced. The proposed approach is the alternative to the diagnostics method applied in the company dealing with the regeneration of the EPB's modules.

[9670] *Advanced solutions on air conditioning in vehicles – A brief review*

Danilescu Florin (The National University of Science and Technology POLITEHNICA Bucharest, Pitești University Centre Pitesti, Romania) and Nicu Bizon (The National University of Science and Technology POLITEHNICA Bucharest).

Abstract

: This research paper reviews the technologies for optimizing automotive air conditioning systems that would ensure passenger comfort and well-being during travel, especially as the automotive industry moves toward electrification and sustainability. Critical analysis of proposed solutions for modern vehicle air conditioning systems focuses on advanced technologies that increase efficiency and sustainability while maintaining optimal performance. The study aims to show that the integration of air conditioning materials and components can improve engine performance to achieve high levels of energy efficiency and reduce fuel consumption. As the demand for environmentally friendly and efficient fossil fuel vehicles is increasing, recent research has focused on studying advanced engineering solutions and revolutionary technologies that will change and streamline the functions of classic car air conditioning systems in correlation with imposed energy efficiency performances and environmental care restrictions, proposing solutions for a sustainable and efficient future. Critically analyzing the research in the thermal management of motor vehicles carried out so far, the work exposes improvements from a technological point of view in the evolution of the cooling systems of the car interior that align with global climate changes and the need for more economical and sustainable transport solutions.

[9671] *Techniques for Measuring and Optimizing Dissolved Oxygen Concentration in a Liquid Lead Environment*

Denisa Toma (RATEN ICN Pitesti), Nicu Bizon (National University of Science and Technology Politehnica Bucharest), Mihai Oproescu (National University of Science and Technology Politehnica Bucharest), Viorel Ionescu (RATEN ICN Pitesti), Alexandra Jinga (RATEN ICN Pitesti), Livia Stoica (RATEN ICN Pitesti) and Sebastian-Alexandru Dragusin (National University of Science and Technology, Politehnica Bucharest).

Abstract

Owing to their superior thermal conductivity, heavy liquid metals (HLMs) are becoming increasingly important as heat transfer and storage media in energy-related technologies such accelerator-driven systems, generation IV (GEN IV) fast reactors, and concentrating solar energy. Molten lead and lead-bismuth eutectic (LBE) are examples of HLM that are aggressive against structural materials, which is one of its main drawbacks. Steel alloying elements' high solubility in lead (Pb) or LBE at high temperatures can cause HLM to selectively dissolve and penetrate, along with structural and phase changes, a decline in mechanical characteristics, and eventually failure. The existence of dissolved oxygen in the liquid metal phase has a significant impact on steel's performance in liquid metals. A continuous layer made of the

oxides of the steel's constituent elements may form on its surface if the oxygen content rises above a particular point, separating the steel from the liquid metal. Thus, diffusion through the oxide layer is required for the primary degrading mechanism of the liquid metal phase at low oxygen content, which is the dissolving of steel components. For the purpose of characterizing corrosion conditions and qualitatively analyzing the behavior of steel constituents, it is therefore sufficient to know the oxygen potential/activity, for instance through measurements using an electrochemical oxygen sensor. This paper aims to highlight the effects that dissolved oxygen has on liquid lead, to explain the need to monitor the residual oxygen concentration in the liquid metal, and also to present the main types of sensors with which this monitoring is done.

[9776] *VRES-CNN: A Tiny Convolutional Image Classifier with Versatile Choice of Hyperparameters*

Radu Dogaru (Dept. of Applied Electronics and Information Eng., National University of Science and Technology Politehnica Bucuresti) and Ioana Dogaru (Dept. of Applied Electronics and Information Eng., National University of Science and Technology Politehnica Bucuresti).

Abstract

Abstract— A novel lightweight convolutional neural network architecture is proposed, denotes as VRES-CNN. Unlike most of the actual lightweight architectures VRES-CNN provides a versatile set of hyper-parameters associated with variable number of macro-blocks. Moreover, the macro-block definition is rather simple and allows very good accuracies by emulating nonlinear convolutions. The use of residual connections, dropout, batch normalization and separable convolutions ensure very good accuracies with a relatively small complexity of the model. With a proper choice of the hyper-parameters, it is demonstrated that models with less than 100 kilo parameters and near state-of-the-art accuracy can be identified for a wide range of datasets (with low or high input image resolutions). In terms of accuracy performance, it is shown that VRES-CNN performs in the state-of-the-art range and much better than a recently proposed lightweight architecture (EtinyNet) for the same or smaller model size.

[9858] *Nonlinear Model Predictive Control of Quadrotor Using Direct Multiple Shooting*

Pham Duc Dai (Thuyloi University) and Bui Thi Hai Linh (Thuyloi University).

Abstract

Quadrotors have been applied to many areas. Control of the quadrotor for tracking the desired trajectory is challenging. This paper proposed to apply the nonlinear model predictive control to guide the quadrotor while getting collision free by using the concept of the hyperplane moving constraints. To address the NMPC, the multiple shooting method has been applied to discretize the optimal control problem to the nonlinear program (NLP) and it is efficiently solved by the standard NLP solver. Numerical computation has been shown that the application of the multiple shooting method gives the more efficient NLP with a less number of optimization variables.

[9879] *Techno-economic Feasibility Analysis for Electric Vehicle Solar Charging Station at Ufa International Airport- A Comparative Case Study*

Md Nafeez Rahman (Ufa university of science and technology), Nurislam Mukhamatullin (Ufa university of science and technology), Shamil Nezamutdinov (Ufa university of science and technology), Rasul Musin (Ufa university of science and technology) and Viacheslav Vavilov (Ufa university of science and technology).

Abstract

The cost of establishing renewable power plants is challenging for both public and private entities, as it will have an adverse effect on the economy. This includes the price of procuring and installing the required quantity of solar panels for electric vehicle charging stations with varying capacities, as well as the cost of obtaining electricity from a common network. In the proposed article, the techno-economic feasibility of establishing three different-sized solar power facilities in the parking area of Ufa International Airport for charging electric vehicles was analyzed. The study recommends that prospective investors make cost-effective decisions based on the attractiveness of the acquired financial metrics.

[9893] *IoT Maleware detection Based on Anomaly traffic identification using CNN-LSTM*

Alaa Abdul Al Muhsen Hussain Al Zubaidi (University of Bucharest).

Abstract

IoT systems are widely used in modern times. However, they present a weak link in any network, and any infected device can seriously damage organizational networks. The security threats for IoT devices are increasing substantially with the advancement of processing power and the rise of AI. Different approaches are used to detect attacks, including machine learning approaches like SVM and RandomForest. However, the traffic volume, the accuracy, and the complexity of such approaches limit the power of detecting potential malware promptly. In this paper, we propose a CNN-LSTM approach to detect a list of known attacks as well as unknown ones. Traffic behavior is a great source of information for detecting infected devices in a network. We used the IOT-23 dataset, which is an open dataset that contains more than 230 million records labeled with various attacks and normal traffic. The model proposed reached 96\% accuracy. The proposed method ensures faster detection of infected devices, thereby limiting the effect of infected devices on the network.