UNIVERSITY OF SCIENCE AND TECHNOLOGY OF ORAN MOHAMED - BOUDIAF

NATIONAL ASSOCIATION OF ALGERIAN PROFESSORS AND RESEARCHERS

PROCEEDINGS

1ST INTERNATIONAL CONFERENCE ON CYBER SECURITY AND ARTIFICIAL INTELLIGENCE APPLICATIONS

OCTOBER, 21-22, 2025,USTO, ORAN, ALGERIA

Mot du Recteur

Mesdames et Messieurs,

Chers collègues, distingués invités, chers participants,
C'est avec un immense honneur et une profonde satisfaction que je prends la parole aujourd'hui à l'occasion de l'ouverture officielle de la 1re Conférence Internationale sur la Cybersécurité et les Applications de l'Intelligence Artificielle, I2CSAI 2025, organisée ici, à l'Université des Sciences et de la Technologie d'Oran Mohamed-Boudiaf.
Cette rencontre scientifique marque une étape importante dans notre engagement collectif à renforcer la coopération internationale et à stimuler la recherche innovante dans deux domaines stratégiques et complémentaires : la cybersécurité et l'intelligence artificielle. Ces thématiques représentent aujourd'hui les piliers du développement technologique et les garants de la souveraineté numérique des nations.
L'USTOMB, à travers ses laboratoires de recherche et ses partenariats académiques et industriels, s'inscrit pleinement dans cette dynamique. Nous sommes convaincus que la synergie entre chercheurs, ingénieurs, étudiants et experts permettra de développer des solutions concrètes face aux défis croissants liés à la protection des systèmes d'information et à l'usage responsable de l'intelligence artificielle.
Je tiens à exprimer mes félicitations et mes remerciements les plus sincères :
au comité d'organisation et scientifique pour la qualité du travail accompli ;
aux conférenciers internationaux et nationaux pour leur contribution précieuse ;
ainsi qu'à l'ensemble des partenaires institutionnels et industriels qui soutiennent cette initiative ambitieuse.
Je forme le vœu que ces deux journées de travaux soient riches en échanges, coopérations et idées novatrices, et qu'elles débouchent sur de nouvelles perspectives de recherche et d'innovation au service de la communauté scientifique et de la société.
Au nom de l'Université des Sciences et de la Technologie d'Oran Mohamed-Boudiaf,
et avec la participation distinguée de nos partenaires, je déclare officiellement ouverte la 1re Conférence Internationale sur la Cybersécurité et les Applications de l'Intelligence Artificielle — I2CSAI 2025.

Je vous souhaite à toutes et à tous plein succès dans vos travaux.

Merci de votre attention.

Prof. Ahmed HAMOU

Mot du Président

Bonjour à vous tous et bienvenue dans notre ville Oran, où nous avons le plaisir et l'honneur de vous accueillir pour cette **première Conférence Internationale sur la Cyber-Sécurité et les Applications de l'Intelligence Artificielle (I2CSAI 2025)**, organisé par l'Université des Sciences et de la Technologie d'Oran-Mohamed Boudiaf conjointement avec l'Association Nationale des Professeurs et Chercheurs algériens et le Laboratoire de Codage et de la Sécurité des Données (LACOSI),du département d'Électronique de la Faculté de Génie Électrique.
Cette conférence inaugure une série de rencontres scientifiques qui ambitionnent de réunir chercheurs, enseignants, industriels, étudiants et praticiens autour de thématiques d'actualité au cœur des transformations numériques. L'intelligence artificielle et la cyber-sécurité représentent aujourd'hui deux piliers incontournables pour la protection des données, la fiabilité des systèmes et le développement d'innovations technologiques durables.

Objectifs de la Conférence I2CSAI 2025
À travers cette manifestation, nous souhaitons :

1. Créer une plateforme internationale d'échanges scientifiques permettant de présenter les avancées récentes en cyber-sécurité et en intelligence artificielle.
2. Favoriser la collaboration entre chercheurs, doctorants, industriels et institutions afin de rapprocher la recherche académique des besoins concrets du monde socio-économique.
3. Encourager la formation et l'implication des jeunes chercheurs et doctorants, en leur offrant l'opportunité de présenter leurs travaux et de bénéficier de retours constructifs de la communauté scientifique.
4. Promouvoir la coopération interdisciplinaire entre l'informatique, le génie électrique, les mathématiques, et les télécommunications, en vue de développer des solutions intégrées et innovantes.
5. Explorer les défis émergents liés à la sécurité des systèmes intelligents, tels que :
   - la protection des données massives (Big Data),
   - la sécurité dans l'Internet des objets (IoT), le cloud et le edgecomputing,
   - la résilience face aux cyber-attaques avancées,
   - et les cryptosystèmes post-quantiques.

6. Stimuler l'innovation technologique et le transfert de connaissances par des collaborations université–industrie, notamment dans les domaines sensibles comme les infrastructures critiques, la santé numérique et les systèmes intelligents.
7. Contribuer au rayonnement scientifique de l'USTO-MB et de l'Algérie, en positionnant Oran comme un pôle d'excellence et de rencontres internationales dans le domaine de la cyber-sécurité et de l'IA.

Je tiens à exprimer ma profonde gratitude à **Monsieur le Recteur Professeur Émérite HAMOU Ahmed** et à **Monsieur le Doyen Professeur Ghalem BACHIR** pour leur soutien institutionnel constant, ainsi qu'aux membres des **comités scientifique et d'organisation** pour leur engagement et leur rigueur. Mes remerciements s'adressent également à nos conférenciers invités et à l'ensemble des participants qui, par leur présence et leurs contributions, donnent à cette conférence sa dimension internationale.

Nous tenons également à remercier tous les collègues qui ont contribué à la réussite de cette conférence, plus particulièrement **:Bouchiba GUELTA**, **OUADI Brahim**, **Tlemsani Redouane**, **Chouraqui Samira**, **Souad KHALAT KIHEL**, sans oublie ceux de l'étranger, pour nous faire partager leur connaissance et expérience sur les avancés de ces thèmes dans leur établissement respectifs.

Je tiens à remercier vivement aux noms des comités scientifiques et d'organisation : les structures qui ont contribué au succès de cette conférence.

Je souhaite que ces journées scientifiques soient pour chacun d'entre vous une occasion précieuse de découverte, de partage et de coopération, dans un esprit de collégialité et d'ouverture .

Je vous souhaite à toutes et à tous une excellente conférence et un agréable séjour à Oran.

Professeur A. Ali-Pacha

Le Président de la Conférence

Younes Grar

Consultant en technologies de l'information et de la communication

The digital era is witnessing an unprecedented acceleration in technological transformation, with Artificial Intelligence (AI) becoming a cornerstone of modern innovation. However, this progress brings along significant cybersecurity challenges. The relationship between AI and information security is therefore dual: AI can both enhance protection and increase risk when misused.

Recent statistics indicate that the AI-driven cybersecurity market is expected to grow from USD 22.4 billion in 2023 to USD 134 billion by 2030, while 87% of organizations worldwide have already experienced AI-powered cyberattacks. This highlights the urgent need for adaptive and intelligent defense mechanisms.

AI plays a key role in early threat detection, automated incident response, big data analysis, and intelligent authentication through facial recognition, biometrics, and behavioral analysis. Nonetheless, major challenges persist, including:

- The emergence of AI-powered attacks that exploit the same technologies used for defense.
- Issues of bias and lack of transparency in AI decision-making processes.
- Data quality and computational requirements, as advanced AI systems demand vast, high-quality datasets and significant computing power.

To address these issues, institutions are encouraged to adopt unified cybersecurity strategies, establish robust AI governance frameworks, and invest in human capital through specialized training in AI ethics and security engineering. Moreover, integrating digital security awareness into education curricula and supporting the creation of national cybersecurity research and innovation centers are essential steps forward.

In conclusion, technological change is inevitable and vital for societal progress. The true challenge is not isolation but active resilience, leveraging national expertise and young talents under a coherent national strategy to ensure secure and sustainable digital development

Sécurité informatique et IA : Enjeux, défis, Convergence et état des lieux en Algérie

Cette présentation explore l'intersection cruciale entre la sécurité informatique et l'intelligence artificielle dans le contexte cyber sécuritaire actuel. Après une introduction contextuelle, elle définit les concepts fondamentaux de cyber sécurité et de sécurité informatique, puis présente les principes et applications de l'intelligence artificielle. Le cœur de l'analyse porte sur la convergence entre ces deux domaines, montrant d'une part comment l'IA révolutionne les approches de sécurité : automatisation de la détection des menaces, analyse prédictive des cyberattaques, et amélioration des systèmes de protection adaptatifs et d'autre part comment les services de sécurité (confidentialité, intégrité, disponibilité, non répudiation, signature, authentification et droits d'accès) sont applicables à un Système d'IA. Si l'IA est un outil efficace pour renforcer la sécurité, elle est aussi un outil redoutable de cyber criminalité pour automatiser les attaques, créer des deepfakes convaincants et développer des malwares adaptatifs.

L'état des lieux examine les réalités actuelles du marché, les solutions émergentes et les défis persistants. Il souligne les opportunités offertes par l'IA pour renforcer la cyber sécurité, tout en identifiant les nouveaux risques qu'elle génère : attaques adversariales, utilisation malveillante par les cybercriminels, et vulnérabilités spécifiques aux systèmes d'IA. L'état des lieux s'arrête aussi sur la situation du pays avec l'approche stratégique ambitieuse avec l'adoption du plan national IA et un dispositif national de cybersécurité, visant une contribution de 7% au PIB d'ici 2027. La présentation conclut sur les perspectives d'avenir et les recommandations stratégiques pour naviguer efficacement dans ce paysage technologique en évolution rapide, où l'IA devient simultanément un bouclier et une épée dans la guerre cybernétique moderne.

Prof. Abdallah Chouarfia

Bibliographie : Abdallah Chouarfia est Professeur d'informatique à l'Université des Sciences et de la Technologie d'Oran (USTO-MB), Ingénieur en informatique sortant du CERI d'Alger en 1981, Docteur-ingénieur en informatique 1983 de l'Université Paul Sabatier de Toulouse (France). Il enseigne les méthodologies de gestion et de développement de projets informatiques, et la sécurité informatique aux étudiants des premiers, seconds et troisièmes cycles universitaires

L'Intelligence des savoirs face à l'intelligence de l'imagination : outils et perspectives.

Abdelhamid Mellouk (Full-time Professor at University of Paris-Est Creteil (UPEC), ClEx2 (via National Commission), Networks & Telecommunications (N&T) Department, IT–Health High School Engineering Department and TincNET research team (http://tincnet.fr), France. He graduated in computer network engineering from the Computer Science High Eng. School, University Oran1 (ex. Senia), Algeria, in DEA computer science from the joint by the University of Paris Sud XI Orsay (Université Paris Saclay), received his Ph.D. in informatics from the same establishment, and a Doctorate of Sciences (Habilitation) diploma from UPEC. He is an active member of the IEEE Communications Society and held several offices including leadership positions in IEEE Communications Society Technical Committees. He has published/coordinated seventeen books in IT areas and more than 250 several refereed international publications in journals, conferences, books, in addition to numerous keynotes and plenary talks in flagship venues. He serves on the Editorial Boards or as Associate Editor for several journals (including IEEE CST and IEEE TVT), and he is chairing or has chaired (or co-chaired) some of the top international conferences and symposia (including IEEE ICC and IEEE GlobeCom). He is also the founder of Network Control Research and Curricula activities at UPEC and President of several other scientific institutions, including Research, Ethics and Programs commission at the Algerian National Council for Scientific Research and Technologies, FR Haut Conseil de l'Evaluation de la Recherche et de l'Enseignement Supérieur (HCERES) Expert, FR National University Council (CNU) member and co-President of Data Science-Artificial Intelligence-Systematic Deep Tech Cluster.

Expert invited to the last GFAI (Global Forum of Artificial Intelligence for Humanity), held in Paris in 2019 under the high authority of the President of the French Republic, bringing together 200 international experts in the field of artificial intelligence, following the recommendations of the last G7, Abdelhamid Mellouk was also one of the co-writers in 2019 with the Artificial Intelligence-Algeria Plan, under the umbrella of Algerian DGRSDT and MESRS, which led, among other things, to the creation of 2 national schools in this field in Sidi Abdallah in Algeria.

His research work has been pioneering in the field of neural networks and artificial intelligence where his doctoral thesis (in 1995) was the first Ph.D. thesis to favour the so-called neuronal techniques designed for automated systems, then he proposed autonomous automatic speech recognition in the beginning of the 2000s (based on Time-Delay Neural Network (TDNN), considered among the first systems designed in the world in the field of predictive neural networks for speech recognition). He has received several scientific distinctions including the “Distinguished Technical Achievement Award”, obtained in 2020 by the IEEE Communication Society due to his scientific work on the direction of a new book collection and book publishing jointly by ISTE and Wiley. He has directed and supported over 25 doctoral theses and masters and written more than 250 scientific publications.

Current duties :

- University Full-Time Professor, (Clex2, the highest French academic degree, obtained by national competition)
- Director of IT&N Department
- President of the permanent commission “Politics and Programs” in CNRST High Council, Algerian President of the Republic, in charge of Higher Education, Research and Innovation.
- President of International SaCoNet Network Think Tank
- • DSA/Systematic.EU European Deep Tech Cluster (Co-President “Data Science & Artificial Intelligence”)
- • Wiley/Iste/Springer NGN-Collection Scientific Books (Director “New Generation Networks” Series)
- • ARC-WG.SAGIP.FR (Head) & ARC-WG.MACS.CNRS.FR (member), (CNRS-GAIP French National Working Group Head)
- • CoDEV-CAPS.SACLAY (French High Council for Saclay-Orsay-Gif-Palaiseau Deep tech Cluster Member)
- • CNU.FR, (French National University Evaluation Council Member)
- • HCERES.FR & https://www.bpifrance.fr/ (French High Council Deputy Scientific Advisor)

Prof. Abdelhamid Mellouk

Artificial Intelligence for earth Observation and sustainable Development

Dr. Mohammed El Amin Larabi is a computer scientist and researcher at the Algerian Space Agency specializing in artificial intelligence, computer vision, and advanced geospatial data analytics. His pioneering work applies deep learning to enhance Earth observation and GeoAI applications, advancing responsible and impactful AI solutions for environmental and societal challenges. Driven by innovation, Dr. Larabi's research bridges AI and geoscience to promote sustainable development through data-driven insights and interdisciplinary collaboration.

This talk highlights the transformative power of Artificial Intelligence in Earth Observation to advance the Sustainable Development Goals (SDGs). It explores how AI-driven geospatial analytics can enhance our understanding of environmental and societal dynamics, enabling more accurate monitoring and informed decision-making. By harnessing machine learning, computer vision, and data fusion, AI transforms vast Earth observation data into actionable insights. The talk emphasizes how these intelligent systems can drive innovation in climate resilience, sustainable urban development, and resource management—positioning AI as a cornerstone technology for achieving global sustainability and shaping a more resilient future for our planet.

Dr. Mohammed El Amin Larabi

Metaheuristic Approaches for MPPT in Shaded Photovoltaic Systems : A Comparative Study of PSO and Firefly Algorithms

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Abstract : The study of metaheuristic techniques for detecting the highest power point of photovoltaic solar panels under shaded conditions (PSC) reveals the effectiveness of various algorithms. Different metaheuristic algorithms are compared. This study compares PSO (particle swarm optimization) to the firefly method (FA). While PSO efficiently tracks the maximum power point, FA stands out for its simplicity of construction with fewer control parameters and its ability to rapidly converge to the global maximum power point (GMPP). Simulation outcomes demonstrate that trackers based on FA and PSO both ensure convergence to the GMPP, with FA standing out for its simplicity and rapid convergence.

Keywords : GMPP, Partial shading, Stochastic optimization, Firefly algorithm, PSO algorithm

Ref : I2CSAI2025-ID08 *I2CSAI'2025*

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Data Security Transmitted in a Swarm of UAVs Using Chaotic Map with DSSS Technique

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Abstract : The use of unmanned aerial vehicles (UAVs) in a variety of military and civilian missions is becoming increasingly common thanks to technological advances. UAVs are capable of working together in swarms to accomplish complex tasks. Reliable and secure communication is the challenge of collision-free data transmission in a UAV swarm. To achieve this goal, we have proposed a method based on the DSSS (Direct Sequence Spread Spectrum) technique synchronized by a pseudo-random chaotic sequence and TDMA (Time Division Multiple Access) transmission as DSSS may not be sufficient for data transmission and control when the number of drone users increases. TDMA assigns time slots to each user, enabling them to use the same frequency channel by dividing the signal into time slots. The problem of colliding data sent to the ground station is solved with this system, making it possible to control air traffic via the Ground Control Station (GCS) using the proposed technique. This wider band of the DSSS data spread makes the signal less sensitive to interference and more resistant to noise. A key element of DSSS is the chaotic pseudo-random code, which must be known by both transmitter and receiver to correctly decode the signal. One of the main security advantages lies in the use of a pseudo-random noise sequence, which acts as a form of encryption.

Keywords : Unmanned Aerial Vehicles (UAV), Ground Control Station (GCS), Direct Sequence Spread Spectrum (DSSS), Time Division Multiple Access (TDMA)

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A Multi-Agent Organizational Approach for Real-Time Course Timetable Scheduling

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Abstract : Effective course planning in educational institutions demands real-time adaptability to dynamic constraints, a challenge traditional methods often fail to address. This study introduces a Multi-Agent Organizational (MAO) approach, implemented using the JaCaMo framework, to address this issue. The system optimizes resource allocation and handles dynamic constraints using autonomous agents. Our results demonstrate that the proposed approach minimizes scheduling conflicts, optimizes resource utilization, and adapts effectively to real-time changes, providing a scalable solution for educational institutions.

Keywords : Multi-Agent System, Timetable Scheduling, JaCaMo Framework

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Towards adaptive SQL Injection detection with incremental learning

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Abstract : SQL Injection Attacks (SQLIAs) have become prevalent cyber-threats, posing significant challenges for modern web applications. This has driven researchers to explore machine learning models to distinguish between malicious and benign requests through binary classification tasks. However, most of the proposed solutions fail to address issues related to adaptability to new attack patterns and ensuring long-term security in real-world applications. In this study, we aim to highlight the potential of incremental learning in SQL injection detection. We conducted comparative experiments using high-performing machine learning models, commonly used in batch learning mode, such as Support Vector Machines (SVM), and in incremental learning mode, such as the Passive Aggressive Classifier (PA). The results demonstrated that incremental learning outperforms batch learning in detecting SQLIAs. Furthermore, incremental learning is an adaptive process that can integrate new data without losing previous knowledge. This allows the model to be updated with new SQL injection patterns while maintaining high performance levels, making it a promising solution for adapting to evolving attack patterns in real-world applications.

Keywords : Structured Query Language Injection Attack (SQLIA), Cybersecurity, Machine Learning, Incremental Learning, Batch Learning

Ref : I2CSAI2025-ID27 *I2CSAI'2025*

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Enhancing ZUC Cipher Security with Generative Adversarial Networks

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Abstract : Securing communication systems against evolving threats is a critical challenge in modern cryptography. This paper presents the integration of Generative Adversarial Networks (GANs) into the cryptographic domain, with a specific focus on enhancing the keystream generation process in the ZUC cipher. The keystream is initially generated using the ZUC algorithm and subsequently refined through the GAN framework. The proposed approach seeks to strengthen the security of the keystream by improving its statistical randomness, entropy, and resistance to cryptanalytic attacks. The proposed approach was evaluated using NIST randomness tests and compared against the traditional ZUC cipher. The results demonstrate that our GAN-enhanced ZUC approach produces keystreams with significantly improved statistical randomness and entropy, offering greater resistance to cryptanalytic attacks compared to the traditional ZUC.

Keywords : Mobile Security, Stream Cipher, ZUC, NIST Test

Proposition an Efficient Confusion Method-Based Text Encryption

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Abstract : In the era of digital communication, the security of sensitive information has become paramount. Text encryption is a fundamental technique to ensure data confidentiality, integrity, and authenticity. This article proposes an efficient confusion method-based text encryption algorithm that leverages recent advancements in cryptographic techniques. The proposed method aims to enhance security while maintaining computational efficiency, making it suitable for real-time applications. The algorithm is evaluated against recent benchmarks. The results demonstrate that the proposed method offers robust security.

Keywords : Text Encryption, Confusion, Cryptography, Data Security, Secret key, Substitution, Permutation

Towards Smart Bins : Integrating YOLOv11 for Automated and Efficient Sorting

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Abstract : This study investigates the use of YOLOv11, an advanced deep learning technology, to enhance waste sorting. YOLOv11 excels in object detection, even under challenging conditions where materials are damaged, partially visible, or mixed. The research evaluates YOLOv11's efficiency by testing it on a GPU and a smartphone, assessing its ability to operate in resource-constrained environments. The results show that YOLOv11 achieves a mAP@50 of 96.4% on a GPU and maintains solid performance on smartphones, with a precision of 90.16%. By focusing on real-world applications, such as smart bins, this research highlights YOLOv11's potential to automate waste sorting, promoting more sustainable resource management.

Keywords : YOLOv11, Automated waste sorting, Object detection.

Ref : ICCSAI2025-ID98 *ICCSAI'2025*

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Hybrid Grasshopper-Optimized Neural Networks for Accurate Structural Damage Prediction Using Modal Parameters

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Abstract : Accurate and robust state estimation is paramount for the autonomous operation and high-performance control of Miniature Unmanned Aerial Vehicles (UAVs). While traditional observers such as the Extended Kalman observer, High-Gain Observers, and Sliding Mode Observers each offer distinct advantages (optimality, rapid convergence, robustness to disturbances), their performance is often sub-optimal or inconsistent across diverse flight conditions, sensor noise and dynamic maneuvers. A fixed observer choice struggle to balance the inherent trade-offs between noise suppression and transient response speed.

This research proposes a novel meta-learning framework for intelligent observer design and selection. Instead of relying on a single, statically tuned observer, our approach uses meta-learning to train a high-level policy capable of dynamically selecting and adapting the optimal observer from a predefined bank in real-time. The meta-learner analyzes the incoming sensor data, current flight dynamics, and estimated uncertainties to predict which observer strategy will yield the minimum state estimation error at the next time step. This system acts as a supervisor, leveraging the strengths of individual observers while mitigating their weaknesses.

The simulation results obtained in the Matlab/Simulink environment demonstrate that the Meta-Learning Observer (MLO) significantly outperforms any single, fixed observer in isolation. The MLO achieves a substantial reduction in the Root Mean Square Error across position, velocity, and attitude estimates, particularly during challenging flight phases characterized by sudden accelerations, turbulent airflow, and varying levels of induced sensor noise. This work provides a scalable and robust solution for advancing reliable perception systems in resource-constrained miniature aerial vehicles

Keywords : Meta-Learning, l'AI, Observer Design, UAVs, Kalman Observer, High-Gain Observer, Sliding Mode Observer.

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Advanced Bearing Fault Diagnosis Using Vibration Analysis and Machine Learning

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Abstract : This article presents an approach that combines vibration analysis and machine learning for the diagnosis of ball bearing faults in rotating machinery. Vibration signal analysis, using statistical parameters such as Root Mean Square (RMS), skewness, and kurtosis, enables the detection of early failures. These features are then used to train a classification model based on Support Vector Machines (SVM). The performance of this model is evaluated using multiple kernels, both linear and nonlinear, to distinguish between healthy bearings and those with localized defects. The results demonstrate that the proposed approach enables effective fault classification in bearings, achieving high classification performance.

Keywords : Vibration analysis, Bearings, Diagnosis, SVM, Kurtosis, Skewness.

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Graph Collaborative Filtering Content Based

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Abstract : Recommender systems are essential for customizing and personalizing user experiences; the most popular techniques are Content-Based (CB) and Collaborative Filtering (CF). Whereas CB bases its suggestions on item attributes while CF uses user-item interactions. Graph Neural Networks (GNNs) have emerged as state-of-the-art for recommendation task solutions, with models such as Neural Graph Collaborative Filtering (NGCF) demonstrating exceptional performance. In this work, we propose a GNN-based recommender system that integrates both CF and CB approaches. By utilizing user-item interactions for CF and item-item interactions for CB, this hybrid approach enhances recommendation quality by effectively utilizing structural information from both perspectives. Code is available at : https ://github.com/RamzeyChibana/Collaborative-Content-based-Filtering

Keywords : Recommendation system, Graph Neural Network, Collaborative Filtering, Content Based

Anomaly Detection on IoT Network Intrusion Using CNN & RNN Models

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Abstract : The use of the Internet of Things (IoT) continues to revolutionize human life whether in the field of industry, agriculture or other more critical areas such as health. The proliferation of different connected object technologies as well as the constraints related to these technologies in terms of energy autonomy and com- puting capacity have generated a major risk concerning security. Indeed, tradi- tional network security solutions are well established but do not fully respond to the mitigation of risks due to IoT vulnerabilities. The analysis of the network traffic of connected objects is an effective way to detect different types of attacks, particularly those based on a behavioral approach. This approach is based on learning models (Machine Learning, Deep Learning) to classify anomalies and detect malicious traffic. In our work, we evaluated four different machine learn- ing models : three recurrent neural network (RNN) models and a convolutional neural network (CNN) model. Our goal was not only to detect anomalies, but also to classify the type of anomalies detected. To do so, we opted for a multi class classification approach.
RNNs, with their ability to model temporal dependencies, are particularly suited to analyze time series of network data. CNNs, on the other hand, are effective in capturing spatial patterns and identifying anomalies in traffic data. The experi- ments and case studies presented demonstrate the effectiveness of these models in real-world scenarios, highlighting their potential to improve the security and performance of computer networks.

Keywords : IoT, RNN, LSTM, GRU, CNN, attack classification.

Selective Encryption of JPEG Compressed Images Using Cipher Stream Encryption

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Abstract : The rapid increase in digital image traffic on the Internet has made the transmission and storage of images a regular activity. In this context, compression and partial encryption represent efficient strategies for decreasing and minimizing the computational resources necessary for processing large volumes of multimedia data. We present a method for partial or selective encryption of JPEG images, focusing on the encryption of quantized DCT coefficients after the Huffman coding phase using an XOR operation. Our approach encrypts the base frequencies that carry essential human visual information (HVS), specifically the DC coefficients and the AC coefficients that are close to the DC. The proposed method demonstrates a significant reduction in encryption and decryption processing times while maintaining an effective security.

Keywords : JPEG, XOR, Compression, Encryption, Images, Crypto-compression.

Visual Servoing Navigation for Multi-Robot Systems Using Image Moments

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Abstract : Our goal is to develop a robust system allowing a group of mobile robots to navigate together in formation. For that purpose, we propose to implement a visual servoing navigation system, allowing tracking of a leader robot within a cooperative multi-robot framework. To construct our servoing scheme, we develop an interaction matrix combining image moments with follower robot velocities and estimate the depth between each follower and the leader robot. The objective is to minimize the difference between the current and desired configurations in a dynamic, unknown environment. To account for unknown object motion, a tracking module using invariant image moments is employed to model visual primitives, enhancing the accuracy and robustness of the results. This is achieved without communication between robots, thereby eliminating error propagation across the team. Experimental results using non-holonomic mobile robots equipped with onboard cameras demonstrate the effectiveness of the proposed method.

Keywords : Navigation, Mobile robot, Invariant moments, Visual servoing.

Video Watermarking Based LSB Technique and AES Encryption Using CBC Mode

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Abstract : This study proposed a combination of watermarking and encryption techniques applied to colored videos. The proposed approach selects frames based on the entropy difference between successive frames. In the embedding phase, the watermark is encrypted using the Advanced Encryption Standard (AES) in Cipher Block Chaining (CBC) mode and divided into three equal parts. These parts are embedded into the intensity component of the three selected frames with the smallest entropy differences using the Least Significant Bit (LSB) method. Ensuring secure communication while maintaining imperceptibility and high visual quality. The analysis is conducted based on quality metrics such as PSNR, MSE, and Normalized Correlation (NCC).

Keywords : Watermark, Digital Video Watermarking, Least Significant Bit (LSB), Cipher Block Chaining (CBC), Copyright Protection, entropy.

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Meta-Learning Observer Design : Intelligent Selection Between Kalman,High-Gain, and Sliding Mode Observers for Miniature UAVs

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Abstract : Accurate and robust state estimation is paramount for the autonomous operation and high- performance control of Miniature Unmanned Aerial Vehicles (UAVs). While traditional observers such as the Extended Kalman observer, High- Gain Observers, and Sliding Mode Observers each offer distinct advantages (optimality, rapid convergence, robustness to disturbances), their performance is often sub- optimal or inconsistent across diverse flight conditions, sensor noise and dynamic maneuvers. A fixed observer choice struggle to balance the inherent trade- offs between noise suppression and transient response speed.

This research proposes a novel meta-learning framework for intelligent observer design and selection. Instead of relying on a single, statically tuned observer, our approach uses meta-learning to train a high- level policy capable of dynamically selecting and adapting the optimal observer from a prede fined bank in real- time. The meta- learner analyzes the incoming sensor data, current flight dynamics, and estimated uncertainties to predict which observer strategy will yield the minimum state estimation error at the next time step. This system acts as a supervisor, leveraging the strengths of individual observers while mitigating their weaknesses.

The simulation results obtained in the Matlab/Simulink environment demonstrate that the Meta- Learning Observer (MLO) signi ficantly outperforms any single, fixed obser- ver in isolation. The MLO achieves a substantial reduction in the Root Mean Square Error across position, velocity, and attitude estimates, particularly during challenging flight phases characterized by sudden accelerations, turbulent air flow, and varying levels of induced sensor noise. This work provides a scalable and robust solution for advancing reliable perception systems in resource-constrained miniature aerial vehicles

Keywords : Meta-Learning, l'AI, Observer Design, UAVs, Kalman Observer, High-Gain Observer, Sliding Mode Observer.

Sonelgaz in the Age of Artificial Intelligence : Towards a Smarter, More Sustainable Grid

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Abstract : This article presents a strategic plan to modernize energy management in Algeria through the integration of advanced artificial intelligence and renewable energy technologies. Using predictive models and IoT solutions, Sonelgaz aims to optimize operational efficiency, reduce energy losses and improve real-time demand management. The document highlights the importance of a comprehensive approach including team training, smart meter deployment and the creation of digital twins to enhance power grid reliability. By effectively integrating renewable energies and adopting appropriate storage solutions, Sonelgaz could not only improve grid resilience, but also actively contribute to the country's energy transition..

Keywords : Artificial intelligence, Deep learning, energy optimization, smart grid, Sonelgaz, Algeria.

Enhancing Esca Disease Detection in Vineyards through Data Fusion and Transfer Learning

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Abstract : Esca (Black Measles) is one of the most destructive fungal diseases affecting grapevines, leading to severe crop losses if not detected early. While deep Convolutional Neural Networks have shown promise in automating disease detection, their effectiveness is limited by the availability of diverse and well-labeled datasets. Existing datasets, such as PlantVillage, provide controlled lab images but struggle with real-world generalization, whereas in-field datasets like EdenLibrary offer more realistic conditions but are often small and potentially lead to models' overfitting. To enhance cross-dataset generalization for in-field Esca detection, this study employs a dataset-fusion approach, combining PlantVillage **(PV)** and EdenLibrary **(EL)** images for training. We evaluate CNN performance across three dataset configurations (**PV, EL**, and **PV-EL**) using VGG16, DenseNet121, and EfficientNet-b7 architectures. Model effectiveness is assessed through accuracy, precision, recall, and F1-score, while feature visualization via Guided Grad-CAM provides further interpretability. Our findings indicate that models trained solely on **PV** or EL datasets struggle with cross-dataset generalization.
In contrast, training on the combined **PV-EL** dataset significantly improves model performance, with respectively more than 10% and 8% increase in accuracy and F1-score on in-field cross-dataset generalization. Heatmap analysis further highlights that lab images help models focus on disease symptoms rather than background noise. These results demonstrate that merging lab and field data enhances CNN robustness for in-field disease detection, reducing dependence on extensive field data collection.

Keywords : Convolutional Neural Networks, Dataset Fusion, Plant Disease Detection, Esca, Transfer Learning, Symptom visualization.

Revolutionizing Randomness : A New Perspective on Pseudo Random Sequence Generator through Elementary Cellular Automata

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Abstract : The demand for random numbers has significantly increased. In this paper, two-dimensional Henon maps and one-dimensional cellular automata are combined to propose a novel evolutionary elementary cellular automaton algorithm, which can serve as a new pseudo-random number generator. Experimental results demonstrate that integrating a chaotic map as an internal parameter in the evolution of cellular automata enables the generation of data with random behavior. Furthermore, the suggested design exhibits satisfactory randomness. Subsequently, we analyze the obtained results and discuss their implications for future cryptographic system designs.

Keywords : Cellular Automata, Chaotic map, Pseudo random number generator, Cryptography, Security Data.

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A Secret Image Sharing Scheme based on Quasi Square Decomposition and BinaryTrees

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Abstract : A quasi-square decomposition is a unique decomposition of natural number into two factors, in this work, this decomposition is combined with a binary tree to give a secret image sharing scheme. The use of orthogonal matrix increases entropy, confusion and diffusion. The experimental results demonstrate that the scheme exhibits good statistical properties.

Keywords : secret image sharing, quasi-square decomposition (QSD), binary trees.

Towards the Next Generation of Solar Cells : Accelerating Material Discovery and Design through AI-Enhanced Simulation

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Abstract : The development of high-efficiency solar cells faces significant challenges regarding the time and cost required for discovering and fabricating new materials. This research introduces an innovative system that integrates advanced computational simulation with generative artificial intelligence models to dramatically accelerate this process. By analyzing vast datasets from simulations and experimental results, our system can accurately predict the properties of new photovoltaic materials. The system virtually generates promising molecular structures and tests their performance via simulation before proceeding to the costly manufacturing stage. Preliminary results have demonstrated this approach's ability to significantly reduce the development cycle and open new avenues for designing solar cells with record efficiency. This system acts as a bridge between theoretical modeling and practical application, contributing to the acceleration of the transition towards sustainable energy. We aim to improve the performance of renewable energy sources such as solar and wind power. Ultimately, this will lead to better integration of solar energy into electrical grids.

Keywords : Solar Cells, Artificial Intelligence, Material Simulation, Machine Learning, Renewable Energy.

Artificial Intelligence Applications for Energy System Performance

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Abstract : Artificial intelligence (AI) has become an integral component of many industries, particularly the use of machine learning techniques. The integration of AI technologies is particularly important in the field of renewable energy. There is con- stant research and development going on in the field of solar energy. The focus is on applying various machine learning techniques to optimize energy production. One area of research involves Maximum Power Point Tracking (MPPT). In this study, we implemented a machine learning algorithm, more specifically a regres-sion tree, using a new dataset derived from experimental measurements. Our ap-proach achieved an accuracy of up to 96%. Our main goal was to carefully create a database from precise experimental measurements that would serve as a funda-mental building block for the machine learning process. A machine learning model that can forecast values relevant to our study is then created and trained us-ing this dataset. Lastly, we implement this model on a specialized platform to help achieve the Maximum Power Point, which is an essential part of solar energy system optimization..

Keywords : Maximum Power Point Traking MPPT, Optimization, Machine Learning, Artificial Intelligence.

Enhancing Handover Management in 5G Networks with a GRU-TCN Model

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Abstract : The evolution of wireless communication networks, fueled by advancements in 5G and the envisioned capabilities of 6G, has introduced significant challenges in mobility management and handover optimization. The frequent handovers in dense networks, particularly at high frequencies like millimeter waves and Te- rahertz bands, can lead to increased signaling overhead, latency, and poten- tial service disruptions. To address these issues, artificial intelligence (AI)-driven solutions are emerging as promising solutions. This paper explores the applica- tion of deep learning techniques for predictive handover management, leveraging historical patterns in signal measurements to enhance handover decision-making. A hybrid GRU-TCN model is proposed that combines Gated Recurrent Units (GRUs) and Temporal Convolutional Networks (TCNs) to achieve efficient handover prediction. The model was trained and tested on a real-world drive-test dataset containing RSRP measurements. Results demonstrate that the GRU-TCN model outperforms other approaches, including GRU-RF (Random Forest), GRU-KNN (K-Nearest Neighbors), and GRU-SVM (Support Vector Machines), in predicting handover events, achieving higher average accuracy and average F1 Score..

Keywords : Handover Optimization, 5G Networks, Signal Strength Predic- tion, RSRP, GRU, RF, KNN, SVM, TCN.

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Feedforward ANN for PV System MPPT Strategy based on A Meta-heuristic PSO Technique

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Abstract : The electrical energy generated by a photovoltaic (PV) panel from sunlight is intermittent due to weather conditions such as ambient temperature and sunlight intensity. Additionally, the PV panel characteristics exhibits non- linear P-V and I-V curves. Therefore, the maximum power point (MPP) is lo- cated at a single point in the non-linear PV characteristic. However, the PV panel's performance is improved by extracting its MPP using the maximum power point tracking (MPPT) technique which usually employs an appropriate DC-DC converter namely the DC-DC boost converter. This paper implements three MPPT strategies, a conventional perturb and observe (PO-MPPT), a clas- sical artificial neural network (ANN-MPPT), and a feedforward artificial neural network meta-heuristic particle swarm optimization (PSO) algorithm (PSO- ANN-MPPT). The MATLAB/Simulink software is used to simulate and control the PV array model integrated with MPPT under an appropriate functional tem- perature and variable sunlight irradiance. Simulation results of each MPPT technique are done and compared according to their performances.

Keywords : Photovoltaic, MPPT, perturb and observe, Artificial Neural Net- work algorithm (ANN), Particle Swarm Optimization (PSO), DC-DC Boost converter.

A Comparative Study of Machine Learning Algorithms for Fault Detection in Power Transmission Lines

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Abstract : This study examines the performance of various machine learning techniques for fault detection in power transmission lines by performing a detailed comparative analysis of six classifiers in order to directly determine the presence or absence of faults, optimizing both accuracy and response time to allow rapid intervention in real scenarios. Performance was evaluated using key parameters such as accuracy, training time, calculation error and confusion matrix. To identify the most effective machine learning techniques, a comparative evaluation is used which demonstrate that the DT, RF, KNN and SVM models work exceptionally well, characterized by high accuracy and low false positive rates, which makes them perfectly adapted to the detection of failures in electrical networks. the other LR and NB models have certain limitations, in particular higher false positive rates

Keywords : Fault Detection, Transmission Lines, Machine Learning techniques, Predictive Maintenance.

Application of Artificial intelligence to the Diagnosis and Modeling of Corona Discharge In High Voltage Systems

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Abstract : The continuous demand for reliability and energy efficiency in high-voltage power networks requires smarter monitoring and diagnostic strategies. However, corona and partial discharges, which are often invisible yet energetically costly, remain major sources of power losses and premature insulation degradation. The main challenge lies in the early detection and accurate modeling of these complex, nonlinear, and multi-parameter phenomena influenced by both electrical and environmental conditions.

In this context, artificial intelligence (AI) offers innovative solutions for the analysis, prediction, and optimization of high- voltage phenomena. Techniques based on artificial neural networks, machine learning algorithms, and fuzzy logic enable efficient processing of large datasets from sensors, pattern recognition of discharge signatures, and fault prediction. Furthermore, the integration of AI into numerical modeling (through surrogate models derived from FEM or COMSOL simulations) significantly reduces computation time while maintaining high accuracy. Recent studies show that AI greatly enhances pre- dictive maintenance, corona loss reduction, and operational optimization of high- voltage equipment. This synergy between artificial intelligence and electrical engineering paves the way for a new generation of intelligent diagnostic and management systems for high- voltage power networks.

Keywords : Artificial intelligence ; High voltage ; Corona discharge ; Partial discharge ; Diagnosis ; Numerical modeling ; Predictive maintenance ; Neural networks ; Machine learning ; Power loss optimization.

Human Optical Flow Estimation using YOLOv8 and Density Maps

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Abstract : Optical flow estimation serves as a cornerstone in diverse do- mains, spanning from video processing to computer vision, facilitating tasks such as privacy preserving human action recognition, pose estima- tion, video surveillance, etc. Despite its pivotal role, challenges persist in accurately estimating optical flow owing to variations in representation and interpretation across applications, and limited availability of real-world data. This paper proposes a novel approach, focusing on pre- cise optical flow estimation tailored for human motion description in videos. Harnessing the power of pretrained deep learning models and us- ing density map approximations, our method offers multitask learning capabilities demanding low compute requirements. Our aim is to fur- nish a portable and cross-domain solution for real-world applications. Our method exhibits promising results in capturing motion details, sub- tracting background while offering computational efficiency, thereby con- tributing to advancements in human-centric optical flow estimation re- search.

Keywords : optical flow, human motion, human activity, density maps, matching algorithms, video processing.

Auction-Driven Spectrum Allocation With AutoEncoder-Based Compression in Rural Wireless Networks : A Novel Framework for Reliable Telemedicine

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Abstract : Rural healthcare faces numerous challenges, includ- ing limited access to specialized medical services and diagnostic equipment, which delays patient care. Enhancing the ability to transmit medical images and data from rural areas to urban hospitals via wireless networks is critical. However, bandwidth limitations, unreliable networks, and concerns over data security and privacy hinder efficient transmission. Additionally, the high data volume of medical content and the limited battery life of IoT devices pose further challenges. To address these challenges, data compression techniques such as Autoencoders (AEs) offer promising solutions by significantly reducing the communication overhead without sacrificing essential image quality or details. Additionally, spectrum allocation mechanisms in rural areas are often inefficient, leading to poor resource utilization. Auction the- ory presents a dynamic and adaptive approach to optimize spectrum allocation. This paper proposes a novel hybrid framework that integrates AE-based data compression with auction-based spectrum allocation, addressing both communication efficiency and spectrum utilization in rural wireless networks. Extensive simulations validate the framework's ability to improve spec- trum utilization, transmission efficiency, and overall connectivity, offering a practical solution for enhancing rural telemedicine infrastructure.

Keywords : Variational autoencoders, spectrum allocation, reverse auction.

Automated classification of thyroid nodules in ultrasound images using Deep Learning

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Abstract : Ultrasound (US) is the modalite of choice in diagnosis of malignancy in thyroid desease. Many studies have demonstrated that early diagnosis is important for reducing the morbidity and mortality risk of thyroid cancer. However, cliniclens need to manually visualise alls images wich is a cumbersome task, time-consuming and lead to wrong decision (false positive).Thus, there is an important need for automatic image classification tools. In this paper, we propose a novel deep-learning-based model that combines the encoder-decoder architecture of UNET with RESNET, followed by a classification using decision tree to classify ultrasound thyroid images into tree stages : normal, benign and malignant. A total of 290 images are used for training and testing the model. We evaluated and compared our method with the state-of- the-art methods and the experimental results demonstrate that our approach is effective in classification of ultrasound thyroid images

Keywords : Ultrasound imaging, thyroid classification, artificial intelligence, deep learning.

PREPROCESSING OF MULTISPECTRAL IMAGES : CASE STUDY OF MOSTAGANEM AREA in Algeria

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Abstract : Multispectral remote sensing plays a crucial role in Earth ob- servation and environmental analysis. However satellite imagery is often affected by noise, atmospheric disturbances, and sensor limitations. For that, we have proposed, in this paper to apply two approaches of images preprocessing on Mostaganem Area situated in Algeria. The first one includes bad bands identification and removal, Minimum Noise Fraction transformation (MNF), radiometric calibration, and atmospheric correc- tion using FLAASH method. The second approach follows the same ini- tial steps but employs QUAC method for atmospheric correction. The results indicate that while FLAASH, a physics-based radiative trans- fer model, requires careful tuning of numerous parameters, it achieves high atmospheric correction accuracy across a broader spectral range. The QUAC method, while simpler to implement, offers lower precision compared to FLAASH. The effectiveness of these preprocessing approaches is demonstrated through the obtained improved image clarity, having reduced dimensionality, and enhanced spectral reliability. These findings demonstrate the importance of preprocessing step in enhancing multispectral images in order to use them for further purposes such as land cover classification, vegetation monitoring, and environmental studies.

Keywords : Landast TM Multispectral Images, Algeria, Mostaganem area, MNF transformation, bad bands removal, FLAASH, QUAC, ENVI software

Adaptive Coverage Optimization in Wireless Sensor Networks Using the Artificial Hummingbird Algorithm

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Abstract : Wireless sensor network (WSN) quality-of-service relies heavily on node coverage, directly influencing area monitoring capabilities. Optimizing this coverage is increasingly challenging due to limited node resources, network dimensions, and complex operational dynamics. This paper introduces an Arti- ficial Hummingbird Algorithm (AHA)-based solution to enhance coverage in randomly deployed, unbalanced WSNs. While promising, the AHA's scalability and parameter tuning limitations are acknowledged. Comparative evaluation against existing algorithms demonstrates the AHA's effectiveness in improving coverage range and convergence speed, warranting further research into ad- dressing its identified limitations. .

Keywords : Meta-heuristics, Optimal Coverage, Bio-inspired Algorithm, Artifi- cial Hummingbird Algorithm, WSNs.

Improved Evolutionary Algorithm Using Nelder-Mead Method and Opposition-based Learning for Numerical Optimization

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Abstract : This study addresses persistent challenges in traditional evolutionary algorithms (EAs), notably premature convergence and inadequate population diversity, which hinder their efficacy in solving complex numerical optimiza- tion problems. We propose an innovative three-stage evolutionary strategy, the Improved Evolutionary Strategy using Nelder-Mead and Opposition-Based Learning (IES-NM-OBL). Our methodology integrates the Adaptive Nelder- Mead simplex method for enhanced local exploitation and Opposition-Based Learning (OBL) to significantly boost exploration and maintain population di- versity within the conventional Evolution Strategy framework. Experimental validations rigorously compared IES-NM-OBL against established benchmark algorithms, including Self-adaptive Evolution Strategy, Differential Evolution, Particle Swarm Optimization, and Genetic Algorithms, across various unimodal and multimodal test functions. The results consistently demonstrate IES-NM- OBL's superior performance in terms of solution accuracy, robustness, and con- vergence speed. The proposed algorithm exhibits robust global and local search capabilities, rapid convergence rates, high solution accuracy, and consistent performance across varying problem dimensions, making it suitable for high- dimensional optimization problems. In conclusion, IES-NM-OBL effectively overcomes the limitations of standard EAs, offering an efficient and impactful optimization methodology for challenging numerical problems, with significant implications for fields such as engineering design and machine learning.

Keywords : Evolutionary Algorithms, Evolution Strategy, Nelder Mead Meth- od, Opposition-Based Learning Strategy, Optimization.

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Applying Aspect-Oriented Programming to Improve Cross- Cutting Concerns in the Internet of Things

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Abstract : Nowadays, the Internet of Things (IoT) technology is increasingly used in various domains such as healthcare and agriculture, which contributes to its rapid development. Nevertheless, the use of object-oriented programming in this technology confronts IoT with several problems related to cross-cutting concerns such as security, tractability logging. Added to all this is the problem of redundant code frequently lead by traditional object –oriented approaches. Aspect oriented programming (AOP) is a different concept of programming that provide new solution to handle cross-cutting concerns about code. The idea of introducing AOP in the Internet of Things (IoT) is inherited from the complexity of sensor data interactions with the sink, reusing objects, the availability of a vast number of connected IoT objects, and the fact that each service needs to create a new object rather than reusing the existing one to satisfy a requirement which required a well-standard mechanism that not only improves the reusability of objects but also improves service modularity and extensibility and reduces cost, which is offered by AOP programming. This paper proposes an AOP model for IOI based on the Petri net graph, offering the reusability, modularity, and extensibility of the aspect-oriented programming concept, and sensor requirements in IOT technology.

Keywords : Aspect-Oriented Programming, Internet of things, Crosscutting Concerns, Petri net

Wireless Security Protocols : Vulnerabilities, Attacks, and Countermeasures

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Abstract : Wireless sensor network (WSN) quality-of-service relies heavily on node coverage, directly influencing area monitoring capabilities. Optimizing this coverage is increasingly challenging due to limited node resources, network dimensions, and complex operational dynamics. This paper introduces an Arti- ficial Hummingbird Algorithm (AHA)-based solution to enhance coverage in randomly deployed, unbalanced WSNs. While promising, the AHA's scalability and parameter tuning limitations are acknowledged. Comparative evaluation against existing algorithms demonstrates the AHA's effectiveness in improving coverage range and convergence speed, warranting further research into ad- dressing its identified limitations. .

Keywords : Meta-heuristics, Optimal Coverage, Bio-inspired Algorithm, Artifi- cial Hummingbird Algorithm, WSNs.

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Analyse des concentrations du dioxyde de carbone dans l'air ambiant à l'aide de l'Imagerie Satellitaire et des techniques du Machine Learning.

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Abstract : Le dioxyde de carbone est le gaz à effet de serre (GES) le plus important, et sa concentration dans l'atmosphère continue d'augmenter. Cela contribue au réchauffement climatique, entraînant des conséquences déjà visibles et qui ne cesseront de s'aggraver si les émissions de GES ne sont pas considérablement réduites. Suivre les niveaux de dioxyde de carbone dans l'air permet d'évaluer l'efficacité des stratégies de réduction des émissions de CO2, mais aussi d'identifier et localiser les zones où les concentrations de ce gaz sont anormalement élevées, afin de limiter leurs émissions. Le recueil et la combinaison des données satellitaires avec des mesures au sol nous a permis de développer un modèle à l'aide des techniques du Machine Learning afin d'évaluer les concentrations de dioxyde de carbone dans la région d'Oran. Les résultats des simulations, référencées géographiquement ont été présentés sous forme de cartes des concentrations de CO2 dans la zone d'étude, par le biais d'un système d'information géographique (SIG), spécialement conçu et développé à cet effet.

Keywords : Dioxyde de carbone ; Gaz à effet de serre ; Image satellitaire ; Machine Learning ; SIG.

Improved Evolutionary Algorithm Using Nelder-Mead Method and Opposition-based Learning for Numerical Optimization

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Abstract : abstract : Automatic emotion recognition has gained significant attention over the past decade, driven by the growing need to enhance human quality of life. However, emotion data often contains sensitive personal information such as gender, age, health status, and identity, which can be exploited by adversarial algorithms to infer private attributes. To mitigate this risk, we propose a federated learning–based framework that conceals identity-related information while maintaining performance on anger recognition tasks. In addition, a differential privacy mechanism is integrated to explicitly limit data leakage within the federated model. Experimental results on the AffectNet dataset demonstrate that anger recognition can be effectively achieved while reducing identity inference risks and ensuring differential privacy guarantees. The level of noise introduced through differential privacy can be tuned to balance the trade-off between privacy and utility.

Keywords : Federated Learning ; Differential Privacy ; Emotion Recognition ; Anger Recognition ; Identity Protection ; AffectNet ; Privacy Preservation ; Deep Learning.

GAN-Based Underwater Image Enhancement

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Abstract : Underwater images are difficult to capture due to light absorption and scattering in the water medium, causing low visibility, haze, and reduced accuracy in vision-based navigation and localization systems for the underwater environment. Marine exploration can be accelerated by using machine learning to dehaze images in real-time, enabling rapid analysis of underwater conditions for autonomous navigation. In this paper, the Cycle- SNSPGAN, a GAN-based image Enhancement method, is utilized to improve visibility in underwater imagery. Our results show that the fine-tuned UW-Cycle-SNSPGAN technique is a promising tool for Enhancing underwater images.

Keywords : Image Enhancement, underwater imaging, generative adversarial network

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Secure Biometric Authentication Using Transfer Learning on Finger Knuckle Prints

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Abstract : Person identification security is one of the most pressing challenges in current times. There is a high need for a trustworthy and secure identity veri- fication solution. A biometric identification system can be a safe and secure way to identify someone. Because it has the ability to identify individuals, the finger knuckle print (FKP) is considered one of the emerging hand biometrics. In this work, we used convolutional neural networks as one of the basic struc- tures for deep learning, as they perform very well in image analysis. By em- ploying transfer learning (pre-trained CNN models), we propose a biometric system based on finger-knuckle prints. We use a dataset containing 7,920 images of finger-knuckle prints. The experimental results were very encouraging and showed the potential for biometric applications utilizing the finger knuckle print. Furthermore, the paper performs a comparison of the identification per- formance of the system with different CNN models (AlexNet, GoogleNet, VGG16, and VGG19) and demonstrates that VGG19 achieved the best recogni- tion performance, reaching a 99.69% Rank-One Recognition Rate (ROR) in the closed-set identification scenario for the right middle finger . These findings highlight the discriminative potential of FKP and confirm the effectiveness of transfer learning for biometric authentication.

Keywords : Biometrics, Figure knuckle print, deep learning, transfer learning, convolutional neural network, Alex net, GOOGLE NET, VGG16, and VGG19.

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Meta-Features, Sparsification, and Selective Sampling in Arabic Text Classification : An Empirical Evaluation

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Abstract : This paper presents an empirical evaluation of meta-features, sparsification, and selective sampling in Arabic text classification. We propose a pipeline that integrates traditional preprocessing with inno- vative techniques to optimize the balance between effectiveness and ef- ficiency. Experiments on three Arabic datasets (Akhbarona, Al-Khaleej, and Al-Arabiya) demonstrate that combining distance-based meta-features with sparsification (SPA) significantly improves computational efficiency without compromising classification performance. Results show that the CentkNNCos + SPA variant achieves the best trade-off, reducing execu- tion times by up to 18.9This work highlights the potential of advanced preprocessing techniques for enhancing Arabic text classification systems.

Keywords : Meta-Features, Sparsification, Selective Sampling, Arabic Text Classification

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Une approche basée sur les algorithmes génétiques pour l'optimisation des attaques de phishing

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Abstract : Les attaques de phishing constituent une problématique critique et persistante en cy- bersécurité. Contrairement aux approches classiques, ce travail introduit une méthodo- logie innovante fondée sur les algorithmes génétiques (GA) pour l'optimisation multi- paramètres des campagnes de phishing. Un modèle mathématique formel est proposé, intégrant des variables comportementales et stratégiques telles que la sélection de la cible, la qualité du contenu, le timing et la capacité d'adaptation dynamique. Une ex- périmentation comparative est menée afin d'évaluer la pertinence de notre approche face à des techniques d'optimisation conventionnelles. Les résultats obtenus mettent en évidence une amélioration significative des performances, confirmant la valeur ajoutée de l'approche évolutionnaire proposée dans un contexte d'attaque simulée.

Keywords : phishing, cybersécurité, algorithme génétique, optimisation, intelligence artifi- cielle.

A Structured Model for Mental Health Data Management : A Case Study from the Sidi Chami Hospital, Oran, Algeria

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Abstract : This work presents the design of a structured data model in the context of mental health information management, developed in collaboration with a clinical psychiatrist. Our objective is to facilitate the interpretation of psychiatric medical records by proposing a data model adapted to real clinical needs. The case study is based on the University Hospital Center of Sidi Chami in Oran, Algeria, taking into account both local specificities and general principles of mental health data management. The final modeling relies on a rigorous typological classification of key entities, such as the patient, medical history, developmental data, social rela- tionships, psychiatric episodes, and treatments. Particular attention was given to the use of categorical and numerical data types in order to allow efficient struc- turing and visualization, while limiting the use of free text fields. The resulting schema thus forms a basis for the construction of a psychiatric database that is analytically and visually exploitable.

Keywords : Mental Health Informatics, UML modeling, Psychiatric Medical Records, Clinical Data Structuring, Information Visualization, Sidi Chami Psychiatric Hospital.

Improving Secure Processing via RSA-Integrated DNA-Based Hybrid Cryptography

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Abstract : This paper proposes a novel hybrid cryptosystem designed to strengthen data security through the integration of Deoxyribonucleic Acid (DNA) cryptography, the One-Time Pad (OTP) method, the Rivest-Shamir-Adleman (RSA) algo- rithm, and the ElGamal Cryptosystem. Inspired by a Feistel network structure, the system enhances confusion and diffusion properties to resist cryptanalytic attacks and ensure robust security. The cryptosystem employs a dual-key strat- egy : a DNA-based OTP key secures communications at the session level, while an RSA public-private key pair provides secure key management and additional protection. Additionally, this new system streamlines the secure transmission of the random DNA key and eliminates unnecessary DNA complement transforma- tions, thereby enhancing both the security and the efficiency of the encryption process. By combining biological techniques with classical cryptographic meth- ods, the proposed approach addresses modern cybersecurity challenges.

Keywords : DNA encoding, One Time Pad, RSA, Feistel structure, ElGamal Cryptosystem, Cyber security.

Hybrid BWO-AIS : A Bio-Inspired Approach for UAV Intrusion Detection

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Abstract : Unmanned Aerial Vehicles (UAVs) are increasingly deployed in var- ious domains, including surveillance, logistics, and military applications. How- ever, their reliance on wireless communication exposes them to significant cy- bersecurity risks, making robust intrusion detection mechanisms essential to en- sure their security. Bio-inspired optimization methods have emerged as promis- ing solutions for enhancing intrusion detection systems (IDS) due to their adaptability and effectiveness in dynamic environments. This paper explores recent developments in nature-inspired algorithms and their application in en- hancing the security of UAV networks, with a specific focus on a novel hybrid approach combining the Black Widow Optimization (BWO) algorithm with Ar- tificial Immune Systems (AIS). The proposed hybrid Immune Black Widow Optimization (IBWO) leverages the exploitation capabilities of BWO and the anomaly detection strengths of AIS to improve threat identification accuracy and convergence speed. A comprehensive comparison of metaheuristic algo- rithms is conducted, evaluating their performance, advantages, and limitations in detecting and classifying cyber threats. Additionally, we focus on the TITS database to assess the effectiveness of these techniques, including the hybrid IBWO, in real-world UAV IDS scenarios. Our results demonstrate that the hy- bridized algorithm outperforms conventional methods.

Keywords : Unmanned Aerial Vehicles (UAV), Intrusion Detection Systems (IDS), bio-inspired algorithm, Black Widow Optimization (BWO), Artificial Immune System (AIS)

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Exploitation des centres d'intérêts à court terme de l'utilisateur pour la personnalisation de la recherche d'information

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Abstract : Les intérêts des utilisateurs d'un système de recherche d'information sont dynamiques de nature. L'évolution au fil du temps de ces intérêts est par- fois rapide et parfois progressif. L'observation et l'exploitation de l'évolution des intérêts des utilisa- teurs peuvent permettre au système de recherche de dé- terminer le contexte courant des nouvelles recherches et d'inférer le besoin en information derrière. Dans ce papier nous présentons une nouvelle approche de personnalisation de recherche d'information. Cette approche est basée sur la conception d'un profil d'utilisateur dans lequel sont combinés les intérêts à court-tems et les intérêts à long-terme de l'utilisateur. Dans la phase de re- cherche, et selon la requête de l'utilisateur, le système décide il s'agit de quel centre d'intérêts à utiliser pour enrichir la requête utilisateur et par conséquent pour guider la nouvelle recherche.

Keywords : Recherche d'information personnalisée, centre d'intérêts à court- terme, centre d'intérêts à long-terme, profil d'utilisateur, pertinence utilisateur.

Enhancing Evil Twin Attack Detection Through CNN-LSTM- Attention and Ensemble Feature Selection

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Abstract : An Evil Twin attack consists of a rogue access point that pretends to be a legitimate network access point. Due to the widespread adoption of Wi-Fi networks in everyday settings, users are increasingly susceptible to these attacks, which can compromise the authenticity, integrity, and confidentiality of the transmitted data. To mitigate Evil Twin attacks in wireless networks, we propose a cutting-edge hybrid intrusion detection system that leverages the strengths of metaheuristic optimization algorithms alongside deep learning techniques. The first phase involves an ensemble feature selection method using metaheuristic algorithms specifically binary variants of the arithmetic optimization algorithms and the Artificial Bee Colony to refine the feature subset of the AWID3 dataset. In the classification phase, a hybrid deep learning architecture combining Convolutional Neural Network, Long Short-Term Memory networks, and an attention mechanism is utilized to accurately differentiate between Evil Twin attack traffic and benign traffic. The AOA-ABC-CNN-LSTM- Attention model achieves an accuracy of 99.62%, a precision of 99.04%, a recall of 99.90%, and an F1-score of 99.52%, demonstrating the model effectiveness in detecting Evil Twin attacks.

Keywords : Evil Twin, Ensemble Feature Selection, CNN-LSTM-Attention, AOA, ABC.

Pseudo-Random Number Generator based on Chaotic Lattice Ladder IIR Filter for Cryptographic Applications

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Abstract : In the field of cryptography, pseudorandom number generators (PRNGs) play a critical role by generating the unpredictable sequences necessary for creating encryption keys and performing content obfuscation through ran- domized data combination techniques.

In this work, we present a high-performance pseudorandom number generator that combines signal processing with chaos engineering. Our approach employs a two-stage lattice-ladder IIR filter with strategically destabilized reflection co- efficients to make it unstable and incorporates a nonlinear overflow function that induces chaotic behavior. The system is seeded with a one-dimensional chaotic map, providing sensitive dependence on initial conditions.

Extensive statistical analysis demonstrates that the generated sequences ex- hibit strong pseudo-random characteristics, making them particularly suitable for data encryption applications. The proposed method offers several advantages, in- cluding deterministic behavior, hardware implementation efficiency, and the ca- pability to generate multiple uncorrelated sequences through parameter varia- tions. These features make our lattice-ladder filter-based PRNG particularly val- uable for data security applications.

Keywords : Cryptography, PRNGs, Lattice-ladder IIR filter, Chaotic map.

Face Liveness Detection with Local and Peripheral Spatio-Temporal Features

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Abstract : The fast progress in facial recognition research made it pos- sible to determine the user's identity from a mobile phone by simply capturing images of his/her face. As a result, facial recognition is now considered a commodity for most mobile devices. However, the availabil- ity of more sophisticated means to disguise one's face, such as high quality masks designed from a set of facial images, now challenges the reliabil- ity of facial recognition for personal identification. Therefore, a liveness or spoofing detection stage is required, before performing recognition. Several algorithms have been proposed in the literature to detect facial spoofing. This paper investigates the advantages of decoupling foveal and peripheral vision to distinguish between genuine and fake faces. In particular, the ocular regions and the areas around the face outline are mainly considered. An S1C1-LSTM (Long Short Term Memory) frame- work has been applied to build a spatio-temporal representation of the subjects' faces to detect spoofing attacks. Several experiments were per- formed on real face images from standard datasets and compared with the approaches which are currently at the state of the art. The presented results well demonstrate the feasibility of the proposed approach for real applications.

Keywords : S1C1 · Spatio-temporal representation · LSTM.

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Comprehensive Analysis of the Usage of Online Ensemble Classifiers for Wireless Sensor Networks DoS Attack Detection

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Abstract : Machine learning techniques are frequently preferred over deep learning methods in domains where the interpretability of predictive model outcomes is essential. However, traditional ML methods face challenges in scenarios requiring frequent updates to accommodate new concepts and maintain model relevance. In this study, the detection of WSN DoS attacks was effectively achieved through the use of online ensemble classifiers, specifically streaming random patches ensembles integrated with the Early Drift Detection Method (EDDM) to ensure model robustness. Results demonstrated accuracy rates of 99.65% and 99.61% for the WSN-BFSF and WSN-DS DoS datasets, respectively.

Keywords : Online Classification, IoT, Wireless Sensor Networks, Concept Drift, DoS Attack


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